Program Announcement To DOE National Laboratories
LAB 01-19
Environmental Management Science Program: Research Related to Deactivation and Decommissioning Issues

The Offices of Science (SC) and Environmental Management (EM), U.S. Department of Energy (DOE), hereby announce their interest in receiving proposals for performance of innovative, fundamental research to support specifically innovative, fundamental research to investigate DOE deactivation and decommissioning issues.

SUPPLEMENTARY INFORMATION: The Office of Environmental Management, in partnership with the Office of Science, sponsors the Environmental Management Science Program (EMSP) to fulfill DOE's continuing commitment to the clean-up of DOE's environmental legacy.

The DOE Environmental Management program currently has ongoing applied research and engineering efforts under its Technology Development Program. These efforts must be supplemented with basic research to address long-term technical issues crucial to the EM mission. Basic research can also provide EM with near-term fundamental data that may be critical to the advancement of technologies that are under development but not yet at full scale nor implemented. Proposed basic research under this Announcement should contribute to environmental management activities that would decrease risk for the public and workers, provide opportunities for major cost reductions, reduce time required to achieve EM's mission goals, and, in general, should address problems that are considered intractable without new knowledge. This program is designed to inspire breakthroughs in areas critical to the EM mission through basic research and will be managed in partnership with SC. The Office of Science's well-established procedures, as set forth in the Office of Science Merit Review System, available on the World Wide Web at: http://www.science.doe.gov/production/grants/merit.html will be used for merit review of proposals submitted in response to this Announcement. Subsequent to the formal scientific merit review, proposals that are judged to be scientifically meritorious will be evaluated by DOE for relevance to the objectives of the Environmental Management Science Program. Additional information can be obtained at: http://www.emsp.em.doe.gov/main.htm. Additional Announcements for the Environmental Management Science Program may be issued during Fiscal Year 2001, covering other areas within the scope of the EM program.

Purpose

The purpose of the EMSP is to foster basic research that will contribute to successful completion of DOE's mission to clean-up the environmental contamination across the DOE complex.

The objectives of the Environmental Management Science Program are to:

- Provide scientific knowledge that will revolutionize technologies and clean-up approaches to significantly, reduce future costs, schedules, and risks;
- "Bridge the gap" between broad fundamental research that has wide-ranging applicability such as that performed in DOE's Office of Science and needs-driven applied technology development that is - conducted in EM's Office of Science and Technology; and
- Focus the Nation's science infrastructure on critical DOE environmental management problems.

The focus of the EMSP is on basic research and the objective of this research Program is to develop a long-range science plan for deactivation and decommissioning (D&D). The National Research Council, Committee on Long-Term Research Needs for Deactivation and Decommissioning at Department of Energy Sites, December 5, 2000 report provided technical advise on the "recommended areas of research where the EM Science Program can make significant contributions to solving (D&D) problems and adding to scientific knowledge generally."

Representative Research Areas

Basic research is solicited in all areas of science with the potential for addressing problems in deactivation and decommissioning. Relevant scientific disciplines include, but are not limited to: chemical sciences (including fundamental interfacial chemistry, computational chemistry, actinide chemistry, and analytical chemistry and instrumentation), engineering sciences (including control systems and optimization, diagnostics, transport processes, fracture mechanics and bioengineering), materials science (including other novel materials-related strategies), and bioremediation (including microbial science related to ex situ treatment of organics, metals and radionuclides and in situ treatment of organics).

Project Renewals

Lead Principal Investigators of record for Projects funded under Office of Science Notice 98-04, Environmental Management Science Program: Research Related to Decontamination and Decommissioning of Facilities, are eligible to submit renewal proposals under this solicitation.

It is recognized that many of the projects funded in FY 1998 of the program have already been very successful. At the same time, we believe that many of these research groups have the potential to make significant additional contributions toward addressing the science needs of the Office of Environmental Management (EM).

DATES: The deadline for receipt of formal proposals is 4:30 P.M., E.S.T, March 20, 2001, in order to be accepted for merit review and to permit timely consideration for award in Fiscal Year 2001.

ADDRESSES: Formal proposals referencing Program Announcement LAB 01-19 should be sent to: U.S. Department of Energy, Office of Science, Medical Sciences Division, SC-73, Office of Biological and Environmental Research, 19901 Germantown Road, Germantown, MD 20874-1290, ATTN: Program Announcement LAB 01-19. This address must be used when submitting proposals by U.S. Postal Service Express, commercial mail delivery service, or when hand carried by the proposer.

