

**Program Announcement
To DOE National Laboratories
LAB 03-04**

***Joint Interagency Program
On Phytoremediation Research***

The Office of Biological and Environmental Research (OBER) of the Office of Science (SC), U.S. Department of Energy (DOE), hereby announces its interest in receiving proposals for research in the Joint Interagency Program on Phytoremediation Research. The DOE is cooperating with the National Science Foundation, the Office of Naval Research, and the Strategic Environmental Research and Development Program in this joint announcement. The focus of the program is on basic research projects that address the fundamental mechanisms of interactions between plants, microorganisms, and contaminant chemicals in soils, sediments and water (potentially marine, estuarine, or freshwater systems) that result in the degradation, extraction, volatilization, or stabilization of the contaminant. Contaminants of interest include organic pollutants, radionuclides and metals. Information derived from such research should provide the knowledge base to develop the effective use of plants to remediate hazardous wastes in the environment. This program is not appropriate for the simple field testing of plant species for their utility in phytoremediation or the specific application of phytoremediation to a particular waste site.

SUPPLEMENTARY INFORMATION: Contaminants of concern have accumulated in various environmental media (soils, sediments, groundwater, seawater) as a consequence of anthropogenic activities. To reduce risk to humans or the environment, remedial technologies may be employed to remove, transform or reduce the concentration or bioavailability of potentially harmful contaminants. Contaminants (and corresponding media) for which harmful effects have been documented include:

- Cd, Pb, Se in soils – Human disease and retardation;
- Se in soil – Livestock and wildlife poisoning;
- Mo in soil – Ruminant livestock poisoning;
- Zn, Ni, Cu in acidic soils resulting from mines/smelting operations – Phytotoxicity to sensitive plants;
- Organotin and Cu (from marine ship paints) in seawater/sediments – accumulation in estuarine shellfish and other benthic biota;
- Polycyclic aromatic hydrocarbons (PAH's, all media) – Human carcinogens/mutagens;
- Polychlorinated biphenyls and dioxins (all media) – Endocrine disruption in many organisms; carcinogens;
- Radionuclides such as Ur, Tc, Cs, Sr from the legacy of nuclear weapons production, in surface soils and subsurface environments – Chemical, radiological and genetic toxicity
- Energetic compounds [such as trinitrotoluene; 1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX); 1,3,5-trinitro-1,3,5-triazine (RDX); picric acid; and degradation products] in estuarine sediments – toxicity toward various estuarine/freshwater species; and

- Hg and As from a range of sources, in all media - may also create risks to humans and the environment.

Although some of these contaminants can be remedied by conventional technologies, such as excavation/incineration, pump-and-treat, or dredging, phytoremediation, or the use of plants for remediation, may offer a more economical, effective alternative that is acceptable to the public. While specific phytoremediation approaches vary, the contaminant is either removed from soils and sediments for disposal or recycling, or left in place following stabilization. Research to elucidate basic mechanisms of phytoremediation and in contemplation of totally new proposals (e.g., "phycoremediation" using estuarine/marine algae, seaweeds and sea grasses) could ultimately lead to the development of a potentially valuable remediation strategy.

Phytoremediation has been applied in a limited fashion for the clean up of both metals and organic pollutants in soils. Because metals cannot be degraded beyond their elemental states, bioremediation of metals and radionuclides in soils and other environmental media has been particularly difficult and expensive. The general strategies for phytoremediation of soil metals and/or radionuclides are (1) to phytoextract the contaminants into the plant shoots for recycling or less expensive disposal, and (2) to phytostabilize the elements through binding with organic matter into persistently non-bioavailable forms. Phytovolatilization, a process that may also remove metals from soil or water to air, has also been considered. The basic genetic, biochemical, physiological, ecological, and environmental mechanisms are not well known for any of these processes.

