

# 2003 Environmental Technologies and Systems

## NSF/EPA PARTNERSHIP FOR ENVIRONMENTAL RESEARCH

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### Program Solicitation

NSF 03-510

Replaces Document NSF 01-76



#### National Science Foundation

Directorate for Engineering

Directorate for Mathematical and Physical Sciences



#### Environmental Protection Agency

**Full Proposal Deadline(s)** (due by 5 p.m proposer's local time):

February 25, 2003

#### Technology for a Sustainable Environment (TSE)

March 04, 2003

#### New Technologies for the Environment (NTE)

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### SUMMARY OF PROGRAM REQUIREMENTS

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#### General Information

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#### Program Title:

2003 Environmental Technologies and Systems  
NSF/EPA PARTNERSHIP FOR ENVIRONMENTAL RESEARCH

#### Synopsis of Program:

In this solicitation, NSF and EPA are offering funds for fundamental and applied research in the physical and biological sciences and engineering that will lead to environmentally-benign methods for industrial processing/manufacturing; sustainable construction processes; and new technologies for pollution sensing and remediation. The competition addresses technological environmental issues of design, treatment, synthesis, processing, and energy conversion; environmentally conscious construction and disaster management; and the production, use, detection, and ultimate disposition of products in continuous and discrete manufacturing industries

as well as in construction industries and in the environment.

There are two parts to this competition. Together they are designed to address pollution avoidance, prevention, treatment, and remediation processes and methodologies. They also support scientific and engineering research with potential long-term industrial and/or societal impacts. Under the Technology for a Sustainable Environment (TSE) part, research proposals are invited that advance the discovery, development, and use of innovative technologies and approaches to avoid or minimize the generation of pollutants at the source. In preventing pollution at its source, the life cycle of both materials and energy can also be considered. Under the New Technologies for the Environment (NTE) part, proposals are invited that explore new technologies that can be applied to environmental remediation, environmental sensing, and small drinking water systems.

#### **NEW ASPECTS** of this year's NSF/EPA Solicitation

- Combination of TSE and NTE into one overall solicitation with two separate deadlines
- Inclusion of *Sustainable Construction Processes* in TSE (Contact: Miriam Heller, NSF)
- Inclusion of *Breakthrough Control Systems for Energy Conversion or Transportation Technologies* under the Non-Reaction-Based Engineering portion of TSE (Contact: Paul Werbos, NSF)
- Inclusion of *Environmental Sensing* technologies in NTE (Contacts: Paul Werbos, NSF and Nick Clesceri, NSF)
- *Treatment Technologies for Arsenic in Small Drinking Water Systems* added to NTE (Contact: April Richards, EPA)

#### **Cognizant Program Officer(s):**

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#### **Applicable Catalog of Federal Domestic Assistance (CFDA) Number(s):**

- 47.041 --- Engineering
- 47.049 --- Mathematical and Physical Sciences
- 66.500 --- Environmental Protection Agency

#### **Eligibility Information**

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- **Organization Limit:** Academic and not-for-profit institutions located in the U.S. are eligible. Profit-making firms and federal agencies are not eligible to apply to this program. However, personnel in profit-making firms may participate as non-funded co-investigators.
- **PI Eligibility Limit:** Only one proposal may be submitted by a Principal Investigator and he/she may only collaborate in one other proposal as a co-Investigator. A Principal Investigator cannot submit an NTE Phase II proposal unless he/she has completed an NTE Phase I exploratory project.
- **Limit on Number of Proposals:** None for the Institution

#### **Award Information**

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- **Anticipated Type of Award:** Standard or Continuing Grant
- **Estimated Number of Awards:** 45 - New NSF and EPA awards combined
- **Anticipated Funding Amount:** \$9,500,000 in Standard and Continuing Grants: approximately \$6.0 million from NSF and \$3.5 million from EPA, pending the availability of funds and quality of proposals. Each award will be made either by NSF or by EPA.

#### **Proposal Preparation and Submission Instructions**

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## A. Proposal Preparation Instructions

- **Full Proposal Preparation Instructions:** The program announcement/solicitation contains supplements to the standard Grant Proposal Guide (GPG) proposal preparation guidelines. Please see the full program announcement/solicitation for further information.

## B. Budgetary Information

- **Cost Sharing Requirements:** Cost Sharing is not required.
- **Indirect Cost (F&A) Limitations:** Not Applicable.
- **Other Budgetary Limitations:** Other budgetary limitations apply. Please see the full funding opportunity document for further information.

## C. Due Dates

- **Full Proposal Deadline Date(s)** (due by 5 p.m proposer's local time):
  - February 25, 2003  
Technology for a Sustainable Environment (TSE)
  - March 04, 2003  
New Technologies for the Environment (NTE)

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## Proposal Review Information

- **Merit Review Criteria:** National Science Board approved criteria. Additional merit review considerations apply. Please see the full funding opportunity document for further information.

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## Award Administration Information

- **Award Conditions:** Additional award conditions apply. Please see the full funding opportunity document for further information.
- **Reporting Requirements:** Additional reporting requirements apply. Please see the full funding opportunity document for further information.

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**I. INTRODUCTION**

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The National Science Foundation (NSF) and the Environmental Protection Agency (EPA) announce their intent to continue to support an extramural grants competition in fundamental environmental research to be held in Fiscal Year (FY) 2003. This NSF/EPA research activity is based on a Memorandum of Understanding between the agencies that establishes a partnership emphasizing the support and merit review of fundamental and applied environmental protection research.

This year the NSF/EPA Partnership solicits applications for the Technology for a Sustainable Environment (TSE) program and adds the New Technologies for the Environment (NTE) program, which ran as a separate NSF competition in 2000 (NSF 00-49).

Further information may be obtained from the NSF and EPA officials below. E-mail inquiries are preferred.

**General Information on the NSF/EPA Partnership for Environmental Research:**

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## **II. PROGRAM DESCRIPTION**

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### **A. TECHNOLOGY FOR A SUSTAINABLE ENVIRONMENT (Prevention)**

#### **Introduction**

As a nation, we seek long-term economic growth that creates jobs while improving and sustaining the environment and preserving economic opportunities and resources for future generations. It is increasingly clear that "end-of-pipe" pollution controls for industrial operations are not always a sufficient means of reaching these goals, nor is unconstrained development of the supporting infrastructure of industrial facilities. A new generation of cleaner industrial manufacturing, processing, and construction technologies is needed that supports pollution avoidance/prevention (at the source), efficient resource use, and industrial ecology. Such a strategy can help industries become more competitive by lowering resource and energy needs and reducing waste/emissions-control costs, thereby fostering sustainable development while maintaining a strong economy.

Besides addressing industrial and economic issues, more environmentally-benign TSE industrial approaches could contribute to the solution of global environmental problems by, for example, lessening the negative impacts of industrialization on the climate and the biosphere.

Research proposals are invited that advance the development and use of innovative manufacturing and processing technologies and approaches directed at avoiding or minimizing the generation of pollutants at the source. Other than those aspects that pertain to materials flows and reuse within industrial processes, the TSE portion (Part A) of this competition is not intended to address issues related to waste monitoring, treatment, remediation, environmental sensors (except in-process sensors), recycling or containment. These areas are very important, and they are supported by the program activities in Part B, New Technologies for the Environment, (NTE).

NSF and EPA are offering funds for fundamental and applied research in the physical sciences and engineering that will lead to the discovery, development, and evaluation of advanced and novel environmentally benign methods for industrial processing, manufacturing, and construction. The competition addresses technological environmental issues of design, synthesis, processing, and the production, use, and ultimate disposition of products in construction and in continuous and discrete manufacturing industries. Projects must employ fundamental new approaches, and address or be relevant to current national concerns for pollution avoidance/prevention (at the source). Projects that are "on the cutting edge" or are "high-risk/high-payoff" are encouraged. Projects that show the potential to change research infrastructure by developing teams, using systems approaches, and introducing new ways of conducting research will also be considered.

Answering research questions related to environmental sustainability issues often requires the analysis and evaluation of scientific and engineering information and complex phenomena over large spatial and time domains. In addition, the use of modern information technology and high-end computing resources to do this research presents exciting opportunities to the research community, and proposals using these approaches may fit in with this program. Other examples of newer research emphases that are expected to have major impacts on scientific and engineering approaches to sustainability could include nanotechnology, molecular modeling,

computational chemistry, sensors, smart materials and buildings, adaptive infrastructure, and simulation of physical, biological, and chemical phenomena. Environmental technology research can also have a critical, albeit indirect, role in developing reliable and affordable alternative energy systems.

This is the seventh joint NSF/EPA solicitation of TSE. About 1,200 proposals have been submitted to the competitions, and about 13% of those (more than 156 TSE projects) were funded. Previous TSE projects were typically funded for three years at a level of about \$120,000 per year.

