Office of Science
Notice 02-12

Natural and Accelerated Bioremediation Research Program

Department of Energy (DOE)

Office of Science Financial Assistance Program Notice 02-12: 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 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 tractable for immobilization by means of bioremediation. Applications are especially encouraged that address the radionuclides uranium and technetium. Applications should describe research projects in one of the following categories:

1. Projects that address the scientific aims of the Biomolecular Science and Engineering Element.

2. Projects to be performed at the NABIR Field Research Center (FRC) addressing field scale biostimulation of microbiological processes that immobilize uranium and/or technetium. Interdisciplinary teams must include, at a minimum, expertise in microbiology, geochemistry and hydrology.

DATES: Researchers are strongly encouraged (but not required) to submit a preapplication for programmatic review. Early submission of preapplications is encouraged, to allow time for review for programmatic relevance. A brief preapplication should consist of one or two pages of narrative describing the research objectives and methods. The deadline for receipt of formal applications is 4:30 p.m., E.S.T., March 13, 2002, to be accepted for merit review and to permit timely consideration for awards late in Fiscal Year 2002, or in early Fiscal Year 2003. An original and seven copies of the application must be submitted; however, applicants are requested not to submit multiple applications using more than one delivery or mail service.

ADDRESSES: If submitting a preapplication, referencing Program Notice 02-12, it should be sent by e-mail to anna.palmisano@science.doe.gov. Formal applications referencing Program Notice 02-12 on the cover page must be forwarded to: U.S. Department of Energy, Office of

Science, Grants and Contracts Division, SC-64, 19901 Germantown Road, Germantown, MD 20874-1290, ATTN: Program Notice 02-12. This address must also be used when submitting applications by U.S. Postal Service Express Mail or any other commercial overnight delivery service, or when hand-carried by the applicant.

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, fax: (301) 903-8519. The full text of Program Notice 02-12 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, and testing of nuclear materials. As a result of these activities, subsurface contamination has been identified at over 7,000 discrete sites across the U.S. Department of Energy (DOE) 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. The only other type of contaminant that appears more often than metal and radionuclide contaminants in groundwater is chlorinated hydrocarbons. More than 50% of all soil and sediments at DOE facilities are contaminated with radionuclides and metals, the contaminants found with the highest frequency in soil at all DOE waste sites. Indeed, while virtually all of the contaminants found at industrial sites nationwide can also be found at DOE sites, many of the metals and especially the radionuclides found on DOE sites are unique to those sites. The NABIR program aims: 1) to provide the fundamental knowledge to support the development of new remediation technologies 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.

While bioremediation of organic contaminants involves their transformation 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 transform 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. Other mechanisms whereby microorganisms can influence mobility of contaminants include alteration of pH, oxidation/reduction reactions and complexation.

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 tractable 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 (groundwater and sediments). NABIR research is oriented toward application in areas that have low levels of widespread contamination because 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 Ethylenediaminetetraacetate 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 of contaminants in place 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). NABIR will provide an improved, multidisciplinary understanding of the biogeochemical functioning of terrestrial subsurface systems. The NABIR Program supports hypothesis-driven research that is more fundamental in nature than demonstration projects.

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. 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. 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 contaminant capture from both 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). 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. Research on phytoremediation is not supported by NABIR.

The NABIR program consists of four interrelated scientific research elements (Biogeochemical Dynamics, Biotransformation, Community Dynamics and Microbial Ecology, and Biomolecular Science and Engineering). Innovative method development for the four NABIR scientific research elements is supported under the Assessment Element. 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 encourages researchers to integrate laboratory and field research. DOE has a Field Research Center (FRC) at the Y-12 site near Oak Ridge National Laboratory (ORNL). Additional information about NABIR and the FRC can be accessed from the NABIR Homepage: http://www.lbl.gov/NABIR/.

Current Request for Applications

Two kinds of projects are solicited in this request for applications:

1. Research projects that address the scientific aims of the NABIR Biomolecular Science and Engineering Element.

2. Research projects to be performed at the NABIR FRC addressing field scale biostimulation of microbiological processes that immobilize uranium and/or technetium. Research would be conducted at the FRC that is located near Oak Ridge National Laboratory, Oak Ridge, TN. Interdisciplinary teams must include, at a minimum, experts in the fields of microbiology, geochemistry, and hydrology.

Applications for research on other elements of the NABIR program will not be addressed at this time.

The NABIR Biomolecular Science and Engineering Element

Research in the Biomolecular Sciences and Engineering element provides a knowledge base, at the biomolecular level, of the processes leading to the in situ immobilization of radionuclides (U, Tc, and Pu) and metals (Cr and Hg) by indigenous subsurface microorganisms. Applications for this solicitation are especially encouraged that address the radionuclides uranium and technetium. 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. 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 radionuclide and radionuclide biotransformation, and 4) developing approaches to manipulate pathways and enzyme systems that mediate these transformations to improve their ability to immobilize these radionuclides and metals.

