

**Program Announcement
To DOE National Laboratories
LAB 03-13**

***Natural and Accelerated
Bioremediation Research Program***

The Office of Biological and Environmental Research (OBER) of the Office of Science (SC), U.S. Department of Energy (DOE), hereby announces its interest in receiving proposals for research in the Natural and Accelerated Bioremediation Research (NABIR) Program. The goal of the NABIR program is to provide the fundamental science that will serve as the basis for development of cost-effective bioremediation and long-term stewardship of radionuclides and metals in the subsurface at DOE sites. The focus of the program is on strategies leading to long-term immobilization of contaminants in place to reduce the risk to humans and the environment. Research should address bioremediation of uranium, technetium, plutonium, chromium or mercury. NABIR is focused on subsurface sediments below the zone of root influence and includes both the vadose (unsaturated) zone and the saturated zone (groundwater and sediments). Proposals should describe research projects in one or more of the following program elements: Biogeochemistry, Biotransformation, Community Dynamics and Microbial Ecology, Biomolecular Science and Engineering, Assessment, and Bioremediation and its Societal Implications and Concerns. Studies that integrate research from more than one NABIR element are strongly encouraged.

DATES: Researchers are strongly encouraged (but not required) to submit a preproposal for programmatic review. Preproposals will be accepted on an ongoing basis, however, early submission of preproposals is encouraged, to allow time for review for programmatic relevance. A brief preproposal should consist of one or two pages of narrative describing the research objectives and methods.

The deadline for receipt of formal proposals is 4:30 p.m., E.S.T., March 11, 2003, to be accepted for merit review and to permit timely consideration for awards late in Fiscal Year 2003 or in early Fiscal Year 2004.

ADDRESSES: Preproposals referencing Program Announcement LAB 03-13 should be sent by E-mail to anna.palmisano@science.doe.gov.

Formal proposals in response to this solicitation are to be submitted as PDF files on CDs. Eight CDs should be submitted for each proposal. Color images should be submitted as a separate file in PDF format and identified as such. These images should be kept to a minimum due to the limitations of reproducing them. They should be numbered and referred to in the body of the technical scientific proposal as Color image 1, Color image 2, etc.

The CDs, referencing Program Announcement LAB 03-13, should be sent to: Environmental Remediation Division, SC-75/Germantown Building, Office of Biological and Environmental

Research, Office of Science, U.S. Department of Energy, 1000 Independence Avenue, SW, Washington, D.C. 20585-1290, ATTN: Program Announcement LAB 03-13.

When submitting by U.S. Postal Service Express Mail, any commercial mail delivery service, or when hand carried by the researcher, the following address must be used: Environmental Remediation Division, SC-75, Office of Biological and Environmental Research, Office of Science, U.S. Department of Energy, 19901 Germantown Road, Germantown, MD 20874-1290, ATTN: Program Announcement LAB 03-13.

FOR FURTHER INFORMATION CONTACT: Dr. Anna Palmisano, Environmental Remediation Sciences Division, SC-75/Germantown Building, Office of Biological and Environmental Research, Office of Science, U.S. Department of Energy, 1000 Independence Ave., SW, Washington, D.C. 20585-1290, telephone: (301) 903-9963, E-mail: anna.palmisano@science.doe.gov, fax: (301) 903-8519.

SUPPLEMENTARY INFORMATION:

Background

For more than 50 years, the U.S. created a vast network of more than 113 facilities for research, development, testing and production of nuclear weapons. As a result of these activities, subsurface contamination has been identified at over 7,000 discrete sites across the U.S. Department of Energy complex. With the end of the Cold War threat, the DOE has shifted its emphasis to remediation, decommissioning, and decontamination of contaminated groundwater, sediments, and structures at its sites. DOE is currently responsible for remediating 1.7 trillion gallons of contaminated groundwater and 40 million cubic meters of contaminated soil. It is estimated that more than 60% of DOE facilities have groundwater contaminated with metals or radionuclides. More than 50% of all DOE facilities have soils or sediments contaminated with radionuclides and metals. While virtually all of the contaminants found at industrial sites nationwide can also be found at DOE sites, many of the metals and most of the radionuclides are unique to DOE sites. The NABIR program aims: 1) to provide the fundamental knowledge that may lead to new remediation technologies or strategies for radionuclides and metals; and 2) to advance the understanding of the key microbiological and geochemical processes that control the effectiveness of *in situ* immobilization as a means of long term stewardship, and how these processes impact contaminant transport.

While bioremediation of organic contaminants involves their biotransformation to benign products such as carbon dioxide, bioremediation of radionuclides and metals involves their removal from the aqueous phase to reduce risk to humans and the environment. Microorganisms can directly affect the solubility of radionuclides and metals by changing their oxidation state to a reduced form that leads to *in situ* immobilization. Or, microorganisms can indirectly immobilize radionuclides and metals through the reduction of inorganic ions that can, in turn, chemically reduce contaminants to less mobile forms. The long term stability of these reduced contaminants is as yet unknown.