Refer to the NSF/EPA Partnership websites for funding details and abstracts of grants: <http://www.nsf.gov/tse> or <http://www.epa.gov/ncer>.

## **Description of Possible TSE Research Projects (PREVENTION)**

The general areas covered by this part (Part A - TSE/Prevention) of the solicitation are:

- Chemistry, Bioengineering, and Chemical Reaction-Based Science and Engineering for Pollution Avoidance or Prevention;
- Non-Reaction-Based Engineering for Pollution Avoidance and Prevention;
- Environmentally Benign Systems and Design, Manufacturing, Processing, and Industrial Ecology for Sustainable Product/Services Realization; and
- Sustainable Construction Processes.

### **1. Chemistry, Bioengineering, and Chemical Reaction-Based Science and Engineering for Pollution Avoidance or Prevention**

The long-range goal of this activity is to develop substances and processes that are safer, reduce health risks, and are environmentally friendly. For the chemical industry, preventing pollution at the source, or "green chemistry and engineering," involves the design of chemicals and alternative chemical processes that do not use toxic feedstocks, reagents or solvents; or processes that reduce the production of toxic by-products or co-products. Data-oriented environmental research is also invited.

Appropriate areas of investigation span the broad range of chemistry and chemical reaction-based engineering and include chemical synthesis and catalysis; computational modeling; sensor innovation (for in-process sensing); reaction mechanisms; and environmentally benign materials. Some specific examples are:

- *Alternative Reaction Conditions*: Development of alternative new reaction conditions, such as using solvents that are environmentally benign, developing advanced laser control of reactivity, or increasing reaction selectivity to reduce wastes and emissions.
- *Safer Chemicals*: Discovery or redesign of useful chemicals and materials that are less toxic to health and the environment or safer in terms of accident potential.
- *Catalysis and Biocatalysis*: Development of innovative synthetic methods using catalysis or biocatalysis, including combinatorial or self-assembly approaches; photochemical, electrochemical or biomimetic activation; or starting materials that are environmentally benign or renewable. Examples of catalyst research include: new multifunctional catalysts that reduce the number of process stages or decrease reaction temperatures; super-selective catalysts exploiting innovative nano- and meso-scale structured environments; novel heterogeneous catalysts that replace state-of-the-art homogeneous ones; supported biocatalysts and biomimetic catalytic materials achieving high yields through more efficient reaction pathways, especially in the specialty/fine/pharmaceutical industries; and novel catalysts for currently uncatalyzed reactions. Examples of biocatalysis include research to convert waste biomass into useful products; genetic engineering to produce more specific biocatalysts; and bioprocessing to decrease use of hazardous reactants and eliminate harmful byproducts.
- *Unit Chemical and Material Processes*: Improved reactor or chemical/material process design in order to increase product yield, improve selectivity, or reduce unwanted by-products. Novel reactors such as reactor-separator combinations that provide for product separation during the reaction, alternative energy sources for reaction initiation, and integrated chemical process design and operation, including in-process sensing and control, are of interest. (NSF will not be funding reaction engineering proposals through this competition. Instead, chemical reactor design and control proposals may be submitted directly to the NSF Process and Reaction Engineering program as regular research proposals. However, EPA will still consider funding such projects via the TSE part of this solicitation.)

*Computational Chemistry and Molecular Simulation:* Rapid advances in computational speed along with the development of highly efficient computational algorithms have begun to make computational chemistry and molecular simulation viable partners to experimental efforts. Areas of interest include molecular modeling work on catalytic and reaction processes in zeolites, electrochemical systems, and other heterogeneous systems, all with environmentally beneficial effects. Applications of new, basic computational methods for the design of chemical plants and/or control of their operation are also of interest.

- *Materials:* Materials substitutions and process alternatives which prevent or reduce environmental harm, such as changes in raw materials or the use of less hazardous solvents in organic coatings, use of materials less harmful to the environment, and materials substitutions in metal plating systems. Combinatorial methods for rapid identification of superior catalytic materials can also be used to optimize the environmental performance of the reactor and process.

## 2. Non-Reaction-Based Engineering for Pollution Avoidance and Prevention

The focus of this program activity is to develop novel benign engineering approaches for preventing or reducing pollution from industrial manufacturing and processing activities, for non-discrete and discrete processes. The scope includes: technology and equipment modification, reformulation or redesign of parts or products, substitution of alternative materials, in-process changes, process controls/testing methodologies to reduce in-process waste, exploitation of intelligent control or computational intelligence, and development of systems technology to enable the practical insertion of pollution-free technologies.

Potential areas of research include:

- *Bioengineering and Technology:* Research in this area includes development of innovative environmental technologies using bioengineering techniques such as bioprocessing in bio-manufacturing processes. Examples include: bioprocessing to increase energy efficiency, or to develop more cost effective methods of producing environmentally benign products. Bio-remediation research is not covered by the TSE portion of this solicitation; it is covered by Part B - NTE.
- *Separations, Mass Transport, and Interfacial Phenomena:* Non-reactive mass transport and interfacial processes, including novel processes for molecularly-controlled synthesis of thin films, and the use of special surfactant systems for surface cleaning and reactions. Solution thermodynamics of environmentally-benign solvents such as ionic or near critical solutions. Separation methods, such as novel cost-effective methods for the highly efficient in-process separation of useful materials from the components of the process stream (for example, field-enhanced and hybrid separation processes); separation methods that reform feedstocks for improved efficiency; and separation methods for recovering waste and other spent materials for reuse as process feedstocks. Development of materials for advanced in-process sensors with potential for reducing resource use or improving production selectivity.
- *Fluid and Thermal Transport Processes:* Improved thermal processes and systems that employ novel thermal or fluid and/or multiphase/particulate systems resulting in significantly lower hazardous effluent production. Examples include: novel refrigeration cycles including heat-operated absorption systems using safe and environmentally-benign working fluids to replace halogenated hydrocarbons hazardous to upper atmosphere ozone levels; innovative heat and mass transfer concepts and devices that facilitate commercialization of such systems, heat transfer and fluid flow of refrigerants such as carbon dioxide at supercritical pressures for implementation in trans-critical heat pump cycles, development of technologies for integrated space-conditioning and water heating systems and the investigation of phase-change processes at the corresponding near-critical pressures, application of micro-channel geometries to the development of compact space-conditioning systems, portable and wearable meso-scale heat pumps for operation in hazardous environments, improved fuel-cell heat and mass transfer for reduced pollutant production. (Combustion-related environmental research is not supported in this solicitation.)
- *Breakthrough in Control Systems for Energy Conversion or Transportation Technologies:* Proposals in this area should not involve incremental progress within the scope of existing funding programs elsewhere. Examples might include the use of new methods in intelligent control to reduce NO<sub>x</sub> fifty percent beyond what seems achievable with conventional methods, or new categories of energy conversion system relevant to distributed generation and non-hydrocarbon transportation systems. (This research area generally relates to electrical power and control systems; however, the representative from the NSF/ECS division should be consulted as to program priority interests.)

Research related to flow stream recycle and process modification or improvement inside the industrial plant is acceptable in this section. Research involving recycle of materials from outside the industrial plant boundaries is not acceptable in this section.

## 3. Environmentally Benign Systems and Design, Manufacturing, Processing, and Industrial Ecology for Sustainable

## Product/Services Realization

Industrial ecology requires that an industrial system be viewed not in isolation from its surrounding systems, but in concert with them. An assessment of global manufacturing demonstrates the need for research on environmentally benign manufacturing/processing and re-manufacturing of materials and products, with particular emphasis on the connectivity within industrial ecology. The systems view requires the approach by which one seeks to optimize the total materials life cycle from extraction, processing, design, and manufacture of product, through use and re-manufacture, to recycling and ultimate disposal. Factors to be optimized include resources, energy and capital.

Potential research topics include, but are not limited to, the following:

- *Life-Cycle Assessment (LCA)*: Innovative methodologies for streamlined and targeted life-cycle assessment and analysis, including product use interactions with the environment and impact prioritization models. Examples include: thermodynamic basis for LCA; strategic metals extraction, usage and capture; cradle-to-grave budgets and cycles; material and energy tradeoffs/balances.
- *Green Design and Materials Cycles*: Environmentally benign product design methodologies, considering the entire life cycle for the materials employed in the production, use, and disposal of products. Examples include: decision-making tools for design based on scientifically sound principles requiring less comprehensive data inputs; re-manufacturing and refurbishing methods and tools including those that evaluate the impact of product use and multi-life cycles; material and energy flows studies ("industrial metabolism"); design for disassembly, reuse, recycling and re-manufacturing.
- *Environmentally Benign Manufacturing*: Research in creating new or modifying current manufacturing processes to reduce or eliminate environmental impacts while also considering manufacturing competitiveness. This includes process design for material and energy minimization and indirect as well as direct impacts of manufacturing over the life cycle. Examples include: novel joining/welding processes that render fumes harmless and/or lead to enhanced disassembly/separation; novel benign hybrid additive/subtractive processing that improves energy and material use efficiency; reduction of contaminant and sludge generation in processes such as electrochemical machining; modified foundry approaches that reduce or reuse current waste streams; novel hybrid processes including plasma or beam processing that create functionality without the addition of new material constituents; dry or controlled environment machining; and nanomanufacturing that addresses pollution prevention or remanufacturing.

