Program Announcement
To DOE National Laboratories
LAB 05-05

Natural and Accelerated
Bioremediation Research Program

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 proposals for research in the Biomolecular Science and Engineering element of 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 understanding the relationships among biological, physical and chemical factors affecting the subsurface fate and transport of metals and radionuclides at DOE sites in the context of remediation and long-term stewardship. Research should address biological aspects of the remediation of uranium, technetium, plutonium, chromium or mercury. NABIR is focused on subsurface sediments below the root zone and includes both the vadose (unsaturated) zone and the saturated zone (groundwater and sediments). Proposals are only being accepted in the following program element: Biomolecular Science and Engineering.

DATES: Researchers are strongly encouraged to submit a preproposal for programmatic review. Preproposals should be submitted by December 21, 2004, to allow sufficient time for review for programmatic relevance and for preparation of the full proposal. A brief preproposal should consist of no more than two pages of narrative describing the research objectives and methods.

The deadline for receipt of formal proposals is 4:30 p.m., Eastern Time, March 3, 2005, to be accepted for merit review and to permit timely consideration for awards late in Fiscal Year 2005 or in early Fiscal Year 2006.

ADDRESSES: Preproposals referencing Program Announcement LAB 05-05 should be sent by E-mail to arthur.katz@science.doe.gov.

Formal proposals in response to Program Announcement LAB 05-05 are to be submitted as 2 paper copies of the proposal and one CD containing the proposal in PDF format. Color images should be submitted as a separate file in PDF format and identified as such. These images should be kept to a minimum due to the limitations of reproducing hardcopies. They should be numbered and referred to in the body of the technical scientific proposal as Color image 1, Color image 2, etc.

The 2 copies of the proposal and the CD, referencing Program Announcement LAB 05-05, should be sent to: Environmental Remediation Sciences Division, SC-75, Office of Biological and Environmental Research, 19901 Germantown Road, Germantown, MD 20874-1290, ATTN: Program Announcement LAB 05-05.

When submitting by U.S. Postal Service Express Mail, any commercial mail delivery service, or when hand carried by the researcher, the following address must be used: Environmental Remediation Sciences Division, SC-75, Office of Biological and Environmental Research, Office of Science, U.S. Department of Energy, 19901 Germantown Road, Germantown, MD 20874-1290, ATTN: Program Announcement LAB 05-05.

FOR FURTHER INFORMATION CONTACT: Dr. Arthur Katz, 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) 903-4932, E-mail: arthur.katz@science.doe.gov, fax: (301) 903-8521.

SUPPLEMENTARY INFORMATION:

Background

For more than 50 years, the U.S. developed and operated a 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. The DOE has shifted its emphasis to remediation, decommissioning, and decontamination of contaminated groundwater, sediments, and structures at its sites. DOE currently is 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 (immobilization) 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. Microorganisms also 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 a topic of ongoing research.

Currently, the fundamental knowledge that would allow cost-effective deployment of *in situ* subsurface bioremediation of radionuclides and metals is lacking. The focus of the NABIR program is on radionuclides and metals that: 1) pose the greatest potential risk to humans and the environment at DOE sites; and 2) are amenable to 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 root zone and includes both the vadose (unsaturated) zone and the saturated zone (both groundwater and sediments). NABIR research is oriented toward areas that have low levels of widespread contamination because remediation with existing technologies is prohibitively expensive. Uranium, technetium, and chromium can be especially mobile in the subsurface under certain conditions; and are risk-driving contaminants at some DOE sites. The effects of co-contaminants such as nitrate, complexing agents (such as EDTA) and chlorinated solvents (such as trichloroethylene and carbon tetrachloride) on the behavior of radionuclides and metals in the subsurface is also of interest to the NABIR program.