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 on subsurface microorganisms to increase our understanding of how genes relevant to bioremediation are expressed in the environment.

Technical Areas of Interest for the Biomolecular Science and Engineering Element

Research projects are sought that focus on understanding the regulation of genes that have been identified to be important in: 1) the immobilization of radionuclides (U, Tc, and Pu) and metals (Cr and Hg) by naturally occurring microorganisms in contaminated subsurface environments, and 2) the growth and survival of microorganisms in the presence of these radionuclides and metals. Applications should primarily focus on indigenous subsurface microorganisms that can precipitate and immobilize these radionuclides and metals. Applications addressing immobilization of uranium and technetium are strongly encouraged. For mercury and plutonium, two other contaminants targeted by the NABIR program, strategies for immobilization are less clear, and may require the development of novel approaches. Detailed studies of the enzymatic mechanisms for radionuclide/metal reduction are needed to increase our understanding of in situ processes and to identify gene targets for better molecular assessment of radionuclide and metal reduction. Microorganisms selected for Biomolecular Science and Engineering research should be those that may play an important role in reducing these radionuclides and/or metals in subsurface environments. Exploring the effects of key environmental parameters on genetic regulation and expression of radionuclide and/or metal reduction is a critical need. The NABIR FRC provides an opportunity for Biomolecular Science and Engineering researchers to work at a DOE site in collaboration with scientists from the Biogeochemistry, Biotransformation, and Community Dynamics 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 these radionuclides and metals in this type of subsurface environment is of special interest. More information on the NABIR FRC and current research being conducted at the FRC can be found at the web site http://www.esd.ornl.gov/nabirfrc. The ultimate goal of this element is to improve our ability to predict and to manipulate the activities of microbes in situ, particularly in an in situ immobilization scenario.

New and creative scientific approaches are sought that address the following fundamental research questions for the Biomolecular Science and Engineering Element:

What are the basic biomolecular mechanisms of uranium and technetium reduction and reoxidation in microorganisms, primarily those indigenous to the subsurface?

How do low pH and high nitrate concentrations impact the biochemistry and gene expression and regulation of uranium and technetium reduction?

How can biomolecular processes be manipulated to enhance the sustainability of immobilization of uranium and technetium?

Are there novel biomolecular mechanisms that can be used to immobilize mercury or plutonium?

For further information on the Biomolecular Science and Engineering Element, please contact Dr. Daniel Drell (Daniel.Drell@science.doe.gov), the Program Element Manager.

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 NABIR FRC provides opportunities for such field-scale experiments. The focus of field experiments at the FRC is on in situ immobilization of radionuclides, such as uranium and technetium by microbiological processes. For more information on the NABIR FRC, access the FRC web site at http://www.esd.ornl.gov/nabirfrc. For this solicitation, applicants are especially encouraged to develop experiments for Area 2, a low nitrate, circumneutral site at the FRC. Applicants may also choose to propose research for Area 1, a high nitrate, low pH site. Both sites are described in the following sections; maps and additional information on the sites are available at the FRC web site.

Applicants must propose a testable hypothesis that is based on biologically-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 should 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 FRC Advisory Panel 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.

Characteristics of Area 2 at the NABIR FRC

The S-3 Ponds were the primary source of contamination detected at Area 2 of the NABIR FRC. The S-3 Ponds consisted of four unlined ponds constructed in 1951 on the west end of the Y-12 Plant. Liquid wastes, composed primarily of nitric acid plating wastes containing nitrate and various radionuclides and metals (e.g., uranium and technetium) were disposed of in the ponds until 1983. Waste disposal activities at the site have created a mixed waste plume of contamination in the underlying unconsolidated residuum (primarily saprolite and fill) and shale bedrock. Area 2 is located several hundred feet to the southwest of the former Ponds. Contaminants were probably transported to Area 2 through a historic stream channel of Bear Creek during operation of the Ponds. Some contaminated residuum and sediments in Area 2 were excavated and deposited in the S-3 Ponds, however, much contaminated residuum remains and contributes to the groundwater contamination currently detected in Area 2.

A typical geologic profile at Area 2 would consist of about 6 m of reworked fill and saprolite at the surface underlain by 2 m of intact saprolite with weathered bedrock below the saprolite. As much as 300-500 mg/kg of uranium may be associated with the solid phase material. The reworked fill tends to have a higher hydraulic conductivity than the native saprolite. Based on data from a tracer study test conducted in 1998, the rate of interstitial groundwater movement in the unconsolidated fill was calculated to range from 0.7 to 4.5 m/day, with an average rate of about 2.2 m/day. Hydraulic monitoring at the site indicates that the depth to groundwater is approximately 4.5 meters from the surface and the hydraulic gradient ranges between about 0.01 and 0.025 to the southwest towards the Creek. Vertical upward gradients between the shale bedrock and unconsolidated zone are as great as 0.25.