## 4. Sustainable Construction Processes

The built environment provides services that sustain our economy and way of life, though at the cost of heavy resource use and waste generation. In 1997, about 80% of all materials, by volume, were used by the construction industry. Buildings over the course of their life-cycle account for 17% of fresh water withdrawals, 25% of wood harvest, 40% of materials use, 54% of energy used, and 50% of fossil fuels consumed. The construction phase of U.S. commercial buildings alone generates on average 740 million tons of carbon dioxide, 25% of CFC emissions, and 8-20% of all solid waste annually. Many environmental consequences of the built environment, namely buildings, are already being addressed. For instance, the U.S. Department of Energy and the National Institute of Standards and Technology have active programs dealing with the energy use and materials problems of building design and operations.

Environmental issues that extend beyond the building envelope to encompass the construction site and neighboring areas are now ripe for investigation. Specifically, the resources used and wastes generated at the construction site over the life of the project should be defined and eventually integrated with life-cycle metrics of the facilities themselves. As we move from traditional design and construction engineering and management toward environmentally-conscious construction, new tools and types of service will be needed to effectively and efficiently optimize construction processes and materials, reduce design errors and omissions and construction defects, meet the users needs, reduce resource requirements, and reduce the environmental burdens associated with construction projects. New processes and material options must then be evaluated on the basis of the economic goals of the industry and concerns for global competitiveness.

Proposals in this section (Section A. 4) will be funded by NSF only. Please contact the program directors for topic interest and funds availability before submission.

Research in the following two areas is solicited:

- *Environmentally Conscious Construction Processes*: Construction can constitute a very large-scale project of relatively long



duration. During a construction project various nonroad vehicles, engines, and equipment contribute to air quality issues as mobile sources. Examples of these are asphalt and concrete pavers, compaction, earth-moving, and excavation equipment, concrete and industrial saws, cement and mortar mixers, concrete trucks, cranes, etc. Additional construction site equipment includes generators, pumps, compressors, welders, and pressure washers. The impacts of these technologies remain largely unquantified. Precipitation and construction-process water transport other construction wastes, such as sealants, adhesives, mortar, and eroded soil, without being subject to full accounting. Scrap and other solid wastes are regularly generated and planned for, but design errors and omissions as well as defects during construction processes occur frequently, increasing both material use and waste. The full impact of construction work requires characterization, quantification, and improvement through:

- *Life-Cycle Assessment (LCA)*: Adapted and new methodologies for life-cycle assessment and analysis of construction site operations, including interactions with the natural environment. Examples include: nonroad vehicle emissions and energy use; waste generation, transport and fate; strategic and nonrenewable materials use and extraction; cradle-to-grave budgets and cycles; material and energy tradeoffs/balances.
- *Environmentally Benign Construction Processes*: Research in creating new or modifying current construction processes to reduce or eliminate environmental impacts while also considering construction costs and construction competitiveness. This includes process design for material and energy minimization and indirect as well as direct impacts of construction-related decisions over the facility life cycle. Examples include: real-time sensing and monitoring of construction processes to reduce defects and the resulting additional wastes and emissions; equipment substitution, technology innovation, or energy recovery for reduced energy requirements and air emissions; novel materials handling processes that improve energy and material use efficiency; novel construction connections and reinforcement technologies that facilitate deconstruction and material reuse rather than demolition.
- *Disaster Management for a More Sustainable Environment*: Disaster management, often a cyclical decision-making process, offers numerous opportunities and challenges to move toward more sustainable construction and construction practices. Research is needed that links post-disaster recovery to mitigation and protection measures that will result in more sustainable built and natural environments. Pre-disaster mitigation measures also must be examined as they relate to sustainable built and natural environments. Finally, construction materials, methods, and design must be re-examined in light of their possible failure and potential concomitant environmental impact. Examples include improved understanding of the cost and benefits of structural and non-structural mitigation measures in geographies vulnerable to hazard(s); expected environmental impact of debris from building collapse, and building design for material reuse in the event of building failure.

### **New Grants for Past TSE Projects: Industrial Collaboration Required**

Proposals that request new grants for continuing work on past or on-going TSE projects MUST include some form of academic-industrial collaboration, partnership or involvement.

### **Additional Information**

Please refer to Section C for additional information on priorities and special proposal requirements.

## **B. NEW TECHNOLOGIES FOR THE ENVIRONMENT (Remediation, Treatment, and Sensing)**

### **Introduction**

As population continues to grow, there are increased pressures on society and the ecosystem that supports it, including the global climate. Scarce resources are being depleted. Air and water pollution causes human disease, damages ecosystems, and harms organisms. Collectively, these pressures are one significant reason for human conflict. These pressures are relieved by advancing our scientific understanding of nature and the world around us, as scientific solutions are implemented in engineered systems. Engineered systems can cope with increased societal pressures, provide cleaner air and water, and thereby reduce risks from environmental pollutants. This provides economic benefits that enable a society to move forward, to care for its people, to provide quality education and health care, and to feed, clothe, and protect itself.

The New Technologies for the Environment program (NTE) focuses on new technologies that can be applied to environmental sensing, remediation, and treatment. The program has two parts: Phase I (exploratory feasibility studies) and Phase II (regular research). All three technology areas described below are appropriate for Phase I proposals. If a Phase I exploratory project has already been successfully completed in area 1 or area 3 (not area 2), the PI may apply for a Phase II grant in the same area.

Phase I of NTE emphasizes high-risk/high-return, exploratory feasibility studies of new technologies applied to the environment. Emphasis is placed on the novelty and potential impact of the approach. Successfully completed Phase I studies may compete for Phase II awards. A subsequent Phase II competition may be held to allow successfully completed Phase I projects to compete for Phase II funds. However, a Phase I award in the current 2003 competition does not necessarily imply that the next solicitation will include Phase II, or that Phase II projects will be funded in the future.

Refer to section III. "Eligibility Information," section IV. "Award Information," and section VI. "Proposal Review Information" for further details about how NTE requirements and awards may differ from TSE.

## **Description of Possible NTE Research Projects**

Proposals submitted **must** focus on one or more of the following three areas of environmental technology.

### **1. Remediation**

Research on new technologies for environmentally benign remediation through biological processes, catalytic chemical processes, transport and separation processes, and thermal and/or fluid processes.

Some examples include:

- Studies of microbial and plant communities and their interactions in contaminated environments, and the use of native and non-native species to effect remediation
- Exploration of novel tailored biocatalysts, membranes and micro- or nano-scale environments such as micelles for separations, segregation, and targeted chemical transformations
- Transport through porous media such as soil, membranes and macro-fluid and air systems
- Transformations driven by electric field processing to ameliorate existing and potential chemical and particulate environmental hazards
- Exploration of new materials and process technologies for capture of carbon dioxide and other greenhouse gases from effluent streams, such as powerplant stack gases

Use of cutting-edge molecular simulation and modeling, micro- and nano-scale technology and hybrid technologies (e.g., Bio plus Non-Bio) is encouraged. Fundamental research leading to new remediation technologies in the following focus areas is of special interest: source characterization of pollutants, cost-effective separation technologies for dilute metals and liquid contaminants, heavy metals removal from incineration gases, and remediation of other gases potentially affecting global climate. Other areas may be acceptable, depending on program interests.

### **2. Treatment Technologies for Arsenic in Small Drinking Water Systems**

EPA is soliciting innovative, exploratory Phase I proposals that address the treatment of arsenic in small drinking water systems. These systems must provide low capital and operating cost, simplify operation, require minimal monitoring and maintenance, and reduce residual waste generation. EPA is particularly interested in highly innovative approaches that would be significantly less costly than current treatment approaches. Proposals on this topic should address this cost comparison issue.

Research technologies should be applicable to providing clean drinking water with less than 10 ppb arsenic in a range of systems from dispersed individual to small scale municipal (which serve less than 10,000 persons). Work may involve innovative processes including ion exchange materials, new adsorption methods, coagulation/filtration technologies, electrodialysis, novel membrane processes, reverse osmosis, and/or point of use (at the tap)/point-of-entry technologies.

For more information regarding arsenic in drinking water: visit <http://www.epa.gov/epahome/hi-arsenic.htm> and <http://www.epa.gov/safewater/arsenic.html>. Support for this activity is primarily from EPA.

