

Program Announcement To DOE National Laboratories LAB 99-06

Environmental Management Science Program: Research Related to Subsurface Contamination/Vadose Zone Issues

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

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 cleanup of DOE's environmental legacy. The program was initiated in Fiscal Year 1996 and funding for the program has been provided in the Conference Report for Fiscal Year 1999 Appropriations for Energy and Water Development, Report 105-749, September 25, 1998, page 107.

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, as published in the Federal Register, March 11, 1991, Vol. 56, No. 47, pages 10244-10246, will be used for merit review of applications 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.em.doe.gov/science>.

Additional Announcements for the Environmental Management Science Program may be issued during Fiscal Year 1999 covering other areas within the scope of the EM program.

DATES: Potential proposers are strongly encouraged to submit a brief preproposal. All preproposals, referencing Program Announcement LAB99-06, should be received by DOE by 4:30 P.M. E.S.T., February 9, 1999. A response encouraging or discouraging a formal proposal

generally will be communicated by electronic mail to the proposer within three weeks of receipt. The deadline for receipt of formal proposals is 4:30 P.M., E.D.T., April 19, 1999, in order to be accepted for merit review and to permit timely consideration for award in Fiscal Year 1999.

ADDRESSES: All preproposals, referencing Program Announcement LAB99-06, should be sent to 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. Preproposals will be accepted if submitted by U. S. Postal Service, including Express Mail, commercial mail delivery service, or hand delivery, but will not be accepted by fax, electronic mail, or other means.

After receiving notification from DOE concerning successful preproposals, proposers may prepare and submit formal proposals. Proposals must be sent to: U.S. Department of Energy, Office of Science, Medical Sciences Division, SC-73, 19901 Germantown Road, Germantown, MD 20874-1290, Attn: Program Announcement LAB99-06. The above address for formal proposals must also be used when submitting formal proposals by U.S. Postal Service Express Mail, any 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, Office of Science and Risk Policy, 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.

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 Year 1996, Fiscal Year 1997, and Fiscal Year 1998 can be viewed at <http://www.doe.gov/em52/science-grants.html>.

Program Funding

It is anticipated that up to a total of \$4,000,000 of Fiscal Year 1999 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 reserves the right to fund in whole or part any or none of the proposals received in response to this Announcement. A parallel announcement with a similar potential total amount of funds has been issued to the private sector (organizations such as: colleges and universities, non-profit organizations, and for-profit commercial organizations) and may be accessed on the World Wide Web at

http://www.doe.er.gov/production/grants/fr99_06.html. All projects will be evaluated using the same criteria, regardless of the submitting institution. Additionally, relevant innovative basic research pertaining to other sites will be considered.

Preproposals

A brief preproposal may be submitted. The original and five copies must be received to be considered. The preproposal should identify on the cover sheet the institution, PI name, address, telephone, fax and E-mail address for the principal investigator, title of the project, and the field of scientific research (using the list in the Proposal Categories section). The preproposal should consist of up to three pages of narrative describing the research objectives and the plan for accomplishing them, and should also include a paragraph describing the research background of the principal investigator and key collaborators if any.

Preproposals will be evaluated relative to the scope and research needs of the DOE's Environmental Management Science Program by qualified DOE program managers from both SC and EM. Preproposals are strongly encouraged but not required prior to submission of a full proposal.

Notification of a successful preproposal is not an indication that an award will be made in response to the formal proposal.

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 cleanup 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

Purpose

The need to build a stronger scientific basis for the Environmental Management effort has been established in a number of recent studies and reports. The Galvin Commission report ("Alternative Futures for the Department of Energy National Laboratories," February 1995) also provided the following observations and recommendations:

"There is a particular need for long term, basic research in disciplines related to environmental cleanup" ... "Adopting a science-based approach that includes supporting development of technologies and expertise" ... "could lead to both reduced cleanup costs and smaller environmental impacts at existing sites and to the development of a scientific foundation for advances in environmental technologies."