NABIR Program

The goal of the NABIR program is to provide the fundamental science that will serve as the basis for understanding the biological, physical and chemical factors affecting the subsurface fate and transport of metals and radionuclides at DOE sites in the context of remediation and long-term stewardship. The NABIR program is focused on subsurface sediments and includes both the vadose zone and the saturated zone, and encompasses both intrinsic bioremediation by naturally occurring microbial communities, as well as accelerated bioremediation through the use of biostimulation (addition of inorganic or organic nutrients). The NABIR Program supports hypothesis-driven, basic research that is more fundamental in nature than demonstration projects. Research on phytoremediation will not be supported by this solicitation.

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

The NABIR program consists of four interrelated Science Elements (Biogeochemistry, Biotransformation, Community Dynamics and Microbial Ecology, and Biomolecular Science and Engineering), and three cross-cutting elements (Assessment, BASIC and Integrative

Studies). The Assessment Element supports innovative method development for the science elements. The Bioremediation and its Societal Implications and Concerns (BASIC) element addresses ethical, legal and societal issues, and the Integrative Studies element requires an integration of research from more than one NABIR research element through laboratory and/or field research. 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.

User Facilities and Other Specialized Resources

For molecular-level studies, applicants may want to explore opportunities to use the wide variety of instrumentation available at the Environmental Molecular Sciences Laboratory (EMSL) at the Pacific Northwest National Laboratory (http://www.emsl.pnl.gov) in Richland, Washington. As a national scientific user facility, EMSL provides users with unique and state-of-the-art resources including facilities for high field magnetic resonance, high performance mass spectrometry, single molecule spectroscopy, interfacial and nanoscale science, and molecular science computing. See the EMSL web site or contact Mr. Paul Bayer (301-903-3524, paul.bayer@science.doe.gov) for further information.

For genome sequencing and related studies, applicants may want to examine the sequence information and resources available through DOE's Joint Genome Institute (JGI) Production Genomics Facility (PGF) in Walnut Creek, California. The PGF provides high-throughput DNA-sequencing capabilities to the scientific community. Beyond genomic sequence information for completed microorganisms (http://genome.jgi-psf.org/), JGI also accepts new proposals for microbial sequencing through its Community Sequencing Program (CSP). See the JGI web site (http://www.jgi.doe.gov/), or contact Dr. David Thomassen (301-903-9817, david.thomassen@science.doe.gov) for further information.

Researchers may want to investigate opportunities to conduct a portion of their research using beamlines at synchrotron light sources. Synchrotron experimental stations often provide information about chemical analysis, including speciation, and sample structure in a shorter time and with greater sensitivity than conventional sources of x-rays. Beamlines suitable for environmental research are available at the Department of Energy synchrotron light sources: The Advanced Light Source (ALS) at Lawrence Berkeley National Laboratory (http://www-als.lbl.gov/), the Advanced Photon Source (APS) at Argonne National Laboratory (http://www.aps.anl.gov/index.html), the National Synchrotron Light Source (NSLS) at Brookhaven National Laboratory (http://www.bnl.gov/envirosuite/default.asp), and the Stanford Synchrotron Radiation Laboratory (SSRL) at the Stanford Linear Accelerator Center (http://ssrl.slac.stanford.edu/). For further information, contact Dr. Roland Hirsch (301-903-9009, roland.hirsch@science.doe.gov).

For studies on DOE-relevant microorganisms, researchers may want to obtain samples from the Oak Ridge Field Research Center (FRC) in Oak Ridge, Tennessee. The FRC provides a site for investigators to obtain DOE-relevant subsurface samples for laboratory-based studies as well as opportunities to conduct field-scale experimental research. The FRC is located on the U.S. Department of Energy Oak Ridge Reservation in Oak Ridge, Tennessee, and it is operated by the

Environmental Sciences Division of the Oak Ridge National Laboratory. The contaminated and background (uncontaminated control) areas are located in Bear Creek Valley (BCV) within the Y-12 Plant area. See the FRC web site (http://www.esd.ornl.gov/nabirfrc) or contact Mr. Paul Bayer (301-903-5324, paul.bayer@science.doe.gov) for more detailed information on the FRC. In addition, researchers may be interested in obtaining cultures from the Subsurface Microbial Culture Collection (SMCC). Contact Mr. Paul Bayer for further information about cultures available through the SMCC.

