Office of Science
Notice DE-FG01-04ER04-06

Natural and Accelerated Bioremediation Research Program

Department of Energy

Office of Science Financial Assistance Program Notice DE-FG01-04ER04-06: Natural and Accelerated Bioremediation Research Program

AGENCY: U.S. Department of Energy

ACTION: Notice inviting grant applications.

SUMMARY: 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 applications for research grants 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 understanding the role of microorganisms in long-term immobilization of contaminants in place, and the potential for their remobilization. Contaminants of interest are 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). Applications should describe research projects in one or more of the following program categories: 1) Biogeochemistry, Biotransformation, Community Dynamics and Microbial Ecology, or Assessment; 2) Interdisciplinary studies that integrate research from more than one NABIR element; or 3) Projects to be performed at the NABIR Field Research Center (FRC) addressing field scale processes that immobilize uranium and/or technetium; field teams must include, at a minimum, expertise in microbiology, geochemistry and hydrology.

DATES: Researchers are strongly encouraged to submit a preapplication for programmatic review. Preapplications should be submitted on or before February 6, 2004, for review for programmatic relevance.

The deadline for receipt of formal applications is 4:30 p.m., E.S.T., March 9, 2004, to be accepted for merit review and to permit timely consideration for awards late in Fiscal Year 2004 or in early Fiscal Year 2005.

ADDRESSES: Preapplications referencing Program Notice DE-FG01-04ER04-06, should be sent by E-mail to: paul.bayer@science.doe.gov.

Formal applications referencing Program Notice DE-FG01-04ER04-06, must be sent electronically by an authorized institutional business official through DOE's Industry Interactive Procurement System (IIPS) at: http://e-center.doe.gov/. IIPS provides for the posting of solicitations and receipt of applications in a paperless environment via the Internet. In order to submit applications through IIPS, your business official will need to register at the IIPS website. **IIPS offers the option of using multiple files, please limit submissions to one volume and one file if possible, with a maximum of no more than four PDF files.** The Office of Science will include attachments as part of this notice that provide the appropriate forms in PDF fillable format that are to be submitted through IIPS. Color images should be submitted in IIPS 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 grant application as Color image 1, Color image 2, etc. Questions regarding the operation of IIPS may be E-mailed to the IIPS Help Desk at: HelpDesk@pr.doe.gov, or you may call the help desk at: (800) 683-0751. Further information on the use of IIPS by the Office of Science is available at: http://www.sc.doe.gov/production/grants/grants.html.

If you are unable to submit an application through IIPS, please contact the Grants and Contracts Division, Office of Science at: (301) 903-5212 or (301) 903-3604, in order to gain assistance for submission through IIPS or to receive special approval and instructions on how to submit printed applications.

FOR FURTHER INFORMATION CONTACT: Mr. Paul Bayer, 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) 903-5324, E-mail: paul.bayer@science.doe.gov, fax: (301) 903-8519. The full text of Program Notice DE-FG01-04ER04-06, is available via the Internet using the following web site address: http://www.sc.doe.gov/production/grants/grants.html.

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.

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. 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. 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 (known as natural attenuation) 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. Thus, understanding the potential for remobilization of contaminants is of special interest.

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 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). Research on phytoremediation will not be supported by this solicitation.

NABIR 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. The NABIR Program supports hypothesis-driven, basic research that is more fundamental in nature than demonstration projects.

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

To encourage hypothesis-based field research and process-level understanding, the NABIR program established the Field Research Center (FRC) for long-term field studies. The FRC provides a site for investigators to conduct field-scale research and to obtain DOE-relevant subsurface samples for laboratory-based studies of bioremediation, and it is located on the U.S. Department of Energy Oak Ridge Reservation in Oak Ridge, Tennessee. The FRC is operated by the Environmental Sciences Division of the Oak Ridge National Laboratory, and it includes a contaminated and a background (uncontaminated control) area for *in situ* studies. Both areas are located in Bear Creek Valley (BCV) within the Y-12 Plant area.

The contaminated research site at the FRC is a 98-hectare plot containing uranium, nitrate, technetium-99, 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 groundwater plume that originated from the S-3 Waste Disposal Ponds.

The background area is approximately 163 hectares and is located in West Bear Creek Valley, about 2 km from the contaminated area. The area lies directly along the geologic strike of the contaminated area and is, therefore, underlain by nearly identical geology, mineralogy, and structure. No known contaminants have been disposed at this location throughout the history of DOE operations. The majority of the area is heavily wooded, with the exception of the Bear Creek floodplain.

Both the background and contaminated areas are well- characterized and well-instrumented, and should be available for five to ten years. The water table resides between 0 and 3 meters below the surface and is readily accessible through multilevel groundwater monitoring wells.

The FRC is responsible for general site characterization activities and provides 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 researchers. See: http://www.esd.ornl.gov/nabirfrc for more detailed information on the NABIR FRC.

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.