The Environmental Management Advisory Board Science Committee (Resolution on the Environmental Management Science Program, May 2, 1997) made the following observations:

"EMSP results are likely to be of significant value to EM" ... "Early program benefits, include: improved understanding of EM science needs, linkage with technology needs, and expansion of the cadre of scientific personnel working on EM problems" ... "Science program has the potential to lead to significant improvement in future risk reduction and cost and time savings."

The purpose of the EMSP is to foster basic research that will contribute to successful completion of DOE's mission to cleanup 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.

"Although the focus of the EMSP is on basic research, as noted above, the objective of this research program is to generate new knowledge to support DOE's mission to remediate its contaminated sites. Some of the Department's most significant contamination problems involve soil and groundwater that contain dense nonaqueous-phase liquids, metals, and radionuclides.

The Department's ability to identify and quantify contaminant sources, predict and monitor contaminant fate, and carry out appropriate remediation remains elusive at many sites across the DOE complex." (National Research Council, Committee on Subsurface Contamination at DOE Complex Sites: Research Needs and Opportunities, December 10, 1998).

Representative Research Areas

Basic research is solicited in all areas of science with the potential for addressing problems in subsurface contamination and transport processes in the vadose (unsaturated) zone. Processes and problems in the vadose zone constitute important subjects of concern to the Department's Environmental Management Program. Relevant scientific disciplines include, but are not limited to: Geological sciences, (including geochemistry, geophysics, hydrogeologic transport modeling, and hydrologic field-studies), plant sciences (including mechanisms of contaminant uptake, concentration and sequestration), 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). The Natural and Accelerated Bioremediation Research (NABIR) program of the Office of Biological and Environmental Research in the Office of Science may issue a Announcement relating to in situ treatment of metals and radionuclides during FY 1999. Research projects relating to this area should be submitted to NABIR rather than to EMSP.

Proposal Categories

In order to properly classify each preproposal and 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. Geochemistry
6. Geophysics
7. Hydrogeology
8. Interfacial Chemistry
9. Materials Science
10. Plant Science
11. Other

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 remediation capabilities. Of course, given the nature of basic research, there will not always be a clear pathway between research results and application to site remediation."

(National Research Council, Board on Radioactive Waste Management, December 1998)

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.

Major Environmental Management Challenges

This research Announcement has been developed for Fiscal Year 1999, along with a development process for a long-term program within Environmental Management, with the objective of providing continuity in scientific knowledge that will revolutionize technologies and clean-up approaches for solving DOE's most complex environmental problems. The following is an overview of the technical challenge facing the Environmental Management Program in the area of Subsurface Contamination/Vadose Zone which is the focus of this Announcement. More detailed descriptions of the specific technical needs and areas of emphasis associated with this problem area can be found in the background section of this Announcement.

Subsurface Contamination/Vadose Zone environmental problems associated with hazardous and radioactive contaminants in soil and groundwater that exist throughout the Department of Energy complex, include radionuclides, heavy metals, and dense, nonaqueous phase liquids. More than 5,700 known Department of Energy groundwater plumes have contaminated over 600 billion gallons of water and 50 million cubic meters of soil. Migration of these plumes threaten local and regional water sources and in some cases, has already adversely impacted off-site resources. In addition, the Department is responsible for the remediation of numerous landfills at Department facilities. These landfills are estimated to contain over three million cubic meters of radioactive and hazardous buried waste, some of which has migrated to the surrounding soils and groundwater. Currently available cleanup technologies are inadequate or unacceptable due to excessive costs, increased risks, long schedules, or the production of secondary waste streams. A window of opportunity is thus provided for EMSP to inject new innovative research to help bridge the technological gap pertaining to the challenges in:

- Subsurface measurements, characterization and transport validation (distribution of contaminants) in soils and fractured rock
- Hydrology and geochemistry effects, including contaminant migration velocity, and immobilization applications
- Groundwater characterization and contaminant breakthrough models
- Surface water toxological cumulative effects
- Inventory estimates and validation