Mechanisms similar to the phytoextraction and phytovolatilization of metals may also apply to the treatment of organic contaminants. In addition, the excretion of bioactive root exudates is an important route for either direct, enzymatic degradation of contaminants, as is the stimulation of the root-colonizing microbial assemblage. Observations from field tests indicate that many plants have the capacity to extract and degrade certain organic chemicals. However, there is little information available about the use of phytoremediation in contaminated marine environments. Potential scenarios for use of either submerged plants (e.g., seaweeds, sea grasses, algae) planted on site, or used in conjunction with confined aquatic disposal sites may be envisioned.

Thus, in many situations, plants may offer an alternative means for clean-up of recalcitrant hazardous wastes. However, in most successful examples of phytoremediation, we lack information about the basic mechanisms plants employ to extract and/or degrade contaminants from polluted environments.

PROGRAM DESCRIPTION

The need to prevent or ameliorate adverse environmental effects of persistent soil and sediment contaminants, and to do so at lower cost than existing technologies, has brought increased attention to phytoremediation. This program solicitation solicits proposals for research projects that address the fundamental mechanisms of interactions between plants, microorganisms, and contaminant chemicals in soils, sediments and water (potentially marine, estuarine, or freshwater systems), which result in the degradation, extraction, volatilization, or stabilization of the contaminant. Such research should address relevant aspects of plant-microorganism-

contaminant interactions, including the phenomena of biodegradation, biotransformation, extraction, and hyperaccumulation of contaminants by plants. Information derived from such research should inform efforts to develop the effective use of plants to remediate hazardous wastes. For example, collaborations among life scientists, environmental chemists and engineers are encouraged.

Examples of research on organic, metal or radionuclide contamination that might be addressed include the following:

- Extent and mechanisms of plant-microorganism interactions that facilitate phytoremediation;
- Soil/sediment geochemistry, fertility, and cultivation practices that influence plant-microorganism-contaminant interactions;
- Environmental factors (e.g., temperature, rainfall) that influence phytoremediation;
- Molecular biological basis of contaminant hyperaccumulation by plants that will facilitate more efficient phytoremediation;
- Fundamental processes by which plants take up or transform radionuclides or metals from contaminated soils and groundwater;
- Biochemical and genetic basis for enhanced biotransformation of organic contaminants by plants and associated microorganisms; and
- Potential for use of marine/estuarine plants for phytoremediation, to include study of biochemical or genetic mechanisms of resistance, and/or the development of molecular biology techniques for genetic manipulation of marine seaweeds/sea grasses.

This program is not appropriate for the simple field testing of plant species for their utility in phytoremediation or the development of systems for the specific application of phytoremediation to particular environmental contamination problems. Proposals for such research will not be considered. However, mechanistic studies conducted under field conditions are desirable. To avoid the high cost of establishing new field research sites, field studies should use well-instrumented, characterized, and documented sites. Some appropriate sites that are available for field research are listed below. The named individuals should be contacted to ascertain the logistical and financial arrangements that will be necessary for research that is proposed at the site and these arrangements should be reflected in the proposal.

- Various Department of Energy sites
Contact: Mr. Paul Bayer, 301-903-5324
paul.bayer@science.doe.gov
- Various Department of Navy sites
Contact: Dr. Linda Chrisey, 703-696-4504
chrisel@onr.navy.mil
- The U.S. Navy's Port Hueneme, CA, site
Contact: Mr. Ernie Lory, 805-982-1299
FAX: 805-982-4304
loryee@nfesc.navy.mil
- Dover Air Force Base, DE
Contact: Tim McHale, 302-677-4147

FAX: 302-677-6837
tjmchale@bellatlantic.net

Researchers must document where any proposed field research will be conducted and must include a letter from the site management indicating their commitment to participate in the research. Arrangements must be made in advance regarding the possible need for funding of activities at the field site. Do not presume that site management will be able to cover add-on research costs.