Currently, the fundamental knowledge that would allow cost-effective deployment of *in situ* subsurface bioremediation of radionuclides and metals is lacking. The focus of the NABIR program is on radionuclides and metals that: 1) pose the greatest potential risk to humans and the environment at DOE sites; and 2) are amenable to for immobilization by means of bioremediation. Thus, research is focused on the radionuclides uranium, technetium and plutonium and the metals chromium and mercury. Radioactive contaminants such as tritium and cobalt are not a focus because of their relatively short half lives, and strontium and cesium are not addressed because they are not readily amenable to biotransformation. Research is focused on subsurface sediments below the zone of root influence and includes both the vadose (unsaturated) zone and the saturated zone (both groundwater and sediments). NABIR research is oriented toward areas that have low levels of widespread contamination; it is too costly to clean up those situations with existing technologies. Uranium, technetium, and chromium can be especially mobile in the subsurface under certain conditions; they are risk-driving contaminants at some DOE sites. The effects of co-contaminants such as nitrate, complexing agents (such as EDTA) and chlorinated solvents (such as trichloroethylene and carbon tetrachloride) on the behavior of radionuclides and metals in the subsurface is also of interest to the NABIR program.

NABIR Program

The goal of the NABIR program is to provide the fundamental science that will serve as the basis for development of cost-effective bioremediation and long-term stewardship of radionuclides and metals in the subsurface at DOE sites. The focus of the program is on strategies leading to long-term immobilization in place of contaminants to reduce the risk to humans and the environment. The NABIR program encompasses both intrinsic bioremediation by naturally occurring microbial communities, as well as accelerated bioremediation through the use of biostimulation (addition of inorganic or organic nutrients). The NABIR Program supports hypothesis-driven, basic research that is more fundamental in nature than demonstration projects. Research on phytoremediation will not be supported by this solicitation; a separate solicitation for a Joint Interagency Program on Phytoremediation Research can be found at: http://www.sc.doe.gov/production/grants/LAB03_04.html.

Naturally occurring subsurface microbes may be involved in intrinsic bioremediation of radionuclides and metals by reduction and immobilization, either directly or indirectly. However, these natural processes typically occur at fairly slow rates, and there may be a need to use biostimulation to enhance the rates. The primary focus of the NABIR program is on biostimulation strategies, due to the ubiquity of metal-reducers in nature. Immobilized radionuclides and metals are not removed from the subsurface as may occur with excavation, pump and treat, or biodegradation of organic contaminants. Immobilization is focused on containment in vadose zone and groundwater plumes. As such, it may be a strategy applied to prevent the discharge of deep or widely distributed contaminants from the vadose zone to groundwater, or from groundwater to a receiving water body (e.g., the Columbia River at Hanford). *In situ* immobilization of contaminants is one approach to long term stewardship, which is the post-closure responsibility of DOE at its contaminated sites. Long term stewardship involves long-term monitoring and other maintenance activities to ensure that residual in-ground contaminants do not spread further. Therefore, an important aspect to the NABIR program is to assess factors controlling the long-term stability of the immobilized contaminants and to devise

approaches (biological/chemical) to maintain their immobilization through the stewardship phase.

The NABIR program consists of four interrelated Science Elements (Biogeochemistry, Biotransformation, Community Dynamics and Microbial Ecology, and Biomolecular Science and Engineering). Innovative method development for the Science Elements is supported under the Assessment Element. The program also includes an element addressing ethical, legal and societal issues called Bioremediation and its Societal Implications and Concerns (BASIC). The NABIR program strongly encourages researchers to integrate laboratory and field research at DOE or DOE-relevant sites. More information on the NABIR program may be found at: <http://www.lbl.gov/NABIR>.

The NABIR Field Research Center (FRC) and Other Field Research Sites

The NABIR FRC provides a site for investigators to conduct field-scale research and to obtain DOE-relevant subsurface samples for laboratory-based studies of bioremediation. The FRC is located on the U.S. Department of Energy Oak Ridge Reservation in Oak Ridge, Tennessee, and it is operated by the Environmental Sciences Division of the Oak Ridge National Laboratory. The contaminated and background (uncontaminated control) areas are located in Bear Creek Valley (BCV) within the Y-12 Plant area. See: <http://www.esd.ornl.gov/nabirfrc> for more detailed information on the NABIR FRC.

The contaminated research site at the FRC is a 98-hectare plot containing uranium, nitrate, technetium, strontium, and cadmium in groundwater, soils, and sediments. To a lesser extent, metals such as mercury, copper, zinc, and lead, and organics such as acetone, methylene chloride, tetrachloroethylene, and toluene are also present. The contaminated area includes the commingled groundwater plumes that originated from a combination of the S-3 Waste Disposal Ponds and the Bone Yard/Burn Yard. Both the background and contaminated areas are well-characterized and well-instrumented, and should be available for a duration of five to ten years. The water table resides between 0 and 3 m below the surface and is readily accessible through multilevel groundwater monitoring wells.