Scientific Issues

Recognized issues that pose challenges in inventories of the subsurface, vadose zone, groundwater, and surface water include:

Subsurface

- Complete estimates of chemical and radiological contaminant concentrations, volumes, and timing of releases need to be considered holistically.
- Model assumptions on distribution of contaminants among different waste processes and streams have not been extensively validated by measurement.
- Models of contaminant distribution are not sufficiently focused on a prioritized list of key chemical and radionuclide contaminants.
- Development of systems assessment capability involves integration of observations of contaminant distributions over a variety of spatial and temporal scales.
- Knowledge of mechanisms and rates of waste release important for system assessment.

Vadose Zone

- Spatial and depth distribution of inventory, its phase association and chemical speciation are not fully known.
- In-situ chemical/physical/hydraulic properties of sediments are not well characterized.
- Chemical and biologic reactions responsible for contaminant retardation, immobilization, and mobilization are insufficiently understood or lack data on key parameters.
- Geohydrochemical effects such as chemical dissolution, clay dispersion, piping, colloid transport are not fully known.
- Preferred hydrologic pathways are not well characterized.
- Credible reactive transport models that include heterogeneity are not available.

Groundwater

- Waste volumes, waste chemistry, timing of waste disposal, and vadose zone transport are not fully characterized to provide accurate flux from vadose zone into groundwater.
- Horizontal and vertical dimensions of contaminant plumes are not fully delineated.
- Plume structure near waterways is important to characterize.
- Variation in plume geometry due to important geologic features and temporal changes in recharge/migration can answer key questions.
- Contaminant transport and impacts of non-aqueous phase liquids in aquifer are not fully described.
- Innovative, low-cost characterization approaches to extending subsurface data are not routinely deployed.

Surface Water

- Types, amounts, and spatial locations of contaminants within and entering waterways are not fully characterized.
- Temporal variation in contaminant input at groundwater discharge sites is not fully characterized.
- Extent of exposures of sensitive biota to contaminants is not known.
- Toxicological impacts on exposed species are insufficiently understood.
- Fate and transport modeling capabilities are not fully descriptive.

Inventory technical element

- Estimates of radionuclides and chemical contaminants that have been or are expected to be released to the vadose zone (location, amount, concentrations, chemical form, and mobilization/release mechanisms are needed as input to a system assessment).
- Needed are complete estimates of chemical and radiological contaminant concentrations, and volumes.
- Methodologies to validate model assumptions are needed for determining the distribution of contaminants among different waste processes and streams.

Background

The DOE has a 50-year legacy of environmental problems resulting from the production of nuclear weapons. Among the most serious are the widespread contamination of soils, sediments, and groundwater. Moreover, many of the contaminated soils, sediments, and groundwater are believed to be impossible to remediate with existing technology. Examples of sites with these intractable problems include the Snake River Aquifer in Idaho, contaminated groundwater at the 100, 200, and 300 areas at Hanford, Washington, Oak Ridge/Savannah River groundwaters and contaminated sediments at the Nevada Test Site. The huge cost, long duration, and technical challenges associated with remediating DOE facilities present a significant opportunity for science to contribute cost-effective solutions. DOE's environmental remediation problems are shared by other federal agencies and the private sector, but DOE faces a unique set of challenges associated with complex mixtures of contaminants especially those mixtures that contain radioactive elements. While the emphasis in the following discussion is on the Hanford Site, it is anticipated that basic research addressing these problems could lead to new technologies with widespread impact across the complex.

The total life cycle costs for the Office of Environmental Management cleanup projects have been estimated to be approximately \$147 billion in the year 2007 and beyond, when EMSP research results have the potential to begin making a significant impact. In that time period remedial action projects are estimated at \$6.1 billion (DOE, April 1998).

