

2001 Technology for a Sustainable Environment

NSF/EPA PARTNERSHIP FOR ENVIRONMENTAL RESEARCH

An Interagency Solicitation

DEADLINE: MAY 21, 2001



NATIONAL SCIENCE FOUNDATION

DIRECTORATE FOR ENGINEERING

DIRECTORATE FOR MATHEMATICAL AND PHYSICAL SCIENCES



ENVIRONMENTAL PROTECTION AGENCY

NATIONAL CENTER FOR ENVIRONMENTAL RESEARCH



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SUMMARY OF PROGRAM REQUIREMENTS

GENERAL INFORMATION

Program Title: 2001 Technology for a Sustainable Environment

Synopsis of Program:

It is well recognized that industrial pollution often has complex negative effects on biological systems in the environment. The various policies and regulations set in place to help protect the environment have stimulated researchers to search for effective, economical ways to minimize pollution.

This competition is designed to address pollution avoidance/prevention processes and methodologies, and to support scientific and technological research with long-term impact on industrial applications. 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.

Other than aspects of materials flow and reuse, this competition is not intended to address issues related to waste monitoring, treatment, remediation, recycling, or containment other than in-process recycling of waste. Research in remediation and treatment of hazardous materials, while very important, is largely supported by other program activities in both agencies, or elsewhere.

Appropriate research areas:

- Chemistry and Chemical Reaction-based Engineering for Pollution Avoidance or Prevention;
- Non-reaction Based Engineering for Pollution Avoidance and Prevention;
- Green Design, Manufacturing, and Industrial Ecology for Sustainable Product/Services Realization.

NSF and EPA are providing funds for fundamental and applied research in the physical sciences and engineering that will lead to environmentally benign methods for industrial processing and manufacturing. The competition addresses technological environmental issues of design, synthesis, processing, and the production, use, and ultimate disposition of products in continuous and discrete manufacturing industries. Projects with fresh ideas that are "on the cutting edge" or are "high-risk/high-payoff" are encouraged. Projects also will be considered that show the potential to change research infrastructure by developing teams, using systems approaches, and/or introducing new ways of conducting research.

For information on prior NSF/EPA competitions, visit <http://www.nsf.gov/tse>, and <http://es.epa.gov/ncerqa>.

Cognizant Program Officer(s):

- Robert Wellek, NSF, Deputy Division Director, Engineering, Chemical and Transport Systems, 525, telephone: Fax (703) 292-9054, e-mail: rwellek@nsf.gov.
- Barbara Karn, EPA, EPA Environmental Research Division, telephone: (202) 564-6824, e-mail: karn.barbara@epamail.epa.gov.

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

- 47.041 --- Engineering
- 47.049 --- Mathematical and Physical Sciences

ELIGIBILITY INFORMATION

- **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 TSE proposal may be submitted by a Principal Investigator and he/she may only collaborate in one other proposal as a co-Investigator.

- **Limit on Number of Proposals:** None for the proposing organization.

AWARD INFORMATION

- **Anticipated Type of Award:** Standard or Continuing Grant
- **Estimated Number of Awards:** 20 Awards ranging from \$50,000 to \$125,000 per year for one to three years.
- **Anticipated Funding Amount:** Approximately \$5.5 million from NSF and EPA combined in FY2001, subject to availability of funds (about \$2.5M from NSF and \$3.0M from EPA).

PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions

- **Full Proposals:** Supplemental Preparation Guidelines
 - 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 Specialized. Please see the full program solicitation for further information.
- **Indirect Cost (F&A) Limitations:** Not Applicable.
- **Other Budgetary Limitations:** Not Applicable.

C. Deadline/Target Dates

- **Letters of Intent (*optional*):** None
- **Preliminary Proposals (*optional*):** None
- **Full Proposal Deadline Date(s):** May 21, 2001

D. FastLane Requirements

- **FastLane Submission:** Full Proposal Required
- **FastLane Contact(s):**
 - FastLane HELP DESK, telephone: (800) 673-6188.
 - Florence I. Rabanal, FastLane Project Coordinator, Directorate for Mathematical and Physical Sciences, telephone: (703) 292-8808, e-mail: frabanal@nsf.gov.

PROPOSAL REVIEW INFORMATION

- **Merit Review Criteria:** National Science Board approved criteria. Additional merit review considerations apply. Please see the full program announcement/solicitation for further information.

AWARD ADMINISTRATION INFORMATION

- **Award Conditions:** Additional award conditions apply. Please see the program announcement/solicitation for further information.
- **Reporting Requirements:** Additional reporting requirements apply. Please see the full program announcement/solicitation for further information.

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IX. OTHER PROGRAMS OF INTEREST

I. INTRODUCTION

The National Science Foundation (NSF) and 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) 2001. This NSF/EPA research activity has been developed based on a Memorandum of Understanding between the agencies which establishes a partnership emphasizing the support and merit review of fundamental environmental research. This is the sixth round of the joint awards competition. Information on awards made in the FY 1995 through FY 2000 competitions may be found on the Internet at <http://www.nsf.gov/tse> or <http://www.epa.gov/ncerqa>.

The NSF/EPA Partnership solicits applications for Technology for a Sustainable Environment (TSE). Awards made through this competition 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. NSF and EPA anticipate awarding approximately \$5.5 million (combined from the two agencies) for TSE, with a projected award range from \$50,000 to \$125,000 per award per year, for one to three years.

