Program Announcement
To DOE National Laboratories
LAB 05-12

Environmental Management Science Program (EMSP): Transport of Contaminants in Subsurface Environments at DOE Sites

SUMMARY: The Office of Science (SC), U.S. Department of Energy (DOE), hereby announces interest in receiving proposals for research in the Environmental Management Science Program (EMSP) to support innovative, fundamental research investigating coupled reactive contaminant transport processes across different spatial scales in heterogeneous subsurface environments at DOE sites; research is also invited on new tools for measuring subsurface properties and parameters important to understanding coupling and scaling phenomena.

DATES: Researchers are strongly encouraged to submit a preproposal for programmatic review. Preproposals should be submitted by February 10, 2005, to allow sufficient time for review of programmatic relevance and for subsequent preparation of the full proposal. The preproposal narrative of no more than two pages should consist of a description of the research objectives, approach, and relevance to DOE needs. The preproposal should also include a list of the key investigators, their disciplines and their institutions using at most one page.

The deadline for receipt of formal proposals is 4:30 P.M., Eastern Time, Tuesday, April 26, 2005, in order to be accepted for merit review and to permit timely consideration for award early in Fiscal Year 2006.

ADDRESSES: Preproposals referencing Program Announcement LAB 05-12 should be sent by E-mail to roland.hirsch@science.doe.gov.

Formal proposals in response to Program Announcement LAB 05-12 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 05-12, should be sent to: Environmental Remediation Sciences Division, Office of Biological and Environmental Research, SC- 75, 19901 Germantown Road, Germantown, MD 20874-1290, ATTN: Program Announcement LAB 05-12.

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:, Office of Biological

and Environmental Research, SC-75, Office of Science, U.S. Department of Energy, 19901 Germantown Road, Germantown, MD 20874-1290, ATTN: Program Announcement LAB 05-12.

FOR FURTHER INFORMATION CONTACT: Dr. Roland F. Hirsch, 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) 903-9009, E-mail: roland.hirsch@science.doe.gov, fax: (301) 903-4154. Please do not use regular mail as delivery may be delayed.

SUPPLEMENTARY INFORMATION:

The Office of Science sponsors environmental remediation research to help fulfill DOE's continuing commitment to the cleanup of the Department's environmental contamination legacy. 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 DOE's mission goals, provide contingency strategies, and, in general, should address problems that are considered to be intractable without new knowledge.

Program Funding

It is anticipated that up to a total of $4 million of Fiscal Year 2006 Federal funds will be available for new and renewal awards resulting from this Announcement. Three-year funding of awards is anticipated, contingent upon the availability of appropriated funds and successful annual progress. Award sizes will be determined by the scope and collaborative nature of the project. Collaborative projects involving several research groups or more than one institution conducting integrated research at multiple scales may be funded up to a limit of $600,000 per year over the three year cycle of the project. Single investigator projects should not exceed $400,000 per year over the three year cycle.

Investigators early in their careers and/or new to DOE's environmental remediation research program are encouraged to apply. The Program Manager is available to discuss new ideas and their alignment with the program.

Collaboration and Training

Multi-disciplinary and inter-institutional collaborations are strongly encouraged to enhance and strengthen research capabilities as needed. Collaboration could include institutions such as universities, industry, non-profit organizations, federal laboratories and Federally Funded Research and Development Centers, including the DOE National Laboratories. 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 and outline a management structure for integrating collaborating investigators. DOE may encourage collaboration among prospective investigators by promoting joint proposals or joint

research projects based on review of the preproposals or through other forms of communication. Involvement of students and post doctoral scientists is encouraged. Refer to http://www.science.doe.gov/grants/Colab.html for details.

Representative Research Areas

Basic research is solicited to elucidate the influence of coupled biological, chemical and hydrologic processes on subsurface contaminant behavior at multiple scales in the vadose and saturated zones (including regions of saturated zone/surface water interaction) and for new tools and approaches that could be incorporated into this research to quantitatively assess process coupling and scaling in heterogeneous environments. Inherent in these studies is the need for multidisciplinary and integrated approaches that allow derivation and scaling of constitutive properties and development of conceptual and numeric models that describe reactive transport behavior in different hydrogeologic environments. Relevant scientific disciplines include, but are not limited to: geosciences (including geology, mineralogy, geochemistry, geophysics, hydrogeologic flow and transport modeling, process modeling, and hydrologic field-studies), chemical sciences (including fundamental interfacial chemistry, computational chemistry, actinide chemistry, and analytical chemistry and instrumentation), biological sciences (including microbiology and biogeochemistry), and engineering and materials sciences (including barrier systems design, diagnostics and transport processes).