The initial focus of NABIR field research is on *in situ* biostimulation experiments to promote immobilization of uranium. Understanding natural and stimulated uranium biotransformation in the presence of high nitrate and low pH in unconsolidated residuum and fractured rock is one of the biggest challenges at the FRC at Oak Ridge, and at other DOE sites. NABIR researchers conduct controlled, field-scale hypothesis testing at the FRC. In addition, the FRC is currently providing subsurface samples for 20 laboratory-based NABIR projects. These projects span all NABIR Science Elements as well as the cross-cutting Assessment and BASIC Elements. Site characterization activities are ongoing and will result in a rich database for use by NABIR researchers. The FRC is responsible for data management, systems integration, and fundamental hydrological and geochemical modeling of the contaminated and background sites. The FRC makes these data and models accessible to all NABIR researchers.

While the FRC provides a major focus for the NABIR program, it is recognized that other sites that represent the different hydrogeological regimes found at DOE sites will also be valuable to

researchers. A large fraction of the national inventory of DOE wastes resides in unconsolidated, porous media in relatively thick, vadose zones and in groundwaters low in soluble organic carbon. For this reason, NABIR investigators are encouraged to take advantage of opportunities to collect and analyze samples from arid western environments that typify the Hanford Reservation and Uranium Mill Tailings Remedial Action (UMTRA) sites. For further information on NABIR Field Research, please contact Mr. Paul Bayer (paul.bayer@science.doe.gov), the NABIR Field Activities Manager.

NABIR investigators may want to take advantage of the capabilities of the Environmental Molecular Sciences Laboratory (EMSL) at the Pacific Northwest National Laboratory (<http://www.emsl.pnl.gov>). EMSL provides users with unique and state-of-the-art resources including facilities for high field magnetic resonance, high performance mass spectrometry, interfacial and nanoscale science, molecular science computing, and optical imaging and spectroscopy.

Current Request for Proposals

Research projects that address the scientific aims of individual NABIR elements including Biogeochemistry, Biotransformation, Community Dynamics, Biomolecular Science and Engineering, as well as the cross cutting elements Assessment and BASIC are solicited in this announcement. Integrative, interdisciplinary studies that involve research from more than one element are especially encouraged. The focus is on field research, or laboratory studies that can be scaled to the field, to provide supporting information for current or future field research. The NABIR Field Research Center (FRC) provides an opportunity for researchers to work at a DOE site in collaboration with scientists from different research elements. Studies at the NABIR FRC show that microbial reduction of radionuclides and metals is affected by the presence of nitrate and low pH. Thus, research into microbial mechanisms involved in the reduction of radionuclides and metals in this type of subsurface environment is of special interest.

Biogeochemistry: The goal of this element is to understand the fundamental biogeochemical reactions that would lead to long-term immobilization of metal and radionuclide contaminants in the subsurface. The focus is on reactions that govern the concentration, chemical speciation, and distribution of metals and radionuclides between the aqueous and solid phases. Biogeochemical reactions in subsurface environments are influenced by a wide variety of factors, including the availability of electron donors and acceptors, the nature of the microbial community, the chemical species or form of contaminant, the hydrogeology of the site, and the nature of the environmental matrix. Often several competing redox reactions make the prediction of the substrates, products, and kinetics difficult. The biogeochemical reactions are further complicated by the sorption of contaminants and reaction products to mineral surfaces, and the presence of natural organic matter and co-contaminants. The research challenge is to identify and prioritize the *key* biogeochemical reactions that are needed to predict the rate and extent of reactions that result in the immobilization of radionuclides and metals. New and creative scientific approaches are sought that address the following fundamental research questions:

- To *increase immobilization* of radionuclides and metals, what are the principal biogeochemical reactions that govern the concentration, chemical speciation, and

distribution of metals and radionuclides between the aqueous and solid phases (with an emphasis on natural geological matrices)? What are the thermodynamic and kinetic controls on these reactions? How do factors such as co-contaminants, sorption processes, and terminal electron acceptors (e.g., nitrate, iron, sulfate), influence these reactions?

- Under what conditions would the contaminants *remobilize*, and what alterations to the environment would increase the long term stability of metals and radionuclides in the subsurface?
- What influence do hydrological processes such as reactive transport, advective/dispersive transport and colloidal transport have on the biological availability, biotransformation, and movement of radionuclides and metals?

Biotransformation: The goal of this element is to understand the mechanisms of microbially mediated transformation of metals and radionuclides in subsurface environments leading to *in situ* immobilization and long term stability. Physiological studies of the biotransformation of metals and radionuclides by subsurface microorganisms will provide the knowledge base needed to understand intrinsic bioremediation and to stimulate biotransformation *in situ*.