Resources at DOE User Facilities

Applicants are encouraged to propose making use of the capabilities provided by DOE's National Scientific User Facilities. The instrumentation and experimental facilities at these user facilities are available free of charge to users who agree to publish their findings in the peer reviewed literature. Applicants may be interested in one or more of the following DOE user facilities:

Applicants may be interested in the capabilities offered at the Environmental Molecular Sciences Laboratory (EMSL), which is located at the Pacific Northwest National Laboratory in Richland, WA. EMSL provides users with unique and leading edge instrumentation for molecular-level studies, including a wide variety of capabilities in spectroscopy and microscopy, particle characterization and imaging, and meter-scale reactive transport. These experimental capabilities are located within EMSL's high field magnetic resonance, high performance mass spectrometry, interfacial and nanoscale science and optical imaging and spectroscopy facilities. In addition, the high-performance molecular science computing facility within the EMSL includes an 11.8 TeraFlop supercomputer for use in reactive transport and flow modeling. See http://www.emsl.pnl.gov for further information.

Applicants may also be interested in the molecular-level capabilities for studying the speciation, properties or behavior of contaminants that are available through DOE's synchrotron radiation facilities. Information concerning the types of analytical techniques available at specific synchrotron facilities is available through *EnviroSync*, a national organization that represents molecular environmental science at the synchrotrons. See http://www.cems.stonybrook.edu/envirosync/ for further information.

Current Request for Applications

Research projects should address the scientific aims of: 1) individual NABIR elements including Biogeochemistry, Biotransformation, Community Dynamics and Assessment; 2) Integrative, interdisciplinary studies that involve research from more than one element; or 3) Field research projects to be performed at the NABIR FRC in Oak Ridge, Tennessee. 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 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, and the potential for remobilization. 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.

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, and Community Dynamics/Microbial Ecology. 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 applications 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 applicant should explain the potential impact and contribution to the NABIR program, as well as the relevance and potential usefulness of the innovation.

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 should include participation from two or more research areas such as 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

Field Scale Bioremediation Experiments

Although bioremediation of radionuclides and metals has been studied in the laboratory, and bioremediation technologies have been demonstrated in the field, there are few examples of carefully controlled, hypothesis-driven, *in situ* bioremediation research at the field-scale. The FRC provides opportunities for such field-scale experiments.

The S-3 Ponds were the primary source of contamination detected in the contaminated zone of the FRC. The S-3 Ponds consisted of four unlined ponds constructed in 1951 on the west end of the Y-12 Plant at Oak Ridge. Liquid wastes, composed primarily of nitric acid plating wastes containing nitrate and various radionuclides and metals (e.g., uranium and technetium), were disposed in the ponds until 1983. Waste disposal activities at the Y-12 Plant created a mixed waste plume of contamination in the underlying unconsolidated residuum (primarily saprolite and fill) and shale bedrock. The ponds were neutralized and denitrified in 1984, and capped in 1988, and the area is now a parking lot.

Three areas in the contaminated zone are currently identified as the primary targets for *in situ* studies. Areas 1 and 3 are located adjacent and directly south and west, respectively, of the S-3 Ponds parking lot and Area 2 is located several hundred feet to the southwest of the parking lot. Applicants may choose to propose research for Area 1 (a high nitrate, low pH site), Area 2 (a low nitrate, circumneutral site) or Area 3 (a very high contaminant concentration, very low pH site). More detailed information on Areas 1, 2 and 3 can be found on the NABIR FRC web site (http://public.ornl.gov/nabirfrc/area123.cfm).

The initial focus of *in situ* research conducted at the FRC has been on biostimulation experiments to understand or promote the immobilization of uranium and technetium by microbial processes. 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. The NABIR program is currently funding the following three *in situ* projects within the contaminated area of the FRC: 1) a stimulated biocurtain for uranium biotransformation combined with denitification; 2) push-pull tests to determine the kinetics of electron-acceptor and electron-donor use for microbially-mediated uranium and technetium reduction and reoxidation; and 3) stimulation of microbial uranium reduction in hydrologically-accessible fractured zones to precipitate uranium oxide and isolate the uranium in low-permeability porous regions. Applicants should attempt to complement existing projects; additional information can be found at http://public.ornl.gov/nabirfrc/awards.cfm.

For this solicitation, the NABIR program is seeking applications that focus on *in situ* studies that are aligned with the short- and mid-term scientific tasks outlined in the recently completed strategic plan for the FRC (http://public.ornl.gov/nabirfrc/FRCStrategicPlan070103.pdf).

Applications should therefore focus on field conditions or processes that affect microbial oxidation/reduction and contaminant transport at the meter or tens of meters scale. The results of *in situ* research should lead to improved parameters for modeling the fate and transport of uranium, technetium or other contaminants. For example, research could be undertaken on microbial metal reduction in the presence of preferential contaminant flow pathways in the saprolite or in reworked fill, during storm events, in the vadose zone, at increasing distance from the source, or at the seasonally variable capillary fringe. Research findings are expected to be useful for incorporation into a site-wide FRC model for reactive transport and groundwater flow.