FOR FURTHER INFORMATION CONTACT: Dr. Roland F. Hirsch, SC-73, Mail Stop F-237, Medical Sciences Division, Office of Biological and Environmental Research, Office of Science, U.S. Department of Energy, 19901 Germantown Road, Germantown, MD 20874-1290, telephone: (301) 903-9009, fax: (301) 903-0567, E-mail: roland.hirsch@science.doe.gov, or Mr. Mark Gilbertson, EM-52, Office of Basic and Applied Research, Office of Science and Technology, Office of Environmental Management, 1000 Independence Avenue, SW, Washington, D.C. 20585, telephone: (202) 586-7150, E-mail: mark.gilbertson@em.doe.gov.

Program Funding

It is anticipated that up to a total of $4,000,000 of Fiscal Year 2001 Federal funds will be available for new Environmental Management Science Program awards resulting from this Announcement. Multiple-year funding of awards is anticipated, contingent upon the availability of appropriated funds. Award sizes are expected to be on the order of $100,000-$300,000 per year for total project costs for a typical three-year award. Collaborative projects involving several research groups or more than one institution may receive larger awards if merited. The program will be competitive and offered to investigators in universities or other institutions of higher education, other non-profit or for-profit organizations, non-Federal agencies or entities, or unaffiliated individuals. DOE is under no obligation to pay for any costs associated with the preparation or submission of proposals if an award is not made. DOE reserves the right to fund in whole or part any or none of the proposals received in response to this Announcement. All projects will be evaluated using the same criteria, regardless of the submitting institution.

Collaboration and Training

Proposers to the EMSP are strongly encouraged to collaborate with researchers in other institutions, such as universities, industry, non-profit organizations, federal laboratories and Federally Funded Research and Development Centers (FFRDCs), including the DOE National Laboratories, where appropriate, and to incorporate cost sharing and/or consortia wherever feasible. Refer to: http://www.sc.doe.gov/production/grants/Colab.html for details.

Proposers are also encouraged to provide training opportunities, including student involvement, in proposals submitted to the program.

Proposal Format

Proposers are expected to use the following format in addition to following instructions listed later in this announcement in the Office of Science, Guide for Preparation of Scientific/Technical Proposals to be Submitted by National Laboratories. Proposals must be written in English, with all budgets in U.S. dollars.

- Field Work Proposal Format (Reference DOE Order 5700.7C) (DOE ONLY)
- Proposal classification sheet (a plain sheet of paper with one selection from the list of scientific fields listed in the Proposal Categories Section)
- Table of Contents
- Project Abstract (no more than one page)
- Budgets for each year and a summary budget page for the entire project period (using DOE F 4620.1)
- Budget Explanation. Proposers are requested to include in the travel budget for each year funds to attend the annual National Environmental Management Science Program Workshop, and also for one or more extended (one week or more) visits to a clean-up site by either the Principal Investigator or a senior staff member or collaborator.
- Budgets and Budget explanation for each collaborative subproject, if any
- Project Narrative (recommended length is no more than 20 pages; multi-investigator collaborative projects may use more pages if necessary up to a total of 40 pages)
- Goals
- Significance of Project to the EM Mission
- Background
- Research Plan
- Preliminary Studies (if applicable)
- Research Design and Methodologies
- Literature Cited

- Collaborative Arrangements (if applicable)
- Biographical Sketches (limit 2 pages per senior investigator)
- Description of Facilities and Resources
- Current and Pending Support for each senior investigator

Proposal Categories

In order to properly classify each proposal for evaluation and review, the documents must indicate the proposer's preferred scientific research field, selected from the following list.

Field of Scientific Research:

1. Actinide Chemistry
2. Analytical Chemistry and Instrumentation
3. Bioremediation
4. Engineering Sciences
5. Interfacial Chemistry
6. Materials Science
7. Other

Proposal Evaluation and Selection

Scientific Merit

Relevance to Mission

Researchers are encouraged to demonstrate a linkage between their research projects and significant contamination problems at DOE sites. Researchers could establish this linkage in a variety of ways - for example, by elucidating the scientific problems to be addressed by the proposed research and explaining how the solution of these problems could improve D&D capabilities. Subsequent to the formal scientific merit review, proposals which are judged to be scientifically meritorious will be evaluated by DOE for relevance to the objectives of the Environmental Management Science Program.