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 BER Long Term Measure of Scientific Advancement to develop science-based solutions for cleanup and long-term monitoring of DOE contaminated sites.**

DOE will also consider, as part of the evaluation, program policy factors including balance among the program areas and research already in progress. Past research solicitations, abstracts, and research reports of projects funded under EMSP can be viewed at: http://emsp.em.doe.gov/researcher.htm.

Subsurface Contamination Research Needs

The Department of Energy is responsible for remediation of waste and environmental contamination resulting from the nation's nuclear weapons program. The nuclear weapons complex includes 5000 facilities at 16 major sites and over 100 smaller sites located in a wide range of climatic and geologic conditions.

Research has been funded in this program to address a broad range of cleanup issues, ranging from facilities deactivation and decommissioning to health and ecological risk, but one of the most vexing problems has been how to identify, predict and control contaminant migration at DOE sites across the nation. The ability to define and predict contaminant transport will be critical to assess risk and, where needed, to develop innovative remediation methods to attenuate or remove contaminants. The need to predict contaminant mobility over the long-term is reinforced by DOE estimates that over 100 sites will have residual contamination once cleanup programs are completed (Reference: DOE, 2001b).

An assessment by the National Research Council of research needs in subsurface science at contaminated DOE sites (NRC, 2000a) explicitly recognized that contamination will remain in the subsurface after surface cleanup and that prediction of contaminant transport in conjunction with development of technologies for containment and stabilization of contaminants in-place are, and will continue to be, critical issues. Key needs in site stewardship that were identified include predicting and simulating the fate and transport of contaminants, developing appropriate remediation or stabilization methods based on this knowledge, and assessing performance of both predictive models and mitigation efforts over the long term.

The development of conceptual and numeric models for the fate and transport of contaminants is of primary concern to DOE ERSD as well as to the environmental science community. The inherent complexity of the subsurface in conjunction with the limited ability to observe processes and interactions as they occur in these systems has proven to be a major obstacle to predictive simulation of contaminant behavior at the field scale. A comprehensive DOE/SC effort to identify the technical frontiers in large scale simulation (DOE, 2004) called for interdisciplinary laboratory and field investigations of subsurface processes at all fundamental length scales. These advances in computation and modeling will reliably extend fundamental knowledge of the processes controlling contaminant reactivity at the molecular/microscopic scales to prediction of contaminant transport at the field. A recent assessment by an Interagency Steering Committee on Multimedia Environmental Models (ISCMEM, http://www.iscmem.org/) indicated that most of the ten participating agencies have programs to simulate the transport of chemical contaminants in subsurface environments. The assessment indicated that the most important technical issues facing the application of these simulations were (1) the formulation of coupled reactive process conceptual models representing a scientific understanding of processes controlling the transformation and movement of contaminants and other relevant properties and processes for a specific system, and (2) how to scale reaction parameters for field scale simulation. Conceptual models should include the coupled reaction networks, hydrologic properties, and geologic structure for a specific system. Depending on the system, a conceptual model for a groundwater contaminant plume might also consist of descriptions of the spatial distribution of chemical and biological components; sediment and mineralogical properties; hydrologic properties, such as hydraulic conductivity; aqueous composition and controlling chemical and microbial reactions. (Davis et al, 2004)

A workshop was convened by the ISCMEM in 2004 to assess the state of the art in modeling processes controlling the field scale migration of contaminants and in conceptual model development and parameterization for reactive transport modeling. Research priorities were established and are summarized in detail (Davis et al, 2004) and the document is available on the

Interagency Steering group web site (http://www.iscmem.org/). It was concluded that a major difficulty in conceptual model development is the identification of appropriate process models in the presence of multi-scale heterogeneities. It was further concluded that process and parameter upscaling in multidimensional systems can best be examined by studying transitions in system behavior across a range of scales. Investigation of conceptual models for inter-scale processes in the same system was thought to be the best approach to identify independent constraints on the components of coupled field scale reactive transport models.