Applicants must propose a testable hypothesis that is based on microbially-mediated mechanisms of immobilization for *in situ* field research, and they should describe a detailed technical approach that should include: 1) establishing a defined (surface area and depth) experimental and control plot within the proposed contaminated field site; and 2) manipulating the experimental plot by amendments of nutrients or other chemicals that might stimulate microbial communities to immobilize uranium or technetium. The technical approach must be described in phases such that completion of each phase could result in publishable results. A statistically robust sampling regimen to determine the efficacy of the manipulation should also be described. Moreover, the applicant must explain the technical feasibility of performing the proposed field research. Technology demonstration projects will not be funded by this solicitation.

The applicants must propose research to be performed as an interdisciplinary team including, at a minimum, expertise in microbiology, geochemistry, and hydrology. The Principal Investigator for the team must have prior experience in relevant field research, and the activities of each team member must be clearly defined. Multi-institutional partnerships are strongly encouraged; for example, applicants may draw expertise from National Laboratories, academia, and other institutions engaged in basic research. The successful team must be willing to partner with other funded NABIR investigators who may wish to obtain samples in conjunction with the proposed field studies.

Although compliance with National Environmental Policy Act (NEPA) is the responsibility of DOE, successful applicants who propose to conduct field research are expected to provide information necessary for the DOE to complete the NEPA review and documentation. Successful applicants will also be expected to brief and to obtain approval of their written work plan from the Field Research Review Panel (FRRP) prior to beginning their field work. For this solicitation, applicants should describe how they would communicate their proposed experimental design and their results to stakeholders, regulators, and community groups. Applicants may wish to review the FRC Communication Plan, which can be found on the FRC web site. All applicants 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) to explain the proposed research. For further information on NABIR Field Research, please contact Mr. Paul Bayer (Paul.Bayer@ science.doe.gov), the NABIR Field Activities Manager.

Additional Information for Applications

Long Term Environmental Remediation Goals

The following indicators establish specific long term goals in Scientific Advancement that the BER program is committed to, and against which progress can be measured. Environmental Remediation: Develop science-based solutions for cleanup and long-term monitoring of DOE contaminated sites. By 2013, a significant fraction of DOE's long- term stewardship sites will employ advanced biology-based clean up solutions and science-based monitors.

All grant proposals should address one or more of these measures and/or explain how the proposed research supports the broad scientific objectives outlined above. More information on the program and the scientific research it supports can be found at our website: http://www.sc.doe.gov/ober/.

Preapplications

A brief preapplication should be submitted. The preapplication should identify, on the cover sheet, the institution, Principal Investigator name, address, telephone, fax and E-mail address, and title of the project. The preapplication should consist of one or two pages of narrative describing the research objectives and methods. These will be reviewed for responsiveness to the scope and research needs described in this notice. Please note that notification of a successful preapplication is not an indication that an award will be made in response to the formal application.

Program Funding

It is anticipated that up to $3 million will be available for multiple awards to be made in late Fiscal Year 2004, and early Fiscal Year 2005, in the categories described above, contingent on availability of appropriated funds. An additional sum, up to $3 million, will be available for competition by DOE National Laboratories under a separate solicitation (LAB 04-06). Applications 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 Biogeochemistry, Biotransformation or Community Dynamic 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. Annual budgets for interdisciplinary field research projects at the FRC are expected to range from $300,000 to $1,000,000 for total costs. Costs for drilling at the FRC should not be included in the applicant's budget. All applications should include letters of agreement to collaborate from potential collaborators; these letters should specify the contributions the collaborators intend to make if the application is accepted and funded. DOE may encourage collaboration among prospective investigators to promote joint applications or joint research projects by using information obtained through the preliminary applications or through other forms of communication. DOE is under no obligation to pay for any costs associated with the preparation or submission of applications if an award is not made.

Merit Review

Applications will be subjected to formal merit review (peer review) and will be evaluated against the following evaluation criteria which are listed in descending order of importance codified at 10 CFR 605.10(d):

1. Scientific and/or Technical Merit of the Project;
2. Appropriateness of the Proposed Method or Approach;
3. Competency of Applicant's personnel and Adequacy of Proposed Resources;
4. Reasonableness and Appropriateness of the Proposed Budget.

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 application constitutes agreement that this is acceptable to the investigator(s) and the submitting institution.

Submission Information

Information about the development, submission of applications, eligibility, limitations, evaluation, the selection process, and other policies and procedures may be found in 10 CFR Part 605, and in the Application Guide for the Office of Science Financial Assistance Program. Electronic access to SC's Financial Assistance Application Guide is possible via the World Wide Web at: http://www.sc.doe.gov/production/grants/grants.html.

In addition, for this notice, 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). **Applicants 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, 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 the National Institutes of Health (NIH) or the National Science Foundation (NSF) (two to three pages).

The Office of Science, as part of its grant regulations, requires at 10 CFR 605.11(b) that a recipient receiving a grant and performing research involving recombinant DNA molecules and/or organisms and viruses containing recombinant DNA molecules shall comply with the 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.

Grantees 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, grantees 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 Catalog of Federal Domestic Assistance number for this program is 81.049, and the solicitation control number is ERFAP 10 CFR Part 605.

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for Resource Management

Published in the Federal Register December 19, 2003, Volume 68, Number 244, Pages 70788-70793.