DOE subsurface sites encompass a range of redox environments where contaminants such as uranium are present. One challenge is to understand the impact of these environments on microbial physiological processes involved in the biotransformation of radionuclides and metals to an immobilized form. Knowledge of the metabolic pathways for biotransformation of these contaminants by naturally occurring microbial communities in vadose zones, saturated zones and the waste plume is needed. A second challenge is to accelerate the rates of these physiological processes *in situ*, in complex subsurface environments. Biotransformation of metals and radionuclides in the subsurface is poorly understood, and predictive models based on laboratory studies have not always accurately simulated the observed fate of metals and radionuclides in the field. It is important to understand the kinetics of desirable metal and radionuclide biotransformations and the physicochemical factors affecting those kinetics in the field. Research is needed to address questions such as:

- What are the primary metabolic pathways for biotransformation of radionuclides and/or metals by subsurface microorganisms at DOE sites, such as the FRC? Physiological processes studied at the laboratory scale will need to demonstrate how results will be scaled to the field.
- How can metal reduction be harnessed or accelerated to immobilize radionuclides and/or metals in the subsurface? Can *in situ* production of organic acids, chelators, or extracellular polymers affect contaminant mobility?
- What environmental controls affect microbial physiological processes involved in radionuclide and metal biotransformations leading to immobilization in vadose and saturated zones? What factors inhibit these biotransformations *in situ*?
- How can we quantify *in situ* biotransformation kinetics so that these parameters can be applied to numerical models of field scale bioremediation?

Community Dynamics and Microbial Ecology: The goal of this element is to determine the potential for natural microbial communities to immobilize radionuclides and metals. In particular, research focuses on: 1) understanding the structure and function of microbial

communities in the subsurface at DOE sites contaminated with metals and radionuclides; and 2) identifying and optimizing the *in situ* growth of microorganisms that transform radionuclides and metals. This research will enhance our ability to predict the effectiveness of intrinsic bioremediation and to optimize microbial community composition for *in situ* immobilization of these contaminants. Diverse microbial communities can be found in subsurface environments. These communities represent an untapped catalytic potential for biotransformation of radionuclides and metals. Most of these microbes, however, are as yet uncultured using current methods. One challenge is to determine if sufficient genotypic and/or phenotypic potential exists to support natural and/or accelerated (biostimulated) bioremediation. Knowledge of microbial community structure and function may ultimately provide the ability to control or stimulate subsurface communities capable of biotransformation of radionuclides and metals. A second challenge is to optimize the community structure and activity for immobilization and metals, and to determine the long term stability of bioremediative communities. Research is needed to address questions such as:

- Is there sufficient biological activity and diversity in subsurface environments to support natural and/or accelerated bioremediation of metals and radionuclides?
- What are the effects of metal and radionuclide contamination on microbial community structure and function, particularly on populations that transform radionuclides and metals? What are the effects of key physical, chemical and hydrological factors on community structure and function, as it relates to immobilization of metals and radionuclides?
- What is the role of consortial interactions in subsurface environments contaminated with radionuclides and metals? Such interactions might include competition for electron donors and acceptors, or consortial interactions in the biotransformation of metals and radionuclides.
- What is the potential importance of gene transfer in natural microbial communities at subsurface sites contaminated with radionuclides or metals?

Those studies that link structure to function of microbial communities that immobilize metals and/or radionuclides at DOE sites are especially encouraged.

Biomolecular Science and Engineering: Research in this element provides a knowledge base, at the biomolecular level, of the processes leading to the *in situ* immobilization of radionuclides and metals by indigenous subsurface microorganisms. The primary goal of this element is to understand the genetic, biochemical, and regulatory processes that mediate biotransformation of these specific radionuclides and metals, leading to their immobilization. Characterization of genes, gene products, and genetic regulatory networks associated with these biotransformations is key to this understanding. Detailed studies of the enzymatic mechanisms for reduction of radionuclides and/or metals are needed to increase our understanding of *in situ* processes and to identify gene targets for better molecular assessment of radionuclide and metal reduction. Secondary goals include: 1) understanding molecular mechanisms of resistance of subsurface microorganisms to radionuclide and metal toxicity; 2) understanding, at a molecular level, the processes of lateral transfer between microbes of genes involved in biotransformation of these radionuclides and metals; 3) developing novel technologies to provide insights into biomolecular

mechanisms of metal and radionuclide biotransformation; and 4) developing approaches to manipulate pathways and enzyme systems that mediate these biotransformations .