Coupled transport and scaling are also highlighted in an upcoming NRC report on nonaqueous phase liquids (NAPLs) source zone assessment and remediation (NRC, 2004), and coupled reactive transport is an issue because biogeochemical processes result in a contaminant plume with a different composition than the original NAPL source. Coupled reactive transport models are also needed that describe the geochemical interactions and reactive transport behavior of contaminants such as U, 129I, and CCl4 in the varied geohydrochemical environments and sediment facies found at DOE sites such as in the Hanford vadose zone and unconfined aquifer. The influence of waste source composition, temperature, co-contaminants, and other properties on reaction chemistry (e.g. sorption, incorporation, precipitation) requires explicit consideration.

Thus the following research priorities and avenues of research are the focus of this Solicitation.

Contaminants

DOE sites across the United States contain over 6 billion cubic meters of contaminated soil, groundwater, and other environmental media (NRC, 2000a). Contaminants of concern across the DOE complex broadly include: radionuclides, metals, and nonaqueous phase liquids (NAPLs). Key contaminants (and their mixtures) of interest for this Solicitation are:

- Radionuclides: plutonium, strontium-90, cesium-137, technetium-99, iodine-129, neptunium-237, and uranium;
- Non-Radioactive Metals: chromium(VI) and mercury; and
- NAPLs: carbon tetrachloride, trichloroethylene, dichloroethylene, tetrachloroethylene, chloroform, dichloromethane, and polychlorinated biphenyls.

A description of the nature and extent of contamination at the principal DOE sites is available at http://www.nap.edu/books/0309065496/html/index.html/. More detailed information is available in some cases from the major DOE sites: Hanford (http://www.hanford.gov, http://www.hanford.gov/cp/gpp/, http://www.hanford.gov/cp/gpp/science/sandt.cfm)
Idaho National Laboratory (http://www.inel.gov/vadosezone/)
Oak Ridge Reservation (http://www.oro.doe.gov/em/) and
Savannah River Site (http://www.srs.gov/general/srs-home.html, http://www.srs.gov/general/enviro/erd/extpage.html)

Integrated Research Needs

This Solicitation has the primary objective of achieving scientific advances in our ability to better define and predict contaminant fate and transport in multidimensional heterogeneous (i.e., real world) systems.

Two principal scientific topics have emerged that cross-cut the program needs described above (NRC, 2001b, NRC, 2004, Anderson et al, 2004, Davis et al, 2004). First, contaminant or co-contaminant subsurface behavior results from a complex interplay of geologic, hydrologic, chemical, and biological processes and reactions. These processes are often coupled and interdependent, and a multidisciplinary approach must be used to incorporate these dependencies into conceptual modeling and into developing strategies for remediation, including containment and stabilization. Second, the processes occur over different spatial and temporal scales in the subsurface, often in heterogeneous media and flow regimes. Scaling methods must therefore address transitions in contaminant chemistry and water movement and changes in contaminant spatial distributions driven by system heterogeneities. These topics form the basis for this Solicitation. Research proposals are solicited in the following areas:

- Coupled reactive transport: Observational, experimental and integrated computational approaches to examine the coupling of biological, chemical, mineralogical, and hydrogeologic processes controlling contaminant and co-contaminant transport.
- Nested or aggregated scale models: Experimental and computational approaches to extrapolate information across spatial scales with the ultimate goal of realistic process and parameter upscaling in subsurface systems.

Successful research in these areas requires close integration of observations of process coupling at different scales into better conceptual models. A desirable product of these studies would be the definition of constitutive relationships that would enable application of the research results to different locations in the DOE site complex. It is expected that successful approaches will entail strong interdisciplinary interactions and integrated experimental and computational components. For example, new methods and approaches, supported by laboratory and field measurements, are needed to describe and model the coupled microbial and chemical reactions that control contaminant behavior at the microscopic and pore-scales and to derive fundamental relationships that can be used in conjunction with scale-dependent physical properties to improve reactive transport modeling across larger spatial and time scales. An illustration of the types of processes and the range of scales considered pertinent to this Solicitation is given on page 135 of the SCaLeS (A Science-Based Case for Large Scale Simulation) program document (DOE, 2004) While research has traditionally been targeted within each scale (see illustration at http://www.pnl.gov/scales/docs/SCaLeS_v2_draft_toc.pdf), methods to bridge between the scales is needed. Research may span all or part of this spectrum in the subsurface up to, and including the zone of groundwater/surface water interaction. Research focused on a single set of DOE site geohydrologic conditions is encouraged to facilitate quantitative descriptions of transitions between different spatial scales and domains. However, this does not preclude innovative approaches based on data from distributed sites. Examples of DOE sites representing a range of geohydrologic conditions are given in the websites listed above.