This solicitation is offered under the auspices of the Environmental Biotechnology Task Force, Biotechnology Research Working Group, Subcommittee on Biotechnology, Committee on Science of the National Science and Technology Council (NSTC). A more detailed statement of interagency interests and priorities in bioremediation research can be found in the Environmental Biotechnology chapter of the NSTC report, Biotechnology for the 21st Century: New Horizons <http://www.nalusda.gov/bic/bio21>.

DATES: The deadline for receipt of formal proposals is 4:30 p.m., E.S.T., January 15, 2003, to be accepted for merit review and to permit timely consideration for awards late in Fiscal Year 2003.

ADDRESSES: Formal proposals, referencing Program Announcement LAB 03-04, should be sent to: U.S. Department of Energy, Office of Science, Office of Biological and Environmental Research, SC-75/Germantown Building, 1000 Independence Avenue, SW, Washington, D.C. 20585-1290. ATTN: Program Announcement LAB 03-04.

When submitting proposals 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: U.S. Department of Energy, Office of Science, Office of Biological and Environmental Research, Division of Environmental Remediation, SC-75, 19901 Germantown Road, Germantown, MD 20874-1290, ATTN: Program Announcement LAB 03-04.

FURTHER INFORMATION/CONTACTS: The full text of Program Announcement LAB 03-04 is available via the Internet using the following web site address: <http://www.sc.doe.gov/production/grants/grants.html>. Further information, if needed, may be obtained from the Agency officials indicated below. E-mail inquiries are preferred.

Dr. Anna Palmisano 301-903-9963
Department of Energy
Anna.palmisano@science.doe.gov

Dr.Linda Chrisey 703-696-4504
Office of Naval Research
chrise@onr.navy.mil

Dr. Bruce Hamilton 703-292-7066
Division of Bioengineering and Environmental Systems

National Science Foundation
bhamilto@nsf.gov

Dr. Sharman D. O'Neill 703-292-7888
Division of Integrative Biology and Neuroscience
National Science Foundation
soneill@nsf.gov

Dr. Andrea Leeson 703-696-2118
Strategic Environmental Research and Development Program
Andrea.leeson@osd.mil

FUNDS AVAILABLE

It is anticipated that up to \$1 million will be available for multiple awards to be made in Fiscal Year 2003 in the categories described above, contingent on availability of appropriated funds, and the programmatic relevance of recommended projects to the participating agencies. Researchers may request project support up to three years, with an upper limit of \$150,000 per year. Out-year support is contingent on availability of funds, progress of the research and programmatic needs of the supporting agency. Each project selected for support will be funded by a single agency. The PI's will be notified by the agency program manager of the need for additional agency-specific forms or procedures.

Submission Information

DOE is under no obligation to pay for any costs associated with the preparation or submission of proposals. In addition, 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). Attachments should include short (two pages) curriculum vitae, a listing of all current and pending federal support and letters of intent when collaborations are part of the proposed research. Curriculum vitae should be submitted in a form similar to that of NIH or NSF (two to three pages), see for example:
<http://www.nsf.gov:80/bfa/cpo/gpg/fkit.htm#forms-9>.

Any recipient of an award from the Office of Science, performing research involving recombinant DNA molecules and/or organisms and viruses containing recombinant DNA molecules shall comply with the National Institutes of Health "Guidelines for Research Involving Recombinant DNA Molecules," which is available via the World Wide Web at: <http://www.niehs.nih.gov/odhsb/biosafe/nih/rdna-apr98.pdf>, (59 FR 34496, July 5, 1994), or such later revision of those guidelines as may be published in the Federal Register.

Researchers must also comply with other federal and state laws and regulations as appropriate; for example, the Toxic Substances Control Act (TSCA) as it applies to genetically modified organisms. Although compliance with NEPA is the responsibility of DOE, researchers proposing

to conduct field research are expected to provide information necessary for the DOE to complete the NEPA review and documentation.

The instructions and format described below should be followed. Reference Program Announcement LAB 03-04 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 20 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.