DOE subsurface sites encompass a wide range of environments with a diversity of microbial communities and contaminants. One of the challenges of the Biomolecular Science and Engineering Element is to select microbes for studies that are active members of subsurface microbial communities. A second challenge is to extrapolate laboratory findings on pure cultures under laboratory conditions to complex *in situ* environmental conditions. This extrapolation is especially critical in studying gene expression, which may be modified by changes in local cellular environments in the subsurface. A third challenge is to take advantage of genomic and other data derived from the DOE Microbial Genome Program (<http://www.ornl.gov/microbialgenomes>) on subsurface microorganisms to increase our understanding of how genes relevant to bioremediation are expressed in the environment. Research is needed to address questions such as:

- How are genes regulated in subsurface microorganisms that are responsible for biotransformation and immobilization of radionuclides and metals? How are genes regulated in these microorganisms to promote survival in the presence of potentially toxic levels of these contaminants?
- What are the effects of key environmental parameters on regulation and expression of genes involved in metal/radionuclide reduction? For example, how do pH and co-contaminants such as nitrate impact the biochemistry and gene expression and regulation of uranium and technetium reduction?
- What are the basic biomolecular mechanisms of uranium and technetium reduction and reoxidation in microorganisms, primarily those indigenous to the subsurface? How can biomolecular processes be manipulated to enhance the sustainability of immobilization of uranium, technetium or chromium? Are there novel biomolecular mechanisms that can be used to immobilize mercury or plutonium?
- What are the biomolecular mechanisms involved in lateral transfer of metal/radionuclide reduction genes in subsurface microbial communities?

Proposals should primarily focus on indigenous subsurface microorganisms that can precipitate and immobilize these radionuclides and metals. The ultimate goal of this element is to improve our ability to predict and manipulate the activities of microbes *in situ*, particularly in an *in situ* immobilization scenario.

Assessment: Assessment is a cross-cutting element with a goal to develop innovative methods to assess processes and endpoints in support of the NABIR Science Elements. Thus, assessment projects are being sought that support the Science Elements of Biogeochemistry, Biotransformation, Community Dynamics/Microbial Ecology, and Biomolecular Science and Engineering. Methods may range from molecular to field scale, but they should improve the understanding of *in situ* bioremediation processes in subsurface environments contaminated with radionuclides and metals. Priority will be given to research proposals that could lead to fieldable, cost-effective, real time assessment techniques and/or instrumentation. NABIR will not fund projects that examine endpoints relating to human health risks. Research should address the development of innovative and effective methods for assessing or quantifying:

- Biogeochemical or biotransformation processes and rates, and microbial community structure and function relative to bioremediation of metals and radionuclides.
- Bioremediation end points, in particular, the concentration, speciation and stability of radionuclide and metal contaminants.

Techniques must enable NABIR science and address specific science needs of the program. The researcher should explain the potential impact and contribution to the NABIR program, as well as the relevance and potential usefulness of the innovation.

Bioremediation and its Societal Implications and Concerns (BASIC): The objective of this element is to identify and explore societal issues associated with NABIR. BASIC is designed to provide information on issues that might influence the implementation of NABIR science and to involve NABIR scientists in discussions about the societal implication of their research. The BASIC program may also provide an avenue to identify key issues and sensitivities involved in bioremediation strategies, such as immobilization of metals and radionuclides *in situ* as a means of long-term stewardship.

Major focus areas for BASIC research include 1) Identifying and prioritizing societal and regulatory issues associated with bioremediation of metals and radionuclides in subsurface environments, particularly strategies that entail immobilization in place; 2) fostering collaboration between NABIR scientists and site stakeholders and 3) enhancing the understanding and communication of NABIR research to stakeholder communities and others. Quantitative approaches and integration with other NABIR program elements are strongly encouraged. BASIC awards will not extend beyond two years beyond the award date. All proposals should provide a plan for evaluation of progress or outcomes. Where a product (guidelines, recommendations, documents, etc.) is the result, dissemination plans including timelines must be discussed.

The NABIR program also encourages smaller award proposals (up to \$35,000 total costs) for innovative and exploratory activities within the BASIC area. Such exploratory awards could be used to carry out pilot investigative research on an issue consistent with any of the above areas of BASIC research, support a sabbatical leave to organize and hold a conference, or to initiate start-up studies that could generate preliminary data for a subsequent proposal. Such small award proposals must use the standard DOE procedures outlined below, but should have a narrative section no more than five pages. These small awards, which will be peer reviewed, will not extend beyond one year from the award date.