DOE shall also consider, as part of the evaluation, program policy factors such as an appropriate balance among the program areas, including research already in progress. Research funded in the Environmental Management Science Program in Fiscal Years 1996 through 2000, can be viewed at: http://emsp.em.doe.gov/portfolio/multisearch.asp.

Major Environmental Management Challenges

The safety for workers conducting D&D operations is a issue that will grow as DOE takes on the more challenging D&D tasks. Workers deal with special hazards that are different from those in other parts of DOEs Accelerating Clean-up Paths to Closure (DOE, 1998a), including the following:

- Working in confined spaces in areas of high radioactivity,
- Disassembling and removing massive steel and concrete structures,
- Direct, hands-on manual labor with powerful saws, torches, and lifting devices, and
- Incomplete knowledge of the highly complex systems they are dismantling.

Scientific Issues

The recognized issues pose challenges in characterization, decontamination, and remote systems where current technology is inadequate and where EMSP funded, research could make significant contributions include:

Characterization

Characterization of contaminated materials is critical at several stages of D&D. Initially, the nature and extent of contamination with both radionuclides and toxic materials must be accurately assessed to ensure adequate protection of workers and the environment, as well as to allow the selection of appropriate methods of decontamination. During decontamination and/or demolition of contaminated equipment and structures, there must be some means of monitoring progress and potential contaminant releases. Finally, after decontamination, the nature and extent of residual contamination must be assessed to determine the final classification and disposal of the item in question.

(1) The identification and development of means, preferably real-time, minimally invasive, and field usable, to locate and quantify difficult to measure contaminants significant to D&D. These means should be applicable to the major materials and configurations of interest, such as concrete, stainless steel, and packaged wastes. The contaminants of interest, includes tritium, technetium-99, plutonium-239 and other actinides, beryllium, mercury, asbestos, and polychlorinated biphenyls (PCBs).

Rationale: The varied nature of D&D facilities has led to a wide range of contaminant types and site-specific characterization challenges, each generally requiring a detector tailored specifically to the contaminant being measured and its matrix. Some 2,700 buildings, constructed mostly of concrete and containing 180,000 metric tons of metals, are currently within EM's D&D task. Four areas where research can advance the state of art: (1) methods to assess the distribution of contaminants within concrete;

(2) sensors to measure contaminants on the surface and within micro-cracks of metals; (3) remote sensing of contaminants; and (4) biosensors.

The development of minimally- and non-invasive real-time in situ sensing technologies to characterize the concentration of contaminants, as a function of depth within concrete, would eliminate difficulties associated with core sample collection and subsequent analysis. Minimally invasive schemes like laser ablation mass spectroscopy or non-intrusive techniques like neutron activation and x-ray analysis appear to be attractive candidates for further research.

More sensitive detectors, for example for alpha particles (USDOE, 1999), as well as simple-to-use techniques, such as chemical indicators are needed to quickly certify levels of nuclides, hazardous metals, and other toxic substances on structural surfaces and equipment. This will help ensure safety in the workplace and reduce costs—for example by allowing non- hazardous waste to be disposed in landfills. Analysis of residual low-energy beta emitters like tritium and Tc-99 is particularly challenging when these isotopes are inside equipment or mixed in heterogeneous waste matrices, because the beta articles cannot penetrate through most materials.

Remote sensing systems can provide both economic and safety benefits by distancing the worker from hazardous work areas. Remote mapping of activity levels using gamma cameras (USDOE, 1998b) is now being used to great advantage in D&D operations. Smaller, higher sensitivity and resolution versions of these instruments would be desirable and may be achievable through further research on detector materials and geometries. Fiber-optic sensing for remote detection of some chemical species is feasible. Further research could lead to its use in sensing chemical contaminants relevant to D&D. Fiber-optic radiation sensors are a more recent development and opportunities exist for both improved performance and novel features such as optical interrogation.

(2) The basic research that could lead to development of biotechnological sensors to detect contaminants of interest may provide a completely new way to meet the needs for characterization of contaminated materials. The field of biotechnology is rapidly expanding, and the contaminants of interest and the materials and configurations in which they must be detected, is noted in (1).

Rationale: There has been tremendous growth in development and commercialization of a broad range of biosensor devices and applications. Modern devices can range from fiber-optic and micro-cantilever-linked immuno assays to subcellular and cellular micro-electronic. Analytes measurable by biosensors include a vast array of organic chemicals, biochemicals, inorganics, and metals and more recently ionizing radiation. Research to integrate microelectronics and nanotechnology with elements of

gene array technology and cellular engineering may lead to new sensor technology (see http://www.nano.gov/press.htm for details). This technology could create new capacity for continuous and remote monitoring in chemically and physically complex environmental and structural systems characteristic of DOE's site D&D needs.

Decontamination

The decontamination of equipment and facilities is necessary at several stages of the D&D process. Initially, radiation and contamination levels may have to be reduced to allow worker access or to limit their exposure to radiation and other hazards. Decontamination may be required before dismantling or demolition work to prevent the spread of radioactive or toxic materials. Unplanned releases can have off-site as well as on-site consequences. Decontamination procedures are intended to result in a small volume of the most hazardous waste, and much larger volumes of waste that has low or no hazard, thus reducing the cost and long-term risk of disposal. Some decontaminated equipment or facilities might be recycled or reused. The end state of any decontamination activity must be consistent with both site-specific and overall DOE clean-up objectives.

(3) The basic research toward fundamental understanding of the interactions of important contaminants with the primary materials of interest in D&D projects, including concrete, stainless steel, paints, and "strippable" coatings is needed.

Rationale: Scientific understanding of the interactions among contaminants and construction materials is fundamental to developing more effective D&D technologies. Both radioactive and toxic contaminants can exist in a variety of chemical forms (for example, in different valence states, complexes, or as colloids), which exhibit very different behaviors. While a good deal of chemical data on the contaminants themselves exist as well as data on their transport in the environment there is little information of direct relevance to D&D problems. Such information includes how contaminants bind to steel and concrete surfaces, how they penetrate into these materials, their migration into pores, fissures, and welds, and time-dependent "aging" effects. Once sufficient thermodynamic and kinetic data on these interactions are obtained to allow their modeling from first principles, the models would allow various decontamination approaches to be evaluated and provide a better way to interpret data from characterization.

(4) The basic research on biotechnological means to remove or remediate contaminants of interest from surfaces and within porous materials.

Rationale: The capacity of microbiological processes to destroy, transform, mobilize, and sequester toxins, pollutants, and contaminants is well-established. Through

research to extend well-known technology in mineral ore leaching and metal recovery, these biochemical capacities may be exploitable for removal of metals and radionuclides from concrete and building debris. An excellent example of which was recently described in an American Society for Microbiology report (see ASM News. 66:133). In addition, microbial biocorrosion processes for structural metals and concrete are well established and the opportunity exists to investigate fundamental processes that could facilitate volumetric reduction of waste from D&D activities. Biotechnical advances in surface treatments of contaminated structures and materials are anticipated from continuing R&D activities, elucidation of biocatalytic properties of biological systems and engineering chemicals, and biosurfactants with unique physical chemical properties. A fundamental understanding of the biological processes would also help to ensure that waste by-products from the decontamination could be safely treated and stabilized.

Remote Systems

For D&D work, remote systems provide a unique means to separate workers from hazardous work areas, thus enhancing their safety and productivity. This technology crosscuts all of the other D&D areas—characterization, decontamination, and dismantlement—and has the potential for substantial performance enhancement and cost reduction. There are broad ranges for potential applicability of fundamental advances in this area.

(5) The basic research toward creating intelligent remote systems that can adapt to a variety of tasks and be readily assembled from standardized modules. Today's remote systems are one-of-a-kind devices of high cost and limited capability. Their inflexibility leads to rapid obsolescence and is a barrier to their deployment. The recommended initial research focus would be as follows:

a. Actuators

Rationale: The actuator is the power (muscle) of remote systems, and as such, it is the key to performance, reliability, and cost. Except for better construction materials and improved control electronics, most actuator technology has not changed for several decades. Today's actuators typically use only one sensor (for position) so that virtually no real time data (for example, force and velocity) are available to make them "intelligent." More complete sensory input, coupled with decision-making software can produce intelligent actuators that are able to adapt to a variety of tasks. Achieving a relatively inexpensive modular design to allow "plug and play" deployment of these devices would be especially useful because equipment that fails or becomes contaminated is usually discarded. Research to answer the question of granularity (What is the minimum number of required standard modules?) to enable

the assembly on demand of the maximum number of remote systems would make the overall system substantially more cost effective in deployment and maintenance.

b. Universal Operational Software to Provide Criteria-Based Decision Making
Rationale: Criteria-based decision making is the essence of intelligence in robotic systems. What is the best use of the system's resources to perform the task at hand? Today's control of robotic devices is derived from techniques developed during World War II in which control is linear (based only on the difference between two measured parameters). A robot capable of mimicking human adaptability, however, would require a non-linear control system coupled to many parameters corresponding to the physical features that accurately represent performance of the task. The criteria-based software could be universal in the same sense that operating systems on personal computers are universal—one system supports many different applications.

c. Virtual Presence of the Worker in Hazardous Environments
Rationale: In the initial planning and characterization phases of D&D work, workers often must enter an area of high radiation and contamination that is also congested with left-in- place equipment and materials for which removal inevitably involves physical stress (fatigue) and the potential for personal injury. Virtual reality systems could allow workers to perform essential survey and decision making functions from a remote location thus enhancing their safety and productivity. Advances in the state of the art as now used in deep sea exploration should be pursued to improve overall system performance by providing force feedback, remote vision, collision avoidance, and radiation resistant sensor technology.

The nature and extent of contamination with both radionuclides and toxic materials must be accurately assessed to ensure adequate protection of workers and the environment, as well as to allow the selection of appropriate methods of decontamination.

Background

DOE expects to spend some $30 billion for D&D of weapons complex facilities after 2006. For example the Savannah River and Hanford sites present the biggest D&D challenges and will be undertaken after 2006 with about half of the $30 billion being saved through use of innovative technologies that it expects could be developed by that time.

The United States involvement in nuclear weapons development for the last 50 years has resulted in the development of a vast research, production, and testing network known as the nuclear weapons complex. The Department has the challenge of deactivating 7,000 contaminated buildings and decommissioning 900 contaminated buildings that are currently on DOE's list of surplus facilities. It is also responsible for decontaminating the metal and concrete within those buildings and disposing of

180,000 metric tons of scrap metal. Deactivation refers to ceasing facility operations and placing the facility in a safe and stable condition to prevent unacceptable exposure of people or the environment to radioactive or other hazardous materials until the facility can be decommissioned. Typically, deactivation involves removal of fuel and stored radioactive and other hazardous materials and draining of systems. Decommissioning is the process of decontaminating or removing contaminated equipment and structures to achieve the desired end state for the facility. Desired end states include complete removal and remediation of the facility, release of facility for unrestricted use, or release of facility for restricted use. Decontamination is the removal of unwanted radioactive or hazardous contamination by a chemical or mechanical process.

Details of the programs of the Office of Environmental Management and the technologies currently under development or in use by Environmental Management Program can be found on the World Wide Web at: http://www.em.doe.gov/index4.html and at the extensive links contained therein. The programs and technologies should be used to obtain a better understanding of the missions and challenges in environmental management in DOE when considering areas of research to be proposed.

References

Note: World Wide Web locations of these documents are provided where possible. For those without access to the World Wide Web, hard copies of these references may be obtained by writing Mark A. Gilbertson at the address listed in the FOR FURTHER INFORMATION CONTACT section.

DOE. 1995. Closing the Circle on the Splitting of the Atom: The Environmental Legacy of Nuclear Weapons Production in the United States and What the Department of Energy is Doing About It. The U.S. Department of Energy, Office of Environmental Management, Office of Strategic Planning and Analysis, Washington, D.C., http://www.em.doe.gov/circle/index.html

DOE. 1998a. Accelerating Clean-up: Paths to Closure - June 1998. http://www.em.doe.gov/closure

DOE. 1998. Report to Congress on the U.S. Department of Energy's Environmental Management Science Program - April 1998. http://emsp.em.doe.gov/

DOE. 2000. Environmental Management Advisory Board. http://www.em.doe.gov/emab/

DOE. 2000 Environmental Management Science Program, Project Summaries. http://emsp.em.doe.gov/

DOE. 2000. Office of Integration and Disposition. http//:www.em.doe.gov/office.html

DOE. 2000 Office of Science and Technology (EM-50). http://www.ost.em.doe.gov/

Environmental Management Advisory Board Science Committee. 1997. Resolution on the Environmental Management Science Program dated May 2, 1997.

National Research Council. 1996. Affordable Clean-up? Opportunities for Cost Reduction in the Decontamination and Decommissioning of the Nation's Uranium Enrichment Facilities. Washington, DC: National Academy Press.

National Research Council. 1998. A Review of Decontamination and Decommissioning Technology Development Programs at the DOE. Washington, DC: National Academy Press.

National Research Council. 1997. Building an Environmental Management Science Program: Final Assessment. National Academy Press, Washington, DC., http://www.nap.edu/readingroom/books/envmanage/

National Research Council. 2000. Letter Report, Committee on Long-Term Research Needs for Deactivation and Decommissioning at Department of Energy Sites December 5, 2000. http://books.nap.edu/books/NI000321/html/1.html#pagetop

Secretary of Energy Advisory Board. Alternative Futures for the Department of Energy National Laboratories. February 1995. Task Force on alternative Futures for the Department of Energy National Laboratories. Washington, D.C., http://www.hr.doe.gov/seab/galvin/tf-rpt.html

The instructions and format described below should be followed. Reference Program Announcement LAB 01-19 on all submissions and inquiries about this program.

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

Proposals from National Laboratories submitted to the Office of Science (SC) as a result of this program announcement will follow the Department of Energy Field Work Proposal process with additional information requested to allow for scientific/technical merit review. The following guidelines for content and format are

intended to facilitate an understanding of the requirements necessary for SC to conduct a merit review of a proposal. Please follow the guidelines carefully, as deviations could be cause for declination of a proposal without merit review.

1. Evaluation Criteria

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

Scientific and/or technical merit of the project

Appropriateness of the proposed method or approach

Competency of the personnel and adequacy of the proposed resources

Reasonableness and appropriateness of the proposed budget

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

2. Summary of Proposal Contents

Field Work Proposal (FWP) Format (Reference DOE Order 5700.7C) (DOE ONLY)
Proposal Cover Page
Table of Contents
Abstract
Narrative
Literature Cited
Budget and Budget Explanation
Other support of investigators
Biographical Sketches
Description of facilities and resources
Appendix

2.1 Number of Copies to Submit

An original and seven copies of the formal proposal/FWP must be submitted.

3. Detailed Contents of the Proposal

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

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

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

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

3.2 Proposal Cover Page

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

Title of proposed project
SC Program announcement title
Name of laboratory
Name of principal investigator (PI)
Position title of PI
Mailing address of PI
Telephone of PI
Fax number of PI
Electronic mail address of PI
Name of official signing for laboratory*
Title of official
Fax number of official
Telephone of official
Electronic mail address of official
Requested funding for each year; total request
Use of human subjects in proposed project:

If activities involving human subjects are not planned at any time during the proposed project period, state "No"; otherwise state "Yes", provide the IRB Approval date and Assurance of Compliance Number and

include all necessary information with the proposal should human subjects be involved.

Use of vertebrate animals in proposed project:

If activities involving vertebrate animals are not planned at any time during this project, state "No"; otherwise state "Yes" and provide the IACUC Approval date and Animal Welfare Assurance number from NIH and include all necessary information with the proposal.

Signature of PI, date of signature

Signature of official, date of signature*

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

3.3 Table of Contents

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

3.4 Abstract

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

3.5 Narrative

The narrative comprises the research plan for the project and is limited to 25 pages. It should contain the following subsections:

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

Preliminary Studies: Use this section to provide an account of any preliminary studies that may be pertinent to the proposal. Include any other information that will help to establish the experience and competence of the investigators to pursue the

proposed project. References to appropriate publications and manuscripts submitted or accepted for publication may be included.

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

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

3.6 Literature Cited

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

3.7 Budget and Budget Explanation

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

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

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

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

3.8 Other Support of Investigators

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

3.9 Biographical Sketches

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

3.10 Description of Facilities and Resources

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

3.11 Appendix

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

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

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

4. Detailed Instructions for the Budget

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

4.1 Salaries and Wages

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

4.2 Equipment

DOE defines equipment as "an item of tangible personal property that has a useful life of more than two years and an acquisition cost of $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.