Proposals in response to this TSE solicitation must be received via FastLane by May 21, 2001. It is anticipated that awards will be made by September 2001. Awards resulting from this TSE competition will be made either by NSF or by EPA (at the option of the agencies, not the grantee).

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

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

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II. PROGRAM DESCRIPTION

TECHNOLOGY FOR A SUSTAINABLE ENVIRONMENT

2.1 Introduction.

As a nation, we seek long-term economic growth that creates jobs while improving and sustaining the environment. It is increasingly clear that "end-of-pipe" pollution controls for industrial operations are not always a sufficient means of reaching these goals. A new generation of cleaner industrial manufacturing and processing technologies is needed that supports pollution avoidance/prevention (at the source), efficient resource use, and industrial ecology. Such a strategy can help companies become more competitive by lowering resource and energy needs, reducing waste and emissions control costs, and, thereby, foster sustainable development while maintaining a strong economy.

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, this competition is not intended to address issues related to waste monitoring, treatment, remediation, recycling, or containment. Research in the areas of remediation and treatment of hazardous materials, while very important, is supported by other program activities in both agencies.

NSF and EPA are providing 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 and manufacturing. The competition addresses technological environmental issues of design, synthesis, processing, and the production, use, and ultimate disposition of products 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 also will be considered that show the potential to change research infrastructure by developing teams, using systems approaches, and introducing new ways of conducting research.

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 utilizing 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 experimental sustainability could include nanotechnology, molecular modeling, computational chemistry, and simulation of physical, biological, and chemical phenomena. Environmental technology research can also have a critical - albeit indirect, role in developing reliable and affordable energy systems.

This is the sixth joint NSF/EPA solicitation of TSE. Over these years, about 127 proposals have been funded (61 by NSF, 44 by EPA, and 22 by both agencies). Figure 1 shows general crosscutting areas of the past research grants. The reader should note that research proposals submitted to this new solicitation do not necessarily need to fit into these general categories.

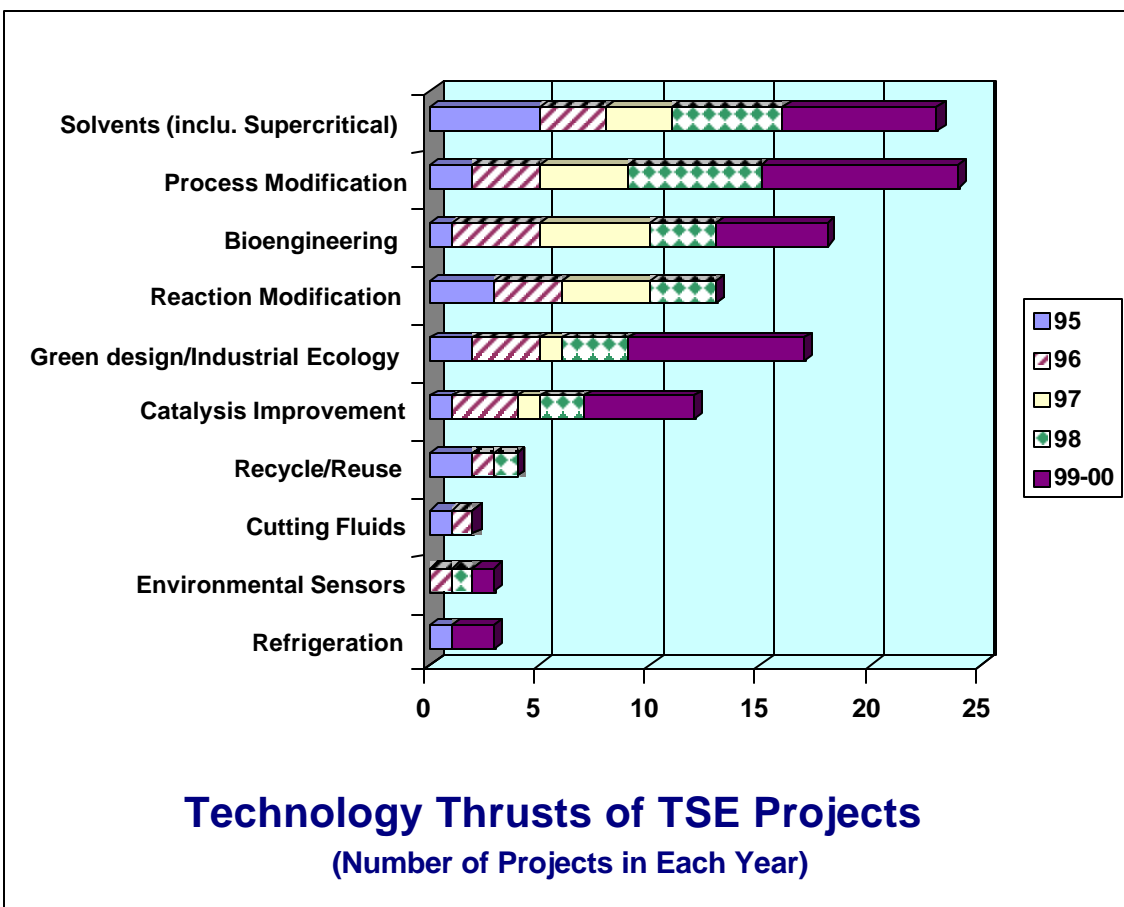


Figure 1