### 3. Environmental Sensing

Research on new sensing technologies to assess the impact of anthropogenic (manmade) factors on natural and/or built environments. Examples of new technologies applied to sensing and measurement could include:

- Molecular bioengineering
- Large and high-density sensor arrays
- Wireless transfer of data from sensor arrays
- Robust micro-sensors in the aquatic environment
- Intelligent-nose technology, combining on-going research into environmental systems technology, sensor fusion or mixed-signal VLSI to enable breakthrough capabilities in detecting trace organics in the environment
- Sensor fusion from multiple modalities with on-board intelligent processing of environmental signals
- Engineered sensor systems relevant to monitoring gases that might stress and/or potentially change the global climate
- Integrated systems combining advanced electromagnetics and computational intelligence to improve the quality and utility of remote sensing of the environment

### C. ADDITIONAL CONSIDERATIONS for BOTH PROGRAMS (TSE and NTE)

#### 1. Industrial-Academic, Government, and International Collaboration

A clearer understanding of problems and more creative solutions often result from collaboration between academic researchers and the industrial investigators who represent the eventual customers for the products of the research. Therefore, applicants are strongly encouraged to seek meaningful project collaboration with industrial partners on research issues that link fundamental and applied aspects of pollution prevention/avoidance. (Industrial collaboration is required for continuing funding of past TSE research.) In some cases, government agencies such as the National Institute of Standards and Technology (NIST) or professional organizations may be an appropriate substitute for an industrial partner. The Appendix of the NSF General Grants Opportunities for Academic Liaison with Industry (GOALI) program announcement (NSF 98-142, available online at [www.nsf.gov/home/crssprgm/goali/](http://www.nsf.gov/home/crssprgm/goali/)) describes several mechanisms for these collaborations. Other mechanisms for collaboration will also be considered.

Government collaborations cannot be supported financially by this program. However, interactions of a non-financial nature are acceptable with non-EPA governmental organizations.

This competition will also entertain proposals that include international collaborative activities, by using a variety of NSF mechanisms.

#### 2. Exploratory Proposals

NSF will accept exploratory proposals in the above technical areas at an early or proof-of-concept stage. These proposals can be prepared using the format found in NSF Small Grants for Exploratory Research (SGER) proposal guidelines (Chapter II, Section D1 of the NSF Grant Proposal Guide <http://www.nsf.gov/cgi-bin/getpub?gpg>); however, these will not be considered SGER proposals. This class of proposal will be reviewed in the same panels as regular TSE and NTE proposals. The level of support for exploratory projects will range up to \$50,000 per year for one or two years.

NSF may provide further support to a successful exploratory project. If the initial concept was successful, a full proposal may be submitted in response to a subsequent NSF/EPA Partnership solicitation or to a regular NSF program. **(Please note that the NTE**

program requires successful completion of an exploratory Phase I project before entry to Phase II.)

### 3. Multidisciplinary Proposals

Environmental problems will often cross disciplinary boundaries. This solicitation welcomes cross-disciplinary proposals that address the TSE and NTE topic areas. Proposals may be submitted by individuals or small cross-disciplinary groups of investigators from eligible institutions.

### 4. Student Involvement

Projects involving the training and education of junior scientists and engineers in academia through the research experience (both graduate and undergraduate students) are very strongly encouraged. All proposals should address the ways in which education and training are integrated within the research program. Efforts to incorporate interdisciplinary educational activities and encourage student teamwork are also encouraged.

### 5. Impact of the Proposed Research

All TSE and NTE proposals **MUST** include a section entitled "Potential Impact". (Refer to Chapter II of the Grant Proposal Guide for detailed requirements.) This section must address the pollutants prevented or remediated by the proposed research at the process industry level (if applicable). It should address the significance of these reductions in terms of reduced risk and other benefits such as reduced energy or other raw materials usage; speculate about unintended consequences; and/or describe a life-cycle approach.

In this section on potential impacts, it is strongly recommended that the proposer address issues such as: the pollutant or class of pollutants the research proposes to prevent or minimize; the seriousness, scope, level, and importance of the environmental problem; and if the proposed technology or method is more economical or more environmentally benign than current technologies or methods. The proposal should contain quantitative information on the pollutants prevented and estimate both process or plant level and national level benefits. It should also address the potential and estimated timeframe for commercial viability of the proposed approach.

While the proposed research may be related to an individual reaction, unit operation, or unit process, the proposer should consider the environmental benefits or impacts of the research in the broader context of the system of which it is a part. In this regard, the proposal must contain a discussion of expected potential environmental benefits or impacts of the proposed research in the broadest systems sense, which may include considerations of the efficient use of natural resources and energy, and materials flows in manufacturing, product use, recycle, recovery or ultimate disposal. This requirement does not imply the need for a full life-cycle analysis, but should be as specific and quantitative as possible.

### 6. EPA Special Interests

EPA is particularly interested in research proposals that relate to priority areas that have been identified by EPA. These areas may involve priority pollutants or toxic chemicals or materials of importance in furthering the mission of the Agency. Research projects could address the elimination or minimization at the source of certain chemicals in an environmentally benign and cost-effective way, e.g., Persistent Bio-accumulative Toxics (PBTs); Hazardous Air Pollutants (HAPs); and Volatile Organic Compounds (VOCs).

Further information on these substances may be found at the EPA websites listed below:

Persistent Bioaccumulative Toxics List <http://www.epa.gov/pbt/cheminfo.htm>

Hazardous Air Pollutants (inc. VOCs) List <http://www.epa.gov/ttn/atw/188polls.html>

Toxic Release Inventory (TRI) Chemicals <http://www.epa.gov/triinter/chemical/index.htm>

High Production Volume Chemicals [http://www.epa.gov/opptintr/chemrtk/hpv\\_1990.pdf](http://www.epa.gov/opptintr/chemrtk/hpv_1990.pdf)

Waste Minimization Priority Chemicals <http://www.epa.gov/wastemin>

### 7. EPA Pollution Prevention Goals

EPA has developed long-term research goals in Pollution Prevention and New Technologies. These goals may be useful in developing

topics for research.

Goals under the EPA Green Chemistry and Engineering area include:

- Provide techniques such as greener synthesis and membrane applications for cleaner manufacturing in the chemical and allied technology sectors, e.g., find benign substitutes for hazardous solvents; provide biotechnological substitutes for current chemical processes; develop new catalysts that improve reactions and prevent formation of hazardous by-products.
- Develop and demonstrate pollution prevention technologies for green manufacturing in high-risk industrial and commercial sectors such as electronics, polymers, steel, petroleum, coatings, and the automotive or metal parts industries.
- Replace environmentally unacceptable materials used in buildings, or in industrial, chemical or consumer sectors

Goals under the EPA Tools area include:

- Develop risk-based design tools for industrial processes using systems approaches as an organizing concept for minimizing adverse impacts on the environment, e.g., create life-cycle assessment tools, develop design-for-the-environment tools
- Develop design tools for environmentally acceptable industrial and consumer products that minimize human health and ecological risks, e.g., design generic predictive tools for environmental impacts, create product or process models
- Develop cost-effective, user-friendly tools for life-cycle assessments of processes and products

Additional information on EPA programs in pollution prevention may be found at:

Green Chemistry Program <http://www.epa.gov/greenchemistry/>  
Green Engineering <http://www.epa.gov/opptintr/greenengineering/>  
Design for the Environment <http://www.epa.gov/opptintr/dfc>

### III. ELIGIBILITY INFORMATION

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Applicants are reminded that proposals will be disqualified if a "Potential Impact" statement is lacking.

The categories of proposers identified in the [Grant Proposal Guide](#) are eligible to submit proposals under this program announcement/solicitation. EPA and NSF welcome applications from all qualified scientists, engineers, and other professionals and strongly encourage women, members of underrepresented groups, and persons with disabilities to compete fully in any of the programs described in this solicitation.

In accordance with Federal statutes and regulations and EPA and NSF policies, no person shall be excluded from participation in, denied the benefits of, or be subjected to discrimination under any program or activity receiving financial assistance from EPA or NSF based on grounds of race, color, age, sex, national origin, or disability.

**NTE Phase II Eligibility:** NTE Phase II research requires previous support of a successful NTE Phase I exploratory project, such as those funded in NSF's 2000 NTE competition. (Note: NTE will not consider any Phase II proposals in the area of Arsenic Treatment in Small Drinking Water Systems.)

### IV. AWARD INFORMATION

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Estimated program budget, number of awards and average award size/duration are dependent upon responsiveness of the proposals to this solicitation, the quality, potential impact, and uniqueness of the proposed research, and the availability of funds. However, the NSF/EPA Partnership expects about \$9.5 million in combined funding to be available for "regular" and exploratory grants (approximately \$6.0 million from NSF and \$3.5 million from EPA).

**Award size and duration:** Approximately 45 Standard and Continuing grants ranging from \$50,000 to \$125,000 per year for one to three years. Anticipated date of NSF awards: July 2003. EPA awards may be later.