Integrative Studies

This solicitation especially encourages those studies that integrate research from more than one NABIR research element through laboratory and/or field research. This interdisciplinary research should focus on achieving the primary goals of the NABIR program through collaborative studies in which the experimental design integrates two or more NABIR elements. Interdisciplinary teams may include participation from two or more research areas that might include: microbiology, geochemistry, hydrology, environmental engineering, numerical

modeling or other disciplines. Partnering with specific field experiments may provide information for hypothesis testing. Such integrative studies might include, for example:

- Employing numerical modeling to integrate information from more than one element, such as Biogeochemistry, Biotransformation, and Community Dynamics and Microbial Ecology, to better predict *in situ* immobilization of metals and radionuclides
- Studies of the effects of key physical, geochemical and hydrological parameters on the structure and function of subsurface microbial communities engaged in metal/radionuclide biotransformation and immobilization
- Integration of new methods in the Assessment element with actual application to studies of biotransformation or biogeochemistry of radionuclide/metal reduction and precipitation
- Linking chemical speciation of radionuclides and metals in subsurface environments to the bioavailability of those contaminants to microorganisms
- Studies on the changes of subsurface microbial community structure and function, and the effect on net rates of biotransformation during biostimulation experiments
- Partnership between any of the Science Elements and research in BASIC

Additional Information for Proposals

It is anticipated that up to \$3 million will be available for multiple awards to be made in late Fiscal Year 2003 and early Fiscal Year 2004 in the categories described above, contingent on availability of appropriated funds. Proposals for all elements except for BASIC may request project support up to three years, with out-year support contingent on availability of funds, progress of the research and programmatic needs. Proposals for BASIC may request support for two years, or one year for exploratory activities. Annual budgets for projects are expected to range from \$100,000 to \$300,000 total costs. Annual budgets for integrative studies involving participants representing more than one research element may range up to \$450,000. All proposals should include letters of agreement to collaborate from potential collaborators; these letters should specify the contributions the collaborators intend to make if the proposal is accepted and funded. DOE may encourage collaboration among prospective investigators to promote joint proposals or joint research projects by using information obtained through the preliminary proposals or through other forms of communication.

Merit Review

For renewals, progress on previous NABIR funded research will be an important criterion for evaluation. As part of the evaluation, program policy factors also become a selection priority. Note, external peer reviewers are selected with regard to both their scientific expertise and the absence of conflict-of-interest issues. Federal and non-federal reviewers will be used, and submission of an proposal constitutes agreement that this is acceptable to the investigator(s) and the submitting institution.

Submission Information

DOE is under no obligation to pay for any costs associated with the preparation or submission of proposals if an award is not made. In addition, for this solicitation, the research description must be 20 pages or less, exclusive of attachments, and must contain an abstract or summary of the proposed research (to include the hypotheses being tested, the proposed experimental design, and the names of all investigators and their affiliations). Researchers who have had prior NABIR support must include a Progress Section with a brief description of results and a list of publications derived from that funding. Attachments should include short (2 pages) curriculum vitae, QA/QC plan, a listing of all current and pending federal support and letters of intent when collaborations are part of the proposed research. Curriculum vitae should be submitted in a form similar to that of NIH or NSF (two to three pages).

Any recipient of an award from the Office of Science, performing research involving recombinant DNA molecules and/or organisms and viruses containing recombinant DNA molecules shall comply with the National Institutes of Health "Guidelines for Research Involving Recombinant DNA Molecules," which is available via the World Wide Web at: <http://www.niehs.nih.gov/odhsb/biosafe/nih/rdna-apr98.pdf>, (59 FR 34496, July 5, 1994), or such later revision of those guidelines as may be published in the Federal Register. Researchers must also comply with other federal and state laws and regulations as appropriate; for example, the Toxic Substances Control Act (TSCA) as it applies to genetically modified organisms. Although compliance with NEPA is the responsibility of DOE, researchers proposing to conduct field research are expected to provide information necessary for the DOE to complete the NEPA review and documentation.

Additional information on the NABIR Program is available at the following web site: <http://www.lbl.gov/NABIR/>. For researchers who do not have access to the world wide web, please contact Karen Carlson; Environmental Sciences Division, SC-74/Germantown Building; U.S. Department of Energy; 1000 Independence Avenue, S.W., Washington, D.C. 20585-1290; phone: (301) 903-3338; fax: (301) 903-8519; E-mail: karen.carlson@science.doe.gov; for hard copies of background material mentioned in this solicitation.

The instructions and format described below should be followed. Reference Program Announcement LAB 03-13 on all submissions and inquiries about this program.

**OFFICE OF SCIENCE
GUIDE FOR PREPARATION OF SCIENTIFIC/TECHNICAL PROPOSALS
TO BE SUBMITTED BY NATIONAL LABORATORIES**

Proposals from National Laboratories submitted to the Office of Science (SC) as a result of this program announcement will follow the Department of Energy Field Work Proposal process with additional information requested to allow for scientific/technical merit review. The following guidelines for content and format are intended to facilitate an understanding of the requirements necessary for SC to conduct a merit review of a proposal. Please follow the guidelines carefully, as deviations could be cause for declination of a proposal without merit review.

1. Evaluation Criteria

Proposals will be subjected to formal merit review (peer review) and will be evaluated against the following criteria which are listed in descending order of importance:

Scientific and/or technical merit of the project

Appropriateness of the proposed method or approach

Competency of the personnel and adequacy of the proposed resources

Reasonableness and appropriateness of the proposed budget

The evaluation will include program policy factors such as the relevance of the proposed research to the terms of the announcement, the uniqueness of the proposer's capabilities, and demonstrated usefulness of the research for proposals in other DOE Program Offices as evidenced by a history of programmatic support directly related to the proposed work.