Current Request for Proposals

Research projects that address the scientific aims of the Biomolecular Science and Engineering element are solicited in this announcement.

Biomolecular Science and Engineering: Research in this element seeks to advance our understanding at the biomolecular level, of the processes leading to the *in situ* immobilization of radionuclides and metals by indigenous subsurface microorganisms. The primary goal of this element is to understand the genetic, biochemical, and regulatory processes that mediate biotransformation of these specific radionuclides and metals, leading to their immobilization. Characterization of genes, gene products, and genetic regulatory networks associated with these biotransformations are key to this understanding. Detailed studies of the enzymatic mechanisms for reduction of radionuclides and/or metals are needed to increase our understanding of *in situ* processes and to identify gene targets for better molecular assessment of radionuclide and metal reduction. Secondary goals include: 1) understanding molecular mechanisms of resistance of subsurface microorganisms to radionuclide and metal toxicity; 2) understanding, at a molecular level, the processes of lateral transfer between microbes of genes involved in biotransformation of these radionuclides and metals; 3) developing novel technologies to provide insights into biomolecular mechanisms of metal and radionuclide biotransformation; and 4) understanding, at the molecular, the regulation of pathways and enzyme systems that mediate biotransformations of metals and radionuclides.

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 and that exhibit evidence of impact to critical processes controlling contaminant mobility. A second challenge is to extrapolate laboratory findings on pure cultures under laboratory conditions to complex *in situ* environmental conditions. This extrapolation is especially critical in studying gene expression, which may be modified by changes in local cellular environments in the subsurface. A third challenge is to take advantage of genomic and other data derived from the DOE Microbial Genome Program (http://microbialgenome.org) on subsurface microorganisms to increase our understanding of how genes relevant to bioremediation are expressed in the environment. Research is needed to address questions such as:

- How are genes regulated in subsurface microorganisms that are responsible for biotransformation and immobilization of radionuclides and metals? How are genes

regulated in these microorganisms to promote survival in the presence of potentially toxic levels of these contaminants?

- What are the effects of key environmental parameters on regulation and expression of genes involved in metal/radionuclide reduction? For example, how do pH and co-contaminants such as nitrate impact the biochemistry and gene expression and regulation of uranium and technetium reduction?
- What are the basic biomolecular mechanisms of uranium, technetium and chromium reduction and reoxidation in microorganisms, primarily those indigenous to the subsurface? What is the pertinent physiology of microorganisms involved in the reduction of these metals and radionuclides in subsurface environments? What are the biomolecular mechanisms involved in lateral transfer of metal/radionlucide reduction genes in subsurface microbial communities that could effect reduction and reoxidation processes? Can biomolecular processes be influenced to enhance the sustainability of immobilization of uranium, technetium or chromium? Are there novel biomolecular mechanisms that can be used to immobilize mercury or plutonium?

Proposals should primarily focus on indigenous subsurface microorganisms that have been shown to precipitate and immobilize these radionuclides and metals under real world conditions. Preference will be given to proposals that study microorganisms that have been isolated from, or associated with, metal and radionuclide-contaminated sites. Microbial community data are available from the FRC (http://public.ornl.gov/nabirfrc/frcwg3.cfm), and several Uranium Mill Tailing Remediation Action (UMTRA) sites (http://www.pnl.gov/nabir-umtra/). The ultimate goal of this element is to improve our ability to predict and affect the activities of microbes in situ, particularly in an *in situ* immobilization scenario.

