

## **Program Announcement To DOE National Laboratories LAB 01-12**

### ***Natural and Accelerated Bioremediation Research (NABIR) 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 projects in the Natural and Accelerated Bioremediation Research (NABIR) Program. Proposals should describe research projects that address the scientific aims of individual NABIR Science Elements including Biogeochemistry, Biotransformation, Community Dynamics, as well as Assessment projects that relate to those elements. Proposals for research in other elements will not be considered at this time. Proposals for research on Bioremediation and its Societal Implications and Concerns (BASIC) have been solicited under a separate announcement (Program Announcement LAB 00-21).

The mission of the NABIR Program is to provide the fundamental science to serve as the basis for development of cost-effective bioremediation of radionuclides and metals in the subsurface at DOE sites. In particular, the program focuses on research that will lead to immobilization of radionuclides and/or metals in place, or that will reduce re-mobilization. NABIR research encompasses both intrinsic bioremediation by naturally occurring microbial communities, as well as accelerated bioremediation through the use of nutrient amendments (inorganic, organic or enzymatic) or microbial amendments. The program consists of seven interrelated scientific research elements (Biogeochemical Dynamics, Biotransformation, Community Dynamics and Microbial Ecology, Biomolecular Science and Engineering, Biotransformation and Biodegradation, Bacterial Transport, and Systems Integration/Data Management). The program also includes an element addressing ethical, legal and social issues of bioremediation called Bioremediation and its Societal Implications and Concerns (BASIC). The NABIR program has established a Field Research Center (FRC) at the Y-12 site near Oak Ridge National Laboratory (ORNL). The FRC is a focal point of NABIR field research and can provide investigators with DOE-relevant samples contaminated with uranium and other radionuclides or metals. Additional information about NABIR and the Field Research Center can be accessed from the NABIR Homepage: <http://www.lbl.gov/NABIR/>.

#### ***Program Focus***

The NABIR Program supports hypothesis-driven research that will help determine the potential for, and advance the field of, bioremediation as a cleanup option for

radionuclides and metals in subsurface environments (both vadose and saturated zones, below the root zone) at the DOE sites. Contaminants of particular interest are the radionuclides uranium, technetium, and plutonium and the metals chromium and mercury. While the focus of the NABIR Program is on field-scale research, the research program will support laboratory, theoretical, modeling, and other non-field research projects, if they fill gaps that would be necessary to improve understanding required for field-scale applications. Problems characterized by large areas with low-concentration of contaminants are emphasized over problems of localized, high concentrations. NABIR research will focus on research leading to immobilization rather than mobilization scenarios for bioremediation of metals and radionuclides. Although the program is directed at specific goals, it supports research that is more fundamental in nature than demonstration projects.

NABIR will not support research leading to ex situ treatments, nor will research on phytoremediation be supported. Research on bioremediation of organic contaminants, such as solvents and complexing agents will not be considered, except to the extent that they influence the primary goal of understanding the remediation of radionuclides and metals. The NABIR Program will not support research to evaluate the risk of contaminants to humans or to the environment.

Research plans that involve the potential release of nutrients, enzymes, and/or chemicals to the field (both at contaminated and non-contaminated control sites) should discuss the involvement of the public or stakeholders in their research, beginning with experimental design through completion of the project. Proposals involving microbial amendments will be solicited in a separate announcement. All proposers should discuss other relevant societal issues, where appropriate, which may include intellectual property protection and communication with and outreach to affected communities (including members of affected minority communities where appropriate).

A centrally-maintained database is being developed to provide appropriate data, such as site characterization and kinetics data, needed by a broad segment of investigators. Proposals shall include a short discussion of the Quality Assurance and Quality Control (QA/QC) measures that will be applied in data gathering and analysis activities. Successful awardees will be expected to coordinate their QA/QC measures with NABIR program managers.

### ***Current Request for Proposals***

Research projects that address the scientific aims of individual NABIR elements, including Biogeochemistry, Biotransformation, Community Dynamics, as well as Assessment projects supporting those three elements are being solicited. Proposals for

research on other elements will not be addressed at this time. Proposals for research on Bioremediation and its Societal Implications and Concerns (BASIC) have been solicited under a separate announcement (Program Announcement LAB 00-21). Proposers for research projects within individual program elements should state which science element is most closely aligned with the proposed research. Proposals are encouraged to propose interdisciplinary research that transcends more than one research element. However, a primary element should be specified for the purpose of merit review.

### **Biogeochemical Dynamics**

The goal of this area 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 (Cr, Hg) and radionuclides (U, Tc, Pu) between the aqueous and solid phases.