2. Summary of Proposal Contents

Field Work Proposal (FWP) Format (Reference DOE Order 5700.7C) (DOE ONLY)

Proposal Cover Page

Table of Contents

Abstract

Narrative

Literature Cited

Budget and Budget Explanation

Other support of investigators

Biographical Sketches

Description of facilities and resources

Appendix

2.1 Number of Copies to Submit

An original and seven copies of the formal proposal/FWP must be submitted. (Unless otherwise instructed in this Program Announcement.)

3. Detailed Contents of the Proposal

Proposals must be readily legible, when photocopied, and must conform to the following three requirements: the height of the letters must be no smaller than 10 point with at least 2 points of spacing between lines (leading); the type density must average no more than 17 characters per inch; the margins must be at least one-half inch on all sides. Figures, charts, tables, figure legends, etc., may include type smaller than these requirements so long as they are still fully legible.

3.1 Field Work Proposal Format (Reference DOE Order 5700.7C) (DOE ONLY)

The Field Work Proposal (FWP) is to be prepared and submitted consistent with policies of the investigator's laboratory and the local DOE Operations Office. Additional information is also requested to allow for scientific/technical merit review.

Laboratories may submit proposals directly to the SC Program office listed above. A copy should also be provided to the appropriate DOE operations office.

3.2 Proposal Cover Page

The following proposal cover page information may be placed on plain paper. No form is required.

Title of proposed project
SC Program announcement title
Name of laboratory
Name of principal investigator (PI)
Position title of PI
Mailing address of PI
Telephone of PI
Fax number of PI
Electronic mail address of PI
Name of official signing for laboratory*
Title of official
Fax number of official
Telephone of official
Electronic mail address of official
Requested funding for each year; total request
Use of human subjects in proposed project:
 If activities involving human subjects are not planned at any time during the proposed project period, state "No"; otherwise state "Yes", provide the IRB Approval date and Assurance of Compliance Number and include all necessary information with the proposal should human subjects be involved.
Use of vertebrate animals in proposed project:
 If activities involving vertebrate animals are not planned at any time during this project, state "No"; otherwise state "Yes" and provide the IACUC Approval date and Animal Welfare Assurance number from NIH and include all necessary information with the proposal.
Signature of PI, date of signature
Signature of official, date of signature*

*The signature certifies that personnel and facilities are available as stated in the proposal, if the project is funded.

3.3 Table of Contents

Provide the initial page number for each of the sections of the proposal. Number pages consecutively at the bottom of each page throughout the proposal. Start each major section at the top of a new page. Do not use unnumbered pages and do not use suffices, such as 5a, 5b.

3.4 Abstract

Provide an abstract of no more than 250 words. Give the broad, long-term objectives and what the specific research proposed is intended to accomplish. State the hypotheses to be tested. Indicate how the proposed research addresses the SC scientific/technical area specifically described in this announcement.

3.5 Narrative

The narrative comprises the research plan for the project and is limited to 20 pages. It should contain the following subsections:

Background and Significance: Briefly sketch the background leading to the present proposal, critically evaluate existing knowledge, and specifically identify the gaps which the project is intended to fill. State concisely the importance of the research described in the proposal. Explain the relevance of the project to the research needs identified by the Office of Science. Include references to relevant published literature, both to work of the investigators and to work done by other researchers.

Preliminary Studies: Use this section to provide an account of any preliminary studies that may be pertinent to the proposal. Include any other information that will help to establish the experience and competence of the investigators to pursue the proposed project. References to appropriate publications and manuscripts submitted or accepted for publication may be included.

Research Design and Methods: Describe the research design and the procedures to be used to accomplish the specific aims of the project. Describe new techniques and methodologies and explain the advantages over existing techniques and methodologies. As part of this section, provide a tentative sequence or timetable for the project.

Subcontract or Consortium Arrangements: If any portion of the project described under "Research Design and Methods" is to be done in collaboration with another institution, provide information on the institution and why it is to do the specific component of the project. Further information on any such arrangements is to be given in the sections "Budget and Budget Explanation", "Biographical Sketches", and "Description of Facilities and Resources".

3.6 Literature Cited

List all references cited in the narrative. Limit citations to current literature relevant to the proposed research. Information about each reference should be sufficient for it to be located by a reviewer of the proposal.

3.7 Budget and Budget Explanation

A detailed budget is required for the entire project period, which normally will be three years, and for each fiscal year. It is preferred that DOE's budget page, Form 4620.1 be used for providing budget information*. Modifications of categories are permissible to comply with institutional practices, for example with regard to overhead costs.