Award dollar amounts for TSE and NTE may differ. TSE Awards may range from \$50,000 to \$125,000 per year for one to three years. NTE Phase I Awards may be funded for one or two years at a maximum of \$50,000 per year, for a total up to \$100,000. NTE Phase II may provide funding for two or three years for a total up to \$350,000.

## V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

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### A. Proposal Preparation Instructions

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#### Full Proposal Instructions:

Proposals submitted in response to this program announcement/solicitation should be prepared and submitted in accordance with the general guidelines contained in the NSF *Grant Proposal Guide* (GPG). The complete text of the GPG is available electronically on the NSF Website at: <http://www.nsf.gov/cgi-bin/getpub?gpg>. Paper copies of the GPG may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from [pubs@nsf.gov](mailto:pubs@nsf.gov).

Principal Investigators are encouraged to review past TSE award lists on the Web at <http://www.nsf.gov/tse> and <http://www.epa.gov/ncer>.

#### (1) Sorting Codes

To facilitate proper assignment and review of applications, each applicant **MUST** identify the topic area in which the application is to be considered. Failure to do so may result in delay. At various places within the application, applicants will be asked to identify this topic area by using the appropriate Sorting Code. The Sorting Codes correspond to the topic areas within this solicitation and are shown below:

#### TSE (Prevention-Oriented)

- Chemistry, Bioengineering, and Chemical Reaction-based Engineering for Pollution Avoidance or Prevention
  - Chemistry TSE03-A
  - Materials TSE03-B
  - Chemical Processes and Reaction Engineering TSE03-C
  - Biochemical and Biotechnical Engineering TSE03-D
- Non-Reaction-Based Engineering for Pollution Avoidance and Prevention
  - Biochemical and Biotechnical Engineering TSE03-D
  - Interfacial, Transport, and Separations TSE03-E
  - Fluid and Thermal Systems TSE03-F
  - Control Systems for Energy Conversion or Transportation TSE03-G
- Environmentally Benign Systems and Design, Manufacturing, Processing, and Industrial Ecology for Sustainable Product/Services Realization
  - Life-Cycle Assessment (LCA) TSE03-H
  - Green Design and Materials Cycles TSE03-I
  - Environmentally Benign Manufacturing TSE03-K
- Sustainable Construction Processes

- o Environmentally Conscious Construction Processes TSE03-L
- o Disaster Management for a More Sustainable Environment TSE03-M

### **NTE (Remediation-Oriented)**

- Remediation
  - o Bioprocessing TSE03-N
  - o Chemical Processing TSE03-O
  - o Transport Processing (Mass, Thermal, and Fluid) TSE03-P
  - o Other TSE03-Q
- Arsenic Treatment in Small Drinking Water Systems TSE03-R
- Environmental Sensing TSE03-S

**The Sorting Code must be placed at the end of the proposal title and enclosed in parentheses**, e.g., "Supercritical CO<sub>2</sub> and CHF<sub>3</sub> as Alternative Solvents for Pollution Prevention (TSE03-C);" and this title and code must also be placed on top of the project summary (abstract) page. NSF and/or EPA may reassign proposals to other or multiple sorting categories to ensure optimal review of proposals.

### **(2) The Application**

Applicants are required to prepare their proposals for full electronic submission to NSF using the FastLane system at <http://www.fastlane.nsf.gov>. For further information, see section (4) below, entitled *How to Apply*.

To fulfill the requirements of section (3) below (optional at the proposal stage), applicants should place the additional pages, clearly labeled, in the Supplementary Documentation section of the FastLane proposal preparation system. These extra pages do not count against NSF's fifteen (15) page limit for the Project Description.

It is important that the application contain all the information requested in the format described. If it does not, the application will be returned without review. Once an applicant is chosen for an award (i.e., after external peer review and internal programmatic review), EPA or NSF program officers may request additional documentation and forms.

### **(3) Additional Pages - EPA Quality Assurance (QA) Narrative**

*The following additional information is optional at the proposal stage. However, it will be required by EPA whenever an EPA award is made. If being included the FastLane proposal, submit the information as Supplementary Documentation, as detailed in Section I of the GPG. The two pages do not count against NSF's 15-page limit for the Project Description.*

For any project involving data collection or processing, conducting surveys, environmental measurements, and/or modeling, or the development of environmental technology (whether hardware-based or via new techniques) for pollution control and waste treatment, provide a statement on quality processes that will be used to assure that results of the research satisfy the intended project objectives. The statement must describe a quality system that complies with the requirements of ANSI/ASQC E4, "Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs," and **must not exceed two pages**. For each item below, the statement must present the required information or reference the specific page and paragraph number of the Research Plan containing that information, or explain why the item does not apply to the proposed research.

- Discuss the activities to be performed or hypothesis to be tested and criteria for determining acceptable data quality. (Note: Such criteria may be expressed in terms of precision, accuracy, representativeness, completeness, and comparability or in terms of data quality objectives or acceptance criteria. Furthermore, these criteria must also be applied to determine the acceptability of existing or secondary data to be used in the project. In this context secondary data is data previously collected for other purposes or from other sources, including the literature, compilations from computerized databases, or results from models of environmental processes and conditions.)
- Describe the study design, including sample type and location requirements, all statistical analyses that were or will be used to estimate the types and numbers of physical samples required, or equivalent information for studies using survey and interview techniques.
- Describe the procedures for the handling and custody of samples, including sample collection, identification, preservation,

transportation, and storage.

- Describe the procedures that will be used in the calibration and performance evaluation of all analytical instrumentation and all methods of analysis to be used during the project. Explain how the effectiveness of any new technology will be measured and how it will be benchmarked to improve existing processes, such as those used by industry.
- Discuss the procedures for data reduction and reporting, including a description of all statistical methods, with reference to any statistical software to be used to make inferences and conclusions; discuss any computer models to be designed or used with associated verification and validation techniques.
- Describe the quantitative and/or qualitative procedures that will be used to evaluate the success of the project, including any plans for peer or other reviews of the study design or analytical methods before data collection.

If parts of the QA Statement are not applicable to the project, a brief statement of justification should be substituted for that element of the QA Statement. This is expected to occur infrequently.

ANSI/ASQC E4, "Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs," is available for purchase from the American Society for Quality at [www.asq.org](http://www.asq.org); or phone 1-800-248-1946 and request item E4-1999. Only in exceptional circumstances should it be necessary to consult this document. An EPA guidance document, "Guidance on Satisfying EPA Quality System Requirements for STAR Grants (EPA QA/G-1STAR)" is available for potential applicants which addresses in detail how to comply with ANSI/ASQC E4. This may be found on the Internet at <http://www.epa.gov/ncer>.

#### **(4) How to Apply**

##### **Electronic Proposal Submission: FastLane**

The NSF FastLane system **MUST** be used for electronic preparation and submission of a proposal through the Web at the FastLane Web site, <http://www.fastlane.nsf.gov>. The Sponsored Research Office (SRO or equivalent) must provide a FastLane Password to each Principal Investigator (PI) to gain access to the FastLane Proposal Preparation application. PIs who have not submitted a proposal to NSF in the past must contact their SRO to be added to the NSF PI database. This should be done as soon as the decision to prepare a proposal is made.

A list of registered institutions and the FastLane registration form are located on the FastLane Web page.

Proposals **MUST** be submitted to NSF by your institution's SRO before 5 p.m. local time on the appropriate deadline date. Proposals or changes in proposal content after that time will not be considered. Informal or incomplete proposals will not be considered. Proposals not adequately addressing the requirements in this solicitation will be returned to the submitting organization, unreviewed.

A proposal will not be processed until the complete proposal (including the Electronically Signed Cover Sheet sent within five working days following proposal submission) is received by NSF.

On the Cover Sheet (NSF Form 1207) the Principal Investigator should select the "Division of Chemical & Transport Systems" as the Division and "INTERFAC TRANS,& THERMODYN PRO" as the program to initially receive and then direct proposals to the proper program.

Proposers are reminded to identify the program announcement/solicitation number ((03-510)) in the program announcement/solicitation block on the proposal Cover Sheet. Compliance with this requirement is critical to determining the relevant proposal processing guidelines. Failure to submit this information may delay processing.

#### **B. Budgetary Information**

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##### **Cost Sharing:**

Cost sharing is not required in proposals submitted under this Program Solicitation.

##### **Other Budgetary Limitations:**



Budgets should include travel funds to Washington, D.C. for one TSE/NTE conference or workshop annually.

### **Budget Preparation Instructions:**

Subcontracts which exceed 40 percent of the total direct cost in any one year in which a subcontract is awarded must be especially well-justified.