The Hanford Site has a high number of remedial action projects with the largest mortgage and covers 1450 square kilometers along the Columbia River in southeastern Washington State. The primary mission of the Hanford Site for nearly 50 years was to produce plutonium for national defense. Since 1943, nine plutonium production reactors, seven chemical separations plants, and various ancillary facilities were constructed and operated at the Hanford Site, with peak defense production activities occurring in the 1950s and early 1960s during the Cold War. Plutonium production, fuel processing, and fuel fabrication had a significant effect on the environment. The Hanford Site contains over 1600 contaminated waste sites; 670 occur within one half mile of the Columbia River. Defense production created over 625,000 cubic meters of solid/liquid wastes containing both radioactive and chemical contamination. Early waste disposal practices have resulted in groundwater contamination levels exceeding federal drinking water standards (DWS). Additional information on the subsurface contamination/vadose zone problems at the Hanford Site can be found in the Richland Environmental Restoration Project, "Groundwater/Vadose Zone Integration Project Specification", DOE/RL-98-48, Review Draft C, Appendix H, Applied

Science and Technology Plan, and Appendix I, Science and Technology Roadmap on the world wide web at: <http://www.bhi-erc.com/vadose/pubrev.htm>. For further information regarding the Hanford Site please contact Mr. James P. Hanson, U.S. Department of Energy, Richland Operations Office, Science and Technology Programs Division, P.O. Box 550, MSIN K8-50, Richland, WA 99352, phone: (509) 372-4503, E-mail: james_p_hanson@rl.gov.

The Department is also concerned with its ability to confirm the performance of behavior of a physical, chemical, or geological process or a technology at a contaminated site. "Basic science can contribute to performance validation through the investigation and development of new or improved tools and methodologies for confirming behavior or performance in the field. There are a number of underlying theoretical and experimental issues of interest—for example, understanding the pre-remediation conditions at a contaminated site and the fundamental hydrogeological, chemical, and biological controls on site or contaminant behavior, how these change during site remediation, and which tests or measurements are sensitive to the behaviors of concern. The inability to confirm such behavior or performance at a contaminated site is one of the primary reasons for the Department's difficulty in prescribing appropriate and cost-effective remediation and monitoring strategies. Moreover, once a remediation action is underway, the Department often lacks methods to measure and confirm the efficacy of the approach. Deployment of new remediation technologies may depend to a great extent on the Department's ability to validate their effectiveness—and provide evidence of remediation efficacy to regulators and other stakeholders." (National Research Council, Committee on Subsurface Contamination at DOE Complex Sites: Research Needs and Opportunities, December 10, 1998).

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> 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 for Background Information

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. 1998. Accelerating Cleanup: Paths to Closure - June 1998. <http://www.em.doe.gov/closure>

DOE. 1998. Environmental Science Program, 1998 Project Summaries - June 1998. <http://www.doe.gov/em52>

DOE. 1998. Report to Congress on the U.S. Department of Energy's Environmental Management Science Program - April 1998. <http://www.doe.gov/em52/rtc.html>

DOE. 1997. Research Needs Collected for the EM Science Program - June 1997.
<http://www.doe.gov/em52/needs.html>

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>

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

National Research Council. 1998. Interim Letter Report, Committee on Subsurface Contamination at DOE Complex Sites: Research Needs and Opportunities, dated December 10, 1998.

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. 1995. Improving the Environment: An Evaluation of DOE's Environmental Management Program. National Academy Press, Washington, D.C.
<http://www.nap.edu/readingroom/books/doemp/>

Richland Environmental Restoration Project, Groundwater/Vadose Zone Integration Project
<http://www.bhi-erc.com/vadose/pubrev.htm>

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.doe.gov/html/doe/whatsnew/galvin/tf-rpt.html>

1999 Hanford Site Technology Needs <http://www.pnl.gov/stcg/needs.stm>

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.

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

The instructions and format described below should be followed. Reference Program Announcement LAB99-06 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 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.

3.4 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.er.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 \$5000 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.