In Area 2, there is a shallow pathway (<10 m) for the migration of groundwater contaminated with uranium (1-2 mg/L) to seep in the upper reach of Bear Creek, which is adjacent to Area 2. Nitrate concentrations are generally <100 mg/L at Area 2, but have been detected above 1,000 mg/L in several of the wells. Technetium concentrations are generally less than 600 pCi/L, and total dissolved solids concentrations are approximately 1,000 mg/L. The pH of groundwater at Area 2 tends to be between 6 and 7 with dissolved oxygen content about 1-2 mg/L. Areas of higher and lower uranium and nitrate exist at Area 2. For example TPB-16 which is

representative of an area with higher uranium and lower nitrate contains 28 mg/L nitrate, 98 mg/L sulfate, 310 mg/L chloride, 60 mg/L inorganic carbon, 2 mg/L dissolved organic carbon, and 1.3 mg/L uranium; well FW003 which is representative of an area with higher nitrate and lower uranium contains 1059 mg/L nitrate, 16 mg/L sulfate, 183 mg/L chloride, 89 mg/L inorganic carbon, 13 mg/L organic carbon, and 0.01 mg/L uranium.

An 8 to 9 m deep trench bisects Area 2 in an east to west direction. The trench was filled with gravel except for an 18 m long section in the middle, which was filled with zero-valent iron. Guar gum slurry was added during excavation to prevent the trench walls from collapsing. The trench is oriented nearly parallel to the direction of groundwater flow and is designed to use both the natural groundwater gradient and the permeability contrast between the gravel and iron in the trench and the native silt and clay outside the trench to direct flow through the iron treatment zone. Approximately 52 wells have been installed at the site. Two 20m X 20m plots (one located on either side of the trench) that are high in uranium are available for use by NABIR PIs for field research.

Characteristics of Area 1 at the NABIR FRC

The S-3 Ponds were also the primary source of contamination detected at Area 1 of the NABIR FRC. A small 7 m X 25 m field plot has been established in Area 1 just south of the S-3 Ponds. This field plot, along with other locations within Area 1, is available for NABIR research. Thirteen monitoring wells have been installed in the field plot. The wells are generally 3 cm in diameter, about 7 m deep and have a 1.5 m length of screened interval at the bottom of the well. The wells have been used in the past for conducting small-scale push-pull tests of various types. A brief description of these experiments can be found at the FRC web site. The impact of these push-pull tests probably does not extend beyond the 7 m X 25 m field plot. A typical geologic profile at the Area 1 field plot would consist of about 1.5 m of reworked fill and saprolite at the surface underlain by about 7 m of intact saprolite with weathered shale bedrock below the saprolite. Hydraulic conductivity of the saprolite is fairly low (about 0.26 m/day) with maximum pumping rates of < 1 liter/minute. Hydraulic monitoring at the site indicates that the depth to groundwater is approximately 3.5 m from the surface and the hydraulic gradient is fairly flat. Contaminants include all the contaminants generally associated with the S-3 Ponds groundwater plume (i.e., nitrate, technetium, uranium, volatile organic compounds and other common anions and cations).

Concentrations of contaminants in groundwater and soil from well to well are variable but tend to be fairly stable over time within individual wells. Nitrate concentrations at the Area 1 field plot in groundwater range from 48 to 10,400 mg/l, uranium ranges from 0.01 to 7.5 mg/l, and technetium-99 ranges from 66 to 31,000 pCi/l. Wells with high uranium (e.g., >1 mg/l) tend to have high to moderate nitrate (>1,000 mg/l) and high technetium concentrations (>12,000 pCi/l). The pH of groundwater at Area 1 tends to be more acidic than Area 2 but ranges between 3.25 and 6.5 with dissolved oxygen content about 1-2 mg/L. Sulfate concentrations range between 219 mg/l and 1 mg/l, and chloride concentrations range between 22 and 760 mg/l. Aluminum can be as high as 620 mg/l, and nickel concentrations average around 8.6 mg/l. Calcium, sodium, magnesium, and manganese are other metals detected at significant concentrations (>100 mg/l) at the site. Tetrachloroethylene (120 ug/l), acetone (230 ug/l), and some other volatile organic

compounds (VOCs) are also detected at the Area 1 field plot. As much as 375 mg/kg of uranium is associated with the solid phase material.

Additional Information for Applications

It is anticipated that up to $2 million will be available for multiple awards to be made in late Fiscal Year 2002 and early Fiscal Year 2003, in the categories described above, contingent on availability of appropriated funds. An additional sum, up to $2 million, will be available for competition by DOE National Laboratories under a separate solicitation (LAB 02-12). 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 projects in the Biomolecular Science and Engineering are expected to range from $100,000 to $300,000 total costs. Annual budgets for interdisciplinary field research projects at the FRC are expected to range from $300,000 - $1,000,000 for total costs. Costs for drilling at the FRC should not be included in the applicant's budget. 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.

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.

Also, as part of the evaluation, program policy factors 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. DOE is under no obligation to pay for any costs associated with the preparation or submission of applications if an award is not made. 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, 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.

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 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. 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; 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; 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.

John Rodney Clark
Associate Director of Science
for Resource Management

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