### **C. Due Dates**

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Proposals must be submitted by the following date(s):

**Full Proposal Deadline(s)** (due by 5 p.m proposer's local time):

February 25, 2003

**Technology for a Sustainable Environment (TSE)**

March 04, 2003

**New Technologies for the Environment (NTE)**

### **D. FastLane Requirements**

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Proposers are required to prepare and submit all proposals for this announcement/solicitation through the FastLane system. Detailed instructions for proposal preparation and submission via FastLane are available at: <http://www.fastlane.nsf.gov/a1/newstan.htm>. For FastLane user support, call the FastLane Help Desk at 1-800-673-6188 or e-mail [fastlane@nsf.gov](mailto:fastlane@nsf.gov). The FastLane Help Desk answers general technical questions related to the use of the FastLane system. Specific questions related to this program announcement/solicitation should be referred to the NSF program staff contact(s) listed in Section VIII of this announcement/solicitation.

*Submission of Electronically Signed Cover Sheets.* The Authorized Organizational Representative (AOR) must electronically sign the proposal Cover Sheet to submit the required proposal certifications (see Chapter II, Section C of the [Grant Proposal Guide](#) for a listing of the certifications). The AOR must provide the required electronic certifications within five working days following the electronic submission of the proposal. Proposers are no longer required to provide a paper copy of the signed Proposal Cover Sheet to NSF. Further instructions regarding this process are available on the FastLane Website at: <http://www.fastlane.nsf.gov>

## **VI. PROPOSAL REVIEW INFORMATION**

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### **A. NSF Proposal Review Process**

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Reviews of proposals submitted to NSF are solicited from peers with expertise in the substantive area of the proposed research or education project. These reviewers are selected by Program Officers charged with the oversight of the review process. NSF invites the proposer to suggest, at the time of submission, the names of appropriate or inappropriate reviewers. Care is taken to ensure that reviewers have no conflicts with the proposer. Special efforts are made to recruit reviewers from non-academic institutions, minority-serving institutions, or adjacent disciplines to that principally addressed in the proposal.

The National Science Board approved revised criteria for evaluating proposals at its meeting on March 28, 1997 ([NSB 97-72](#)). All NSF proposals are evaluated through use of the two merit review criteria. In some instances, however, NSF will employ additional criteria as required to highlight the specific objectives of certain programs and activities.

On July 8, 2002, the NSF Director issued Important Notice 127, Implementation of new Grant Proposal Guide Requirements Related to the Broader Impacts Criterion. This Important Notice reinforces the importance of addressing both criteria in the preparation and review

of all proposals submitted to NSF. NSF continues to strengthen its internal processes to ensure that both of the merit review criteria are addressed when making funding decisions.

In an effort to increase compliance with these requirements, the January 2002 issuance of the GPG incorporated revised proposal preparation guidelines relating to the development of the Project Summary and Project Description. Chapter II of the GPG specifies that Principal Investigators (PIs) must address both merit review criteria in separate statements within the one-page Project Summary. This chapter also reiterates that broader impacts resulting from the proposed project must be addressed in the Project Description and described as an integral part of the narrative.

Effective October 1, 2002, NSF will return without review proposals that do not separately address both merit review criteria within the Project Summary. It is believed that these changes to NSF proposal preparation and processing guidelines will more clearly articulate the importance of broader impacts to NSF-funded projects.

The two National Science Board approved merit review criteria are listed below (see the [Grant Proposal Guide](#) Chapter III.A for further information). The criteria include considerations that help define them. These considerations are suggestions and not all will apply to any given proposal. While proposers must address both merit review criteria, reviewers will be asked to address only those considerations that are relevant to the proposal being considered and for which he/she is qualified to make judgements.

#### **What is the intellectual merit of the proposed activity?**

How important is the proposed activity to advancing knowledge and understanding within its own field or across different fields? How well qualified is the proposer (individual or team) to conduct the project? (If appropriate, the reviewer will comment on the quality of the prior work.) To what extent does the proposed activity suggest and explore creative and original concepts? How well conceived and organized is the proposed activity? Is there sufficient access to resources?

#### **What are the broader impacts of the proposed activity?**

How well does the activity advance discovery and understanding while promoting teaching, training, and learning? How well does the proposed activity broaden the participation of underrepresented groups (e.g., gender, ethnicity, disability, geographic, etc.)? To what extent will it enhance the infrastructure for research and education, such as facilities, instrumentation, networks, and partnerships? Will the results be disseminated broadly to enhance scientific and technological understanding? What may be the benefits of the proposed activity to society?

NSF staff will give careful consideration to the following in making funding decisions:

#### ***Integration of Research and Education***

One of the principal strategies in support of NSF's goals is to foster integration of research and education through the programs, projects, and activities it supports at academic and research institutions. These institutions provide abundant opportunities where individuals may concurrently assume responsibilities as researchers, educators, and students and where all can engage in joint efforts that infuse education with the excitement of discovery and enrich research through the diversity of learning perspectives.

#### ***Integrating Diversity into NSF Programs, Projects, and Activities***

Broadening opportunities and enabling the participation of all citizens -- women and men, underrepresented minorities, and persons with disabilities -- is essential to the health and vitality of science and engineering. NSF is committed to this principle of diversity and deems it central to the programs, projects, and activities it considers and supports.

## **ADDITIONAL REVIEW CRITERIA**

All proposals will be evaluated by panel review. However, if a proposal deals with a highly specialized area, supplemental mail review may be used.

#### **Special Criteria for Judging NTE proposals**

- Research must be based on novel ideas that are NOT already widely researched and published. (Phase I ideas may be supported by only limited preliminary data.)
- The proposals must contain a high level of engineering technology input.

- o A reasonable plan for the feasibility demonstration within the proposed budget and schedule must be included.

### ***Industrially Relevant Issues and Impact***

TSE has been established to address problems related to industrial pollution prevention and avoidance at the source. Therefore, each TSE proposal will be evaluated on its potential impact on industrial pollution. The proposer may find much useful (though not required) background information on the Internet. Significant process industry concerns are highlighted in documents such as Vision 2020, on the Web at <http://www.ccrhq.org/vision/index.html>. A list of toxic chemicals can be found at <http://www.epa.gov/tri/chemical.html>. A list of high production volume chemicals may be found at <http://www.epa.gov/chemrtk/hpvchmlt.htm>.

Industrial collaborators are another source of environmental issues to be addressed. If an industrial collaboration is described in the proposal, reviewers will assess the collaborative contribution to meeting the goals of this competition.

Collaboration on environmental projects with government laboratories such as NIST (National Institute of Standards and Technology) is also encouraged, especially when the project is fundamental and yet of importance to industry. However, award funds may not be allocated to government partners.

### **NSF/EPA Post-Review**

Following the review panel, a joint selection panel of NSF and EPA staff will review the recommendations of the panel and arrive at agency funding recommendations. Applications that receive high merit scores from the peer reviewers are subjected to a programmatic ("relevancy") review within EPA, the object of which is to assure a balanced research portfolio for EPA. Scientists from the Office of Research and Development (ORD) Laboratories and EPA program and regional offices review these recommended applications in relation to program priorities and their complementarity to the ORD intramural program and recommend selections to the National Center for Environmental Research (NCER) (<http://www.epa.gov/ncer>).

Staff from NSF and EPA will contact the potential grantee regarding possible clarifications of the budget, scope, and format. Copies of the evaluations by technical reviewers will be made available to each applicant at the end of the decision process. In case of proposals that may be funded by EPA, some different forms will be necessary to conform to EPA format and policy requirements. Funding decisions are the sole responsibility of EPA and NSF. Grants are selected on the basis of technical merit, relevancy to the research priorities outlined, program balance, and budget. The anticipated date of awards is Summer 2003. The total funding will be about \$9.5 million--approximately \$6.0 million from NSF and \$3.5 million from EPA, subject to the availability of funds and proposal quality.

### **Proprietary Information**

By submitting an application in response to this solicitation, the applicant grants NSF and EPA permission to share the application with technical reviewers both within and outside the Agencies. Applications should not include proprietary or other types of confidential information that cannot be evaluated on this basis.

## **B. Review Protocol and Associated Customer Service Standard**

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All proposals are carefully reviewed by at least three other persons outside NSF who are experts in the particular field represented by the proposal. Proposals submitted in response to this announcement/solicitation will be reviewed by Panel Review.

Reviewers will be asked to formulate a recommendation to either support or decline each proposal. The Program Officer assigned to manage the proposal's review will consider the advice of reviewers and will formulate a recommendation.

A summary rating and accompanying narrative will be completed and submitted by each reviewer. In all cases, reviews are treated as confidential documents. Verbatim copies of reviews, excluding the names of the reviewers, are sent to the Principal Investigator/Project

Director by the Program Director. In addition, the proposer will receive an explanation of the decision to award or decline funding.

NSF is striving to be able to tell applicants whether their proposals have been declined or recommended for funding within six months. The time interval begins on the date of receipt. The interval ends when the Division Director accepts the Program Officer's recommendation.