Technological Research Needs

The development and application of new tools for parameter measurement and characterization from the molecular/microscopic to field scales is encouraged when incorporated into research efforts addressing the two topic areas of coupled reactive transport and scaling listed above. Examples include new methods for measurement of biogeochemical processes at the pore scale; new methods for high resolution imaging and mapping of heterogeneity; innovative use of isotopic geochemistry and "designer" tracers to identify contaminant sources, preferential flow paths and regions of contaminant attenuation; and natural analogs to assess transport over extended length and time scales. New methods for remote sensing and for characterization and speciation of contaminants are sought. The development and validation of these tools for use in the subsurface environment is expected to markedly extend DOE's ability to characterize and monitor subsurface environments and address research needs in this area identified by the National Academy of Sciences (NRC, 2000a, NRC, 2000b, NRC, 2001a) and DOE (DOE, 2001a).

Availability of User Facilities and Other Specialized Resources

The ERSD within the DOE Office of Biological and Environmental Research (http://www.science.doe.gov/ober/ERSD_top.html) has responsibility for programs and facilities that offer unique and complementary resources for conduct of EMSP research. Potential researchers are encouraged to consider use of these programs/facilities in development of proposals.

- The Field Research Center (FRC) at Oak Ridge National Laboratory (http://www.esd.ornl.gov/nabirfrc/index.html) provides a DOE site location where scientists can conduct field scale research and obtain DOE relevant samples of soils, sediments, and ground waters for laboratory research. A useful general orientation for prospective investigators is available at http://public.ornl.gov/nabirfrc/workshop2004_presentations.cfm.
- The Environmental Molecular Science Laboratory (EMSL) at the Pacific Northwest National Laboratory, (http://www.emsl.pnl.gov), is operated by ERSD as a national scientific user facility with state-of-the-art instrumentation in environmental spectroscopy, high field magnetic resonance, high performance mass spectroscopy, high resolution electron microscopy, x-ray diffraction, and high performance computing.
- The EMSL's high performance supercomputer is available for computational research in the physical, chemical and biological sciences, including molecular thermodynamics and kinetics, heavy element chemistry, geochemistry, surface chemistry and groundwater flow and transport simulations (http://www.emsl.pnl.gov/capabs/mscf.shtml). Remote and on-site access to the 11+ TeraFlops, Linux-based Hewlett-Packard system and associated software, plus visualization and data storage capabilities is available through a separate proposal and external peer review process. Proposals for allocations of large blocks of time on the EMSL's HP system are solicited annually (usually in February or March for allocations beginning in October). Awards typically average 500,000 hours for multi-investigator teams (http://mscf.emsl.pnl.gov/about/allocation.shtml). DOE also provides compute cycles to the scientific user community at other high performance computing centers. For example, the National Energy Research Supercomputing Center (NERSC) at the Lawrence Berkeley National Laboratory provides a 10+ TeraFlops IBM

system plus extensive data storage capabilities (http://www.nersc.gov). NERSC usually solicits proposals for time allocations in June or July. Proposals are externally peer reviewed and time awards are announced in December. The Center for Computational Science (CCS) at the Oak Ridge National Laboratory has several supercomputers available to users, including a Cray X-1, two IBM-based systems, and an SGI Altix system (http://www.ccs.ornl.gov). Proposals for time allocations on the various systems at the CCS may be submitted throughout the year, but will be subject to an internal peer review process (http://www.ccs.ornl.gov/accounts/acct-FAQ.html).

- ERSD (http://www.sc.doe.gov/ober/ober_top.html) provides user support for experiments at synchrotron light sources that are capable of providing structural and chemical information often unavailable with conventional sources of x-rays. DOE laboratories with synchrotrons supporting ERSD research and points of contact include: Argonne National Laboratory (http://www.aps.anl.gov/index.html), contact Ken Kemner (kemner@anl.gov); Brookhaven National Laboratory (http://www.nsls.bnl.gov/), contact Jeffrey Fitts (fitts@bnl.gov); Lawrence Berkeley National Laboratory (http://esd.lbl.gov/als_environmental_program/), contact Susan Hubbard (sshubbard@lbl.gov); and Stanford Synchrotron Radiation Laboratory (http://www-ssrl.slac.stanford.edu/mes/remedi/index.html), contact John Bargar, bargar@slac.stanford.edu). Use of the synchrotron light sources requires a separate approval process.