A written justification of each budget item is to follow the budget pages. For personnel this should take the form of a one-sentence statement of the role of the person in the project. Provide a detailed justification of the need for each item of permanent equipment. Explain each of the other direct costs in sufficient detail for reviewers to be able to judge the appropriateness of the amount requested.

Further instructions regarding the budget are given in section 4 of this guide.

* Form 4620.1 is available at web site: <http://www.sc.doe.gov/production/grants/Forms.html>

3.8 Other Support of Investigators

Other support is defined as all financial resources, whether Federal, non-Federal, commercial or institutional, available in direct support of an individual's research endeavors. Information on active and pending other support is required for all senior personnel, including investigators at collaborating institutions to be funded by a subcontract. For each item of other support, give the organization or agency, inclusive dates of the project or proposed project, annual funding, and level of effort devoted to the project.

3.9 Biographical Sketches

This information is required for senior personnel at the laboratory submitting the proposal and at all subcontracting institutions. The biographical sketch is limited to a maximum of two pages for each investigator.

3.10 Description of Facilities and Resources

Describe briefly the facilities to be used for the conduct of the proposed research. Indicate the performance sites and describe pertinent capabilities, including support facilities (such as machine shops) that will be used during the project. List the most important equipment items already available for the project and their pertinent capabilities. Include this information for each subcontracting institution, if any.

3.11 Appendix

Include collated sets of all appendix materials with each copy of the proposal. Do not use the appendix to circumvent the page limitations of the proposal. Information should be included that may not be easily accessible to a reviewer.

Reviewers are not required to consider information in the Appendix, only that in the body of the proposal. Reviewers may not have time to read extensive appendix materials with the same care as they will read the proposal proper.

The appendix may contain the following items: up to five publications, manuscripts (accepted for publication), abstracts, patents, or other printed materials directly relevant to this project, but not generally available to the scientific community; and letters from investigators at other institutions stating their agreement to participate in the project (do not include letters of endorsement of the project).

4. Detailed Instructions for the Budget

(DOE Form 4620.1 "Budget Page" may be used)

4.1 Salaries and Wages

List the names of the principal investigator and other key personnel and the estimated number of person-months for which DOE funding is requested. Proposers should list the number of postdoctoral associates and other professional positions included in the proposal and indicate the number of full-time-equivalent (FTE) person-months and rate of pay (hourly, monthly or annually). For graduate and undergraduate students and all other personnel categories such as secretarial, clerical, technical, etc., show the total number of people needed in each job title and total salaries needed. Salaries requested must be consistent with the institution's regular practices. The budget explanation should define concisely the role of each position in the overall project.

4.2 Equipment

DOE defines equipment as "an item of tangible personal property that has a useful life of more than two years and an acquisition cost of \$25,000 or more." Special purpose equipment means equipment which is used only for research, scientific or other technical activities. Items of needed equipment should be individually listed by description and estimated cost, including tax, and adequately justified. Allowable items ordinarily will be limited to scientific equipment that is not already available for the conduct of the work. General purpose office equipment normally will not be considered eligible for support.

4.3 Domestic Travel

The type and extent of travel and its relation to the research should be specified. Funds may be requested for attendance at meetings and conferences, other travel associated with the work and subsistence. In order to qualify for support, attendance at meetings or conferences must enhance the investigator's capability to perform the research, plan extensions of it, or disseminate its results. Consultant's travel costs also may be requested.

4.4 Foreign Travel

Foreign travel is any travel outside Canada and the United States and its territories and possessions. Foreign travel may be approved only if it is directly related to project objectives.

4.5 Other Direct Costs

The budget should itemize other anticipated direct costs not included under the headings above, including materials and supplies, publication costs, computer services, and consultant services (which are discussed below). Other examples are: aircraft rental, space rental at research establishments away from the institution, minor building alterations, service charges, and fabrication of equipment or systems not available off-the-shelf. Reference books and periodicals may be charged to the project only if they are specifically related to the research.

a. Materials and Supplies

The budget should indicate in general terms the type of required expendable materials and supplies with their estimated costs. The breakdown should be more detailed when the cost is substantial.

b. Publication Costs/Page Charges

The budget may request funds for the costs of preparing and publishing the results of research, including costs of reports, reprints page charges, or other journal costs (except costs for prior or early publication), and necessary illustrations.

c. Consultant Services

Anticipated consultant services should be justified and information furnished on each individual's expertise, primary organizational affiliation, daily compensation rate and number of days expected service. Consultant's travel costs should be listed separately under travel in the budget.

d. Computer Services

The cost of computer services, including computer-based retrieval of scientific and technical information, may be requested. A justification based on the established computer service rates should be included.

e. Subcontracts

Subcontracts should be listed so that they can be properly evaluated. There should be an anticipated cost and an explanation of that cost for each subcontract. The total amount of each subcontract should also appear as a budget item.

4.6 Indirect Costs

Explain the basis for each overhead and indirect cost. Include the current rates.