In all cases, after programmatic approval has been obtained, the proposals recommended for funding will be forwarded to the Division of Grants and Agreements (or the equivalent EPA division) for review of business, financial, and policy implications and the processing and issuance of a grant or other agreement. Proposers are cautioned that only a Grants and Agreements Officer may make commitments, obligations or awards on behalf of NSF or authorize the expenditure of funds. No commitment on the part of NSF should be inferred from technical or budgetary discussions with a NSF Program Officer. A Principal Investigator or organization that makes financial or personnel commitments in the absence of a grant or cooperative agreement signed by the NSF Grants and Agreements Officer does so at their own risk.

## **VII. AWARD ADMINISTRATION INFORMATION**

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### **A. NSF Notification of the Award**

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Notification of the award is made to *the submitting organization* by a Grants Officer in the Division of Grants and Agreements. Organizations whose proposals are declined will be advised as promptly as possible by the cognizant NSF Program Division administering the program. Verbatim copies of reviews, not including the identity of the reviewer, will be provided automatically to the Principal Investigator. (See section VI.A. for additional information on the review process.)

### **B. NSF Award Conditions**

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An NSF award consists of: (1) the award letter, which includes any special provisions applicable to the award and any numbered amendments thereto; (2) the budget, which indicates the amounts, by categories of expense, on which NSF has based its support (or otherwise communicates any specific approvals or disapprovals of proposed expenditures); (3) the proposal referenced in the award letter; (4) the applicable award conditions, such as Grant General Conditions (NSF-GC-1); \* or Federal Demonstration Partnership (FDP) Terms and Conditions \* and (5) any announcement or other NSF issuance that may be incorporated by reference in the award letter. Cooperative agreement awards also are administered in accordance with NSF Cooperative Agreement Terms and Conditions (CA-1). Electronic mail notification is the preferred way to transmit NSF awards to organizations that have electronic mail capabilities and have requested such notification from the Division of Grants and Agreements.

\*These documents may be accessed electronically on NSF's Website at [http://www.nsf.gov/home/grants/grants\\_gac.htm](http://www.nsf.gov/home/grants/grants_gac.htm). Paper copies may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from [pubs@nsf.gov](mailto:pubs@nsf.gov).

More comprehensive information on NSF Award Conditions is contained in the NSF *Grant Policy Manual* (GPM) Chapter II, available electronically on the NSF Website at <http://www.nsf.gov/cgi-bin/getpub?gpm>. The GPM is also for sale through the Superintendent of Documents, Government Printing Office (GPO), Washington, DC 20402. The telephone number at GPO for subscription information is (202) 512-1800. The GPM may be ordered through the GPO Website at <http://www.gpo.gov>.

### **Special Award Conditions:**

Upon conclusion of the review process, meritorious applications may be recommended for funding by either NSF or EPA at the option of the agencies, not the applicant. Subsequent grant administration procedures will be in accordance with the individual policies of the awarding agency.

### **EPA Grant Administration**

The funding mechanisms for all EPA awards issued under this solicitation will consist of grant agreements between EPA and the

recipient. In accordance with Public Law 95-224, grants are used to accomplish a public purpose of support or stimulation authorized by Federal statute rather than acquisition for the direct benefit of the Agency. In using a grant agreement, EPA anticipates that there will be no substantial involvement during the course of the grant between the recipient and the Agency.

EPA grants awarded as a result of this solicitation will be administered in accordance with CFR Parts 30 and 40 or the most recent terms and conditions of FDP-III, Federal Demonstration Partnership General Terms and Conditions, depending upon the grantee institution.

EPA provides awards for research in the sciences and engineering related to environmental protection. The awardee is solely responsible for the conduct of such activities and preparation of results for publication. EPA, therefore, does not assume responsibility for such findings or their interpretation.

EPA abstracts (one-page project summaries), annual and final reports and their summaries are to be submitted electronically. Abstracts and summaries will be posted on the NCER home page on the Internet at <http://www.epa.gov/ncer>.

### **C. Reporting Requirements**

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For all multi-year grants (including both standard and continuing grants), the PI must submit an annual project report to the cognizant Program Officer at least 90 days before the end of the current budget period.

The Investigator should consult with the cognizant NSF program officer because individual program officers may have additional or more specific guidelines for these reports.

Within 90 days after the expiration of an award, the PI also is required to submit a final project report. Failure to provide final technical reports delays NSF review and processing of pending proposals for the PI and all Co-PIs. PIs should examine the formats of the required reports in advance to assure availability of required data.

PIs are required to use NSF's electronic project reporting system, available through FastLane, for preparation and submission of annual and final project reports. This system permits electronic submission and updating of project reports, including information on project participants (individual and organizational), activities and findings, publications, and other specific products and contributions. PIs will not be required to re-enter information previously provided, either with a proposal or in earlier updates using the electronic system.

EPA has its own reporting requirements and they will be outlined in EPA award documents.

### **VIII. CONTACTS FOR ADDITIONAL INFORMATION**

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General inquiries regarding this program should be made to:

- Robert M Wellek, Deputy Division Director, National Science Foundation, Engineering/Chemical & Transport Systems, fax: (703) 292-9054, email: [rwellek@nsf.gov](mailto:rwellek@nsf.gov)
- Stephen Lingle, Division Director, Environmental Protection Agency, Environmental Engineering Research Division, telephone: (202) 564-6820, email: [lingle.stephen@epa.gov](mailto:lingle.stephen@epa.gov)
  
- Barbara Karn, Environmental Protection Agency, Environmental Engineering Research Division, Tel: (202) 564-6824, Email: [karn.barbara@epamail.epa.gov](mailto:karn.barbara@epamail.epa.gov)

For questions related to the use of FastLane, contact:

- FastLane HELPDESK, User Support, National Science Foundation, Monday to Friday 8am to 8pm, telephone: 1-800-673-6188, email: [fastlane@nsf.gov](mailto:fastlane@nsf.gov)

## IX. OTHER PROGRAMS OF INTEREST

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The NSF *Guide to Programs* is a compilation of funding for research and education in science, mathematics, and engineering. The NSF *Guide to Programs* is available electronically at <http://www.nsf.gov/cgi-bin/getpub?gp>. General descriptions of NSF programs, research areas, and eligibility information for proposal submission are provided in each chapter.

Many NSF programs offer announcements or solicitations concerning specific proposal requirements. To obtain additional information about these requirements, contact the appropriate NSF program offices. Any changes in NSF's fiscal year programs occurring after press time for the *Guide to Programs* will be announced in the NSF *E-Bulletin*, which is updated daily on the NSF Website at <http://www.nsf.gov/home/ebulletin>, and in individual program announcements/solicitations. Subscribers can also sign up for NSF's *Custom News Service* (<http://www.nsf.gov/home/cns/start.htm>) to be notified of new funding opportunities that become available.

## ENVIRONMENTAL PROGRAMS AND ACTIVITIES

This section describes a few of the numerous EPA and NSF activities related to environmental technology. The activities described below are for background information only. They may not necessarily be related to this solicitation, and they may not currently be accepting proposals separate from this solicitation.

### Environmental Protection Agency

The NSF/EPA Technology for a Sustainable Environment activity is an integral part of EPA's STAR program (Science To Achieve Results), and supports EPA's Green Chemistry Challenge Program, Green Engineering, Design for the Environment, and other pollution prevention activities in EPA.

*The STAR Program (Science To Achieve Results):* This is EPA's extramural research grant program, an important mechanism for promoting a sound scientific foundation for environmental protection. STAR is administered by the Office of Research and Development's National Center for Environmental Research (NCER). Specific programmatic announcements will be found on the Internet at <http://www.epa.gov/ncer>.

*The Green Chemistry Program:* This EPA program is directed at preventing pollution by promoting design of less toxic chemical substances and alternative chemical pathways that involve less toxic feedstocks, reagents, or solvents and generate fewer toxic products, by-products, or co-products. As part of this program, EPA has initiated the Green Chemistry Challenge Program to recognize and promote fundamental and innovative chemical methodologies that accomplish pollution prevention through source reduction and that have a broad application in industry. Green chemistry encompasses all aspects and types of chemical processes--including synthesis, catalysis, analysis, monitoring, separations, and reaction conditions--that reduce negative impacts on human health and the environment relative to the current state of the art. Through awards and grants programs, the Green Chemistry Challenge Program recognizes and promotes fundamental and innovative technologies that incorporate the principles of green chemistry into chemical design, manufacture, and use. The Green Chemistry Challenge Awards Program recognizes those in industry, academia, and government who have met the Green Chemistry objectives in an exemplary way. The Green Chemistry Challenge Grants Program, through projects awarded under TSE, enhances support for cutting-edge research in this area.

*National Green Chemistry and Engineering Conference:* Held each year in Washington, D.C. by the American Chemical Society with support from EPA, NSF, and several other federal agencies and trade and professional organizations, this conference presents the latest research findings and provides a forum for an annual overview of research in the environmental area.

*Design for the Environment (DFE) and the Green Engineering Programs:* Through the DFE program, EPA provides businesses with

information to make environmentally-informed choices and ultimately prevent pollution and reduce risks. DFE partners with industry, public interest groups, universities, research institutions, labor groups, and other governmental agencies to evaluate cleaner alternatives to existing products, processes, or technologies. Across a wide variety of projects, the DFE program strives to promote the consideration of environmental factors along with the traditional business decision parameters of cost and performance. Currently, DFE supports cooperative industry projects in eight sectors. Other green engineering programs include educational partnerships for curriculum development and professional training in pollution prevention, and a project in environmental accounting.

## **National Science Foundation**

The National Science Foundation, in its core programs and in special solicitations, supports fundamental research in a broad sweep of environmental areas, including ecosystem studies, marine and freshwater research, atmospheric sciences, risk analysis, polar regions, climate change, as well as environmentally relevant engineering, materials sciences, and computation. Programmatic descriptions are posted on the NSF web site, <http://www.geo.nsf.gov/ere>.

A special NSF competition on *Biocomplexity in the Environment* is usually held every one or two years. The last round was held in Spring 2002, and solicited proposals in the following areas: Dynamics of Coupled Natural and Human Systems; Coupled Bio-geochemical Cycles; Genome-Enabled Environmental Science and Engineering; Instrumentation Development for Environmental Activities, and Materials Use: Science, Engineering and Society. Those interested in environmental technologies may find opportunities in each of these areas. For example, research related to industrial ecology, life-cycle analysis, genetic engineering, and sensor development may be appropriate in the four areas, respectively. Research is required to be highly interdisciplinary, involve complex systems, and include both physical and living components, including humans. Quantitative methods, education, and a global perspective are essential. See <http://www.nsf.gov/cgi-bin/getpub?nsf02010> for details.

*Environmental Molecular Science Institutes (EMSI) and Collaborative Research Activities in Environmental Molecular Science (CRAEMS)*: This program, described in NSF 02-015, <http://www.nsf.gov/mps/chem/emsi98.htm>, is aimed at increasing fundamental issues that underpin the amelioration of environmental problems caused by societal activities that are energy- and pollution-intensive. Projects are expected to advance the discipline of chemistry and related molecular sciences, increase understanding of environmental systems, serve as models for excellence in collaborative interdisciplinary research, and contribute ultimately to beneficial technologies and processes. The program is supported by the Division of Chemistry and the Office of Multidisciplinary Activities in the Mathematical and Physical Sciences Directorate, and are also supported by the Office of Sciences (SC) of the Department of Energy.

## **Joint NSF and EPA Metabolic Engineering Activities**

*Interagency Announcement of Opportunities in Metabolic Engineering*: Metabolic Engineering proposals will not be funded in TSE or NTE and should be directed to this program instead. This activity is designed to allow two or more agencies to support Metabolic Engineering projects of common interest. The most recent program announcement is NSF 02-037. It provides an interagency definition of Metabolic Engineering and focuses on three topic areas that are of particular interest to the eight participating agencies (including EPA and NSF): bio-remediation, environmentally-conscious manufacturing, and pollution prevention. Researchers are strongly advised to consult with contacts within two or more participating agencies prior to submitting a proposal. (The NSF contact is Fred Heineken.)

## **Other Agencies**

Federal research-support programs in the environmental area can be complementary. For example, the research supported in this solicitation is on the more fundamental end of the research continuum, although collaboration with industrial researchers is strongly encouraged. Funding from other agencies such as the Commerce Department (e.g., the National Institute of Standards and Technology) tends to support more applied stages of research and may require collaboration and co-funding by industry.

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## **ABOUT THE NATIONAL SCIENCE FOUNDATION**

The National Science Foundation (NSF) funds research and education in most fields of science and engineering. Awardees are wholly responsible for conducting their project activities and preparing the results for publication. Thus, the Foundation does not assume responsibility for such findings or their interpretation.

NSF welcomes proposals from all qualified scientists, engineers and educators. The Foundation strongly encourages women, minorities and persons with disabilities to compete fully in its programs. In accordance with Federal statutes, regulations and NSF policies, no person on grounds of race, color, age, sex, national origin or disability shall be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving financial assistance from NSF, although some programs may have special requirements that limit eligibility.

*Facilitation Awards for Scientists and Engineers with Disabilities (FASSED)* provide funding for special assistance or equipment to enable persons with disabilities (investigators and other staff, including student research assistants) to work on NSF-supported projects. See the GPG Chapter II, Section D.2 for instructions regarding preparation of these types of proposals.

The National Science Foundation promotes and advances scientific progress in the United States by competitively awarding grants and cooperative agreements for research and education in the sciences, mathematics, and engineering.

To get the latest information about program deadlines, to download copies of NSF publications, and to access abstracts of awards, visit the NSF Website at <http://www.nsf.gov>

- **Location:** 4201 Wilson Blvd. Arlington, VA 22230
  
- **For General Information** (NSF Information Center): (703) 292-5111
  
- **TDD (for the hearing-impaired):** (703) 292-5090 or (800) 281-8749
  
- **To Order Publications or Forms:**  
  
Send an e-mail to: [pubs@nsf.gov](mailto:pubs@nsf.gov)  
  
or telephone: (703) 292-7827
  
- **To Locate NSF Employees:** (703) 292-5111

## **ABOUT THE ENVIRONMENTAL PROTECTION AGENCY**

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The mission of the Environmental Protection Agency (EPA) is to protect both environmental quality and human health. Achievement of this mission requires the application of sound science to assessment of environmental problems and to evaluation of possible solutions. A significant challenge is to support both "core" research that is longer term and addresses cross-cutting environmental problems as well as problem-driven research that addresses science issues relevant to meeting current Agency goals. Requests for Applications issued by the Science To Achieve Results (STAR) program are an important mechanism for promoting a sound scientific foundation for environmental protection.

EPA's research programs focus on reduction of risks to human health and ecosystems and on the reduction of uncertainty associated with risk assessment. Through its laboratories and through grants to academic and other not-for-profit institutions, EPA also fosters the development and evaluation of new risk reduction technologies across a spectrum, from pollution prevention through treatment, remediation and monitoring. In all areas, EPA is interested in research that recognizes issues relating to environmental justice, the concept of achieving equal protection from environmental and health hazards for all people without regard to race, economic status, or culture.



The U.S. Environmental Protection Agency's National Center for Environmental Research promotes and advances environmental science in the United States by competitively awarding grants for research focusing on reduction of risks to human health and ecosystems and on reduction of uncertainty associated with risk assessment.

To get the latest information about program deadlines, to view previously awarded grants, results and the latest announcements, and to download text and forms, visit the EPA Web Site at <http://www.epa.gov/ncer>.

To learn more about all of EPA's research, visit <http://www.epa/ORD>.

For EPA activities in general, visit <http://www.epa.gov>.

EPA is located at 1200 Pennsylvania Ave. NW, Washington, DC 20460.

- General Information Tel. (202) 260-7200
- TDD (for the hearing-impaired) Tel. (202) 260-3658

## PRIVACY ACT AND PUBLIC BURDEN STATEMENTS

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The information requested on proposal forms and project reports is solicited under the authority of the National Science Foundation Act of 1950, as amended. The information on proposal forms will be used in connection with the selection of qualified proposals; project reports submitted by awardees will be used for program evaluation and reporting within the Executive Branch and to Congress. The information requested may be disclosed to qualified reviewers and staff assistants as part of the proposal review process; to applicant institutions/grantees to provide or obtain data regarding the proposal review process, award decisions, or the administration of awards; to government contractors, experts, volunteers and researchers and educators as necessary to complete assigned work; to other government agencies needing information as part of the review process or in order to coordinate programs; and to another Federal agency, court or party in a court or Federal administrative proceeding if the government is a party. Information about Principal Investigators may be added to the Reviewer file and used to select potential candidates to serve as peer reviewers or advisory committee members. See Systems of Records, NSF-50, "Principal Investigator/Proposal File and Associated Records," 63 Federal Register 267 (January 5, 1998), and NSF-51, "Reviewer/Proposal File and Associated Records," 63 Federal Register 268 (January 5, 1998). Submission of the information is voluntary. Failure to provide full and complete information, however, may reduce the possibility of receiving an award.

An agency may not conduct or sponsor, and a person is not required to respond to an information collection unless it displays a valid OMB control number. The OMB control number for this collection is 3145-0058. Public reporting burden for this collection of information is estimated to average 120 hours per response, including the time for reviewing instructions. Send comments regarding this burden estimate and any other aspect of this collection of information, including suggestions for reducing this burden, to: Suzanne Plimpton, Reports Clearance Officer, Division of Administrative Services, National Science Foundation, Arlington, VA 22230.

OMB control number: 3145-0058.