Relevance to Mission

A Key consideration in the evaluation of research proposals will be applicability to the Environmental remediation Science Division (ERSD) mission of DOE environmental remediation. Researchers will need to identify specific areas of scientific need and make a strong case for the value of the proposed research in helping resolve those needs. The proposal should explain how resolution of these needs could improve capabilities in site stewardship and/or contaminant remediation. Therefore, all proposals submitted in response to this Solicitation must explicitly state how the proposed research will support the accomplishment of the ERSD Long Term Measure to *develop science-based solutions for cleanup and long- term monitoring of DOE contaminated sites.*

Additional Information for Proposals

It is anticipated that up to $1 million will be available for multiple awards to be made in late Fiscal Year 2005 and early Fiscal Year 2006 in the categories described above, contingent on availability of appropriated funds. This call is open to all interested parties. The NABIR program currently funds more than a dozen projects in this element, and expects to receive renewal proposals in response to this announcement.

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 are not to exceed $400,000 total costs. All proposals should include letters of agreement to collaborate from included collaborators; these letters should specify the contributions the collaborators intend to make if the proposal is accepted and funded. DOE may encourage collaboration among prospective investigators to promote joint proposals or joint research projects by using information obtained through the preproposals or through other forms of communication. DOE is under no obligation to pay for any costs associated with the preparation or submission of proposals if an award is not made.

Submission Information

The research description must be 20 pages or less, exclusive of attachments, and must contain an abstract or summary of the proposed research (to include the hypotheses being tested, the proposed experimental design, and the names of all investigators and their affiliations). **Researchers who have had prior NABIR support must include a Progress Section with a brief description of results, the funding history (i.e., number of years and amounts per year for all PI's and co-PI's), 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.

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

Additional information on the NABIR Program is available at the following web site: http://www.lbl.gov/NABIR/. For researchers who do not have access to the world wide web, please contact Judy Nusbaum; Environmental Remediation Sciences Division, SC-75/Germantown Building; U.S. Department of Energy; 1000 Independence Avenue, S.W., Washington, D.C. 20585-1290; phone: (301) 903-4902; fax: (301) 903-4154; E-mail: judy.nusbaum@science.doe.gov; for hard copies of background material mentioned in this solicitation.

The instructions and format described below should be followed. Reference Program Announcement LAB 05-05 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

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.

The evaluation will include program policy factors such as the relevance of the proposed research to the terms of the announcement and the Department's programmatic needs. External peer reviewers are selected with regard to both their scientific expertise and the absence of conflict-of-interest issues. Non-federal reviewers may be used, and submission of a proposal constitutes agreement that this is acceptable to the investigator(s) and the submitting institution.

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

Formal proposals in response to Program Announcement LAB 05-05 are to be submitted as 2 paper copies of the proposal and 1 CD containing the proposal in PDF format. Color images should be submitted as a separate file in PDF format and identified as such. These images should be kept to a minimum due to the limitations of reproducing hardcopies. They should be numbered and referred to in the body of the technical scientific proposal as Color image 1, Color image 2, etc.

3. Detailed Contents of the Proposal

Adherence to type size and line spacing requirements is necessary for several reasons. No researcher should have the advantage, or by using small type, of providing more text in their proposals. Small type may also make it difficult for reviewers to read the proposal. Proposals must have 1-inch margins at the top, bottom, and on each side. Type sizes must be 10 point or larger. Line spacing is at the discretion of the researcher but there must be no more than 6 lines per vertical inch of text. Pages should be standard 8 1/2" x 11" (or metric A4, i.e., 210 mm x 297 mm).

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 Budget and Budget Explanation

A detailed budget is required for the entire project period 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/grants/Forms-E.html

3.6 Project Description

The Project Description 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".

3.7 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.

3.8 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.

3.9 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.

3.10 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.

3.11 Appendix

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

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

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

4. Detailed Instructions for the Budget

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

4.1 Salaries and Wages

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

4.2 Equipment

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

4.3 Domestic Travel

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

4.4 Foreign Travel

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

4.5 Other Direct Costs

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

a. Materials and Supplies

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

b. Publication Costs/Page Charges

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

c. Consultant Services

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

d. Computer Services

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

e. Subcontracts

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

4.6 Indirect Costs

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