Office of Science
Notice 03-04

Joint Interagency Program
On Phytoremediation Research

Department of Energy

Office of Science Financial Assistance Program Notice 03-04: Joint Interagency Program On Phytoremediation Research

AGENCY: U.S. Department of Energy

ACTION: Notice inviting grant applications.

SUMMARY: The Office of Biological and Environmental Research (OBER) of the Office of Science (SC), U.S. Department of Energy (DOE), hereby announces its interest in receiving applications for research grants 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.

DATES: The deadline for receipt of formal applications 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: We encourage you to submit formal applications in response to this solicitation electronically through DOE's Industry Interactive Procurement System (IIPS) at: http://e-center.doe.gov/. IIPS provides for the posting of solicitations and receipt of applications in a paperless environment via the Internet. Applications must be submitted through IIPS in PDF format by an authorized institutional business official. Questions regarding the operation of IIPS may be e-mailed to the IIPS Help Desk at: HelpDesk@pr.doe.gov or you may call the help desk at: (800) 683-0751. Further information on the use of IIPS by the Office of Science is available at: http://www.sc.doe.gov/production/grants/grants.html.

If you are unable to submit the application through IIPS, formal applications may be sent to: U.S. Department of Energy, Office of Science, Grants and Contracts Division, SC-64/Germantown Building, 1000 Independence Avenue, SW, Washington, D.C. 20585-1290. ATTN: Program Notice 03-04.

When submitting applications by U.S. Postal Service Express Mail, any commercial mail delivery service, or when hand carried by the applicant, the following address must be used: U.S. Department of Energy, Office of Science, Grants and Contracts Division, SC-64, 19901 Germantown Road, Germantown, MD 20874-1290, ATTN: Program Notice 03-04.

FURTHER INFORMATION/CONTACTS: The full text of Program Notice 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
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National Science Foundation
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Division of Integrative Biology and Neuroscience
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Andrea.leeson@osd.mil

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 applications (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 notice solicits applications 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. Applications 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 application.

- 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

Applicants 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.

FUNDS AVAILABLE

It is anticipated that up to $3 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. An additional sum, up to $1 million, will be available for competition by DOE National Laboratories under a separate solicitation (LAB 03-04). Applications 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.

MERIT REVIEW

Applications will be subjected to formal merit review (peer review) and will be evaluated against the following evaluation criteria which are listed in descending order of importance codified at 10 CFR 605.10(d):

1. Scientific and/or Technical Merit of the Project;
2. Appropriateness of the Proposed Method or Approach;
3. Competency of Applicant's personnel and Adequacy of Proposed Resources;
4. Reasonableness and Appropriateness of the Proposed Budget.

Also, as part of the evaluation, program policy factors 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.

Submission Information

Information about the development, submission of applications, eligibility, limitations, evaluation, the selection process, and other policies and procedures may be found in 10 CFR Part 605, and in the Application Guide for the Office of Science Financial Assistance Program. Electronic access to SC's Financial Assistance Application Guide is possible via the World Wide Web at: http://www.sc.doe.gov/production/grants/grants.html. DOE is under no obligation to pay for any costs associated with the preparation or submission of applications. In addition, for this notice, 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.

The Office of Science as part of its grant regulations requires at 10 CFR 605.11(b) that a recipient receiving a grant and performing research involving recombinant DNA molecules and/or organisms and viruses containing recombinant DNA molecules shall comply with the NIH "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. Grantees 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, grantees proposing to conduct field research are expected to provide information necessary for the DOE to complete the NEPA review and documentation.

The Catalog of Federal Domestic Assistance Number for this program is 81.049, and the solicitation control number is ERFAP 10 CFR Part 605.

John Rodney Clark
Associate Director of Science
for Resource Management

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