Contaminated subsurface environments are complex. 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 hydrology, 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 to immobilize radionuclides and metals for long term stability. New and creative scientific approaches are sought that address the following fundamental research questions:

- With the goal of increasing 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? What are the thermodynamic and kinetic controls on these reactions? How do factors such as co-contaminants, sorption processes, and the structure and composition of minerals that serve as terminal electron acceptors, influence these reactions?
- With the goal of decreasing the possible re-mobilization of immobilized radionuclides and metals, how can the above questions be addressed? 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, transformation, and movement of radionuclides and metals?

### **Biotransformation**

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 transformation of radionuclides and metals to an immobilized form. Knowledge of the metabolic pathways for transformation 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. 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?
- Can these biotransformations be harnessed or accelerated to immobilize radionuclides and/or metals in the subsurface?
- 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 transformations in situ?

### **Community Dynamics and Microbial Ecology**

Fundamental research in Community Dynamics and Microbial Ecology at both the molecular and the microbial level is needed to understand the natural intrinsic processes of bioremediation at contaminated sites. 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 transformation of radionuclides and metals. A second challenge is to optimize the community structure and activity for immobilization of radionuclides 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 metals and radionuclides (or other environmental factors) on microbial community activity and diversity, particularly of populations that transform radionuclides and metals?
- What is the role of consortial interactions on biotransformations of metals and radionuclides in contaminated subsurface environments? Such interactions might include competition for electron donors and acceptors, or other consortial interactions that affect the transformation of metals and radionuclides.
- What is the potential importance of gene transfer in natural microbial communities at subsurface sites contaminated with radionuclides or metals?

### **Assessment**

The Assessment Element is a cross-cutting element with a goal to develop innovative methods to assess processes and endpoints in support of the NABIR Science Elements. In this call, assessment projects that support the Science Elements of Biogeochemistry, Biotransformation, and Community Dynamics/Microbial Ecology are being sought. 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 processes, 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.

### **Program Funding**

It is anticipated that approximately \$2 million will be available for multiple awards to be made in late FY 2001 and early FY 2002 in the categories described above, contingent on availability of appropriated funds. Proposals may request project support up to three years, with out-year support contingent on availability of funds, progress of the research and programmatic needs. Annual budgets for projects in the four scientific research element projects are expected to range from \$100,000 to \$400,000 total costs. 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.

**DATES:** Researchers are strongly encouraged (but not required) to submit a preproposal for programmatic review. The deadline for preproposals is January 8, 2001. 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., February 28, 2001, to be accepted for merit review and to permit timely consideration for award late in Fiscal Year 2001 or in early Fiscal Year 2002. An original and seven copies of the proposals must be submitted; however, proposers are requested not to submit multiple proposals using more than one delivery or mail service.

**ADDRESSES:** If submitting a preproposal, referencing Program Announcement LAB 01-12, it should be sent by e-mail to: [anna.palmisano@science.doe.gov](mailto:anna.palmisano@science.doe.gov).

Formal proposals referencing Program Announcement LAB 01-12 on the cover page must be forwarded to: U.S. Department of Energy, Office of Science, Office of Biological and Environmental Research, SC-74, 19901 Germantown Road, Germantown, MD 20874-1290, ATTN: Program Announcement LAB 01-12. This address must also be used when submitting proposals by U.S. Postal Service Express Mail or any other commercial overnight delivery service, or when hand-carried by the proposer.

**FOR FURTHER INFORMATION CONTACT:** Dr. Anna Palmisano, Environmental Sciences Division, SC-74, Office of Biological and Environmental Research, Office of Science, U.S. Department of Energy, 19901 Germantown Road, Germantown, MD 20874-1290, telephone: (301) 903-9963, e-mail: [anna.palmisano@science.doe.gov](mailto:anna.palmisano@science.doe.gov), fax: (301) 903-8519.

### **Submission Information**

Renewal proposals must include a list of publications resulting from prior NABIR funding. 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 announcement, 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). Attachments should include short 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), see for example: <http://www.nsf.gov:80/bfa/cpo/gpg/fkit.htm#forms-9>.

Any recipient of an award from SC performing research involving recombinant DNA molecules and/or organisms and viruses containing recombinant DNA molecules shall comply with the National Institutes of Health (NIH) "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.

Awardees 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, awardees 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; U.S. Department of Energy; 19901 Germantown Road, Germantown, MD 20874-1290, phone: (301) 903-3338, fax: (301) 903-8519, e-mail: [karen.carlson@science.doe.gov](mailto:karen.carlson@science.doe.gov); for hard copies of background material mentioned in this announcement.

The instructions and format described below should be followed. Reference Program Announcement LAB 01-12 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.

## **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 25 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 \$5000 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.