Submission Information

For this solicitation, 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 current ERSD support (i.e., renewal proposals) must include a Progress Section with a 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 for proposed collaborators (when applicable). Curriculum vitae should be submitted in a form similar to that of NIH or NSF. DOE is under no obligation to pay for any costs associated with the preparation or submission of applications.

Researchers must comply with 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.

Information about ERSD programs on the role of microbes in contaminant remediation and transport can be found at: http://www.lbl.gov/NABIR/. The ERSD may issue further Solicitations on the role of microorganisms on contaminant metals and radionuclides during FY 2005. Proposals focused on the use of biological processes for *in situ* remediation should respond

to these other Solicitations. Proposals featuring biological affects on coupled reactions and on upscaling issues in contaminant fate and transport should be submitted to this Solicitation.

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 contacting Roland Hirsch at the electronic mail address listed in the FOR FURTHER INFORMATION CONTACT section.

Anderson, S.P.; J. Blum; S.L. Brantley; O. Chadwick; J. Chorover; L.A. Derry; J.I. Drever; J.G. Herring; J. W. Kirchner; L.R. Kump; D. Richter; A.E. White 2004. Proposed Initiative Would Study Earth's Weathering Engine EOS 85, 265-269.

Davis, J.A.; S.B. Yabusaki; C.I. Steefel; J.M. Zachara; G.P. Curtis; G.D. Redden; L.J. Criscenti; B.D. Honeyman 2004. Assessing Conceptual Models for Subsurface Reactive Transport of Inorganic Contaminants EOS 85, 449-455.

Department of Energy, 2001a. A National Roadmap for the Vadose Zone Science & Technology. http://www.inel.gov/vadosezone/

Department of Energy, 2001b. A Report to Congress on Long-Term Stewardship. Office of Environmental Management. Washington, DC.

Department of Energy, 2004. A Science-Based Case for Large Scale Simulation. Vol. II. Office of Science, United States Department of Energy. Washington, DC http://www.pnl.gov/scales/docs/SCaLeS_v2_draft_toc.pdf

National Research Council, 2000a. Research Needs in Subsurface Science, U.S. Department of Energy's Environmental Management Science Program. National Academy Press, Washington, DC. http://www.nap.edu/browse.html

National Research Council, 2000b. Seeing into the Earth: Noninvasive Characterization of the Shallow Subsurface for Environment and Engineering Application, U.S. Department of Energy's Environmental Management Science Program. National Academy Press, Washington, DC. http://www.nap.edu/browse.html

National Research Council, 2001a. A Strategic Vision for Department of Energy Quality of Research and Development. National Academy Press, Washington, DC. http://www.nap.edu/browse.html

National Research Council, 2001b. Science and Technology for Environmental Cleanup at Hanford. National Academy Press, Washington, DC. http://www.nap.edu/browse.html

The instructions and format described below should be followed. Reference Program Announcement LAB 05-12 on all submissions and inquiries about this program.

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

Proposals from National Laboratories submitted to the Office of Science (SC) as a result of this program announcement will follow the Department of Energy Field Work Proposal process with additional information requested to allow for scientific/technical merit review. The following guidelines for content and format are intended to facilitate an understanding of the requirements necessary for SC to conduct a merit review of a proposal. Please follow the guidelines carefully, as deviations could be cause for declination of a proposal without merit review.

1. Evaluation Criteria

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

Scientific and/or technical merit of the project

Appropriateness of the proposed method or approach

Competency of the personnel and adequacy of the proposed resources

Reasonableness and appropriateness of the proposed budget

For renewals, progress on previous ERSD funded research will be an important criterion for evaluation. As part of the evaluation, program policy factors also become a selection priority. Note, external peer reviewers are selected with regard to both their scientific expertise and the absence of conflict-of-interest issues. Federal and non-federal reviewers will be used, and submission of an application constitutes agreement that this is acceptable to the investigator(s) and the submitting institution.

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 05-12 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

Changes made from this point in the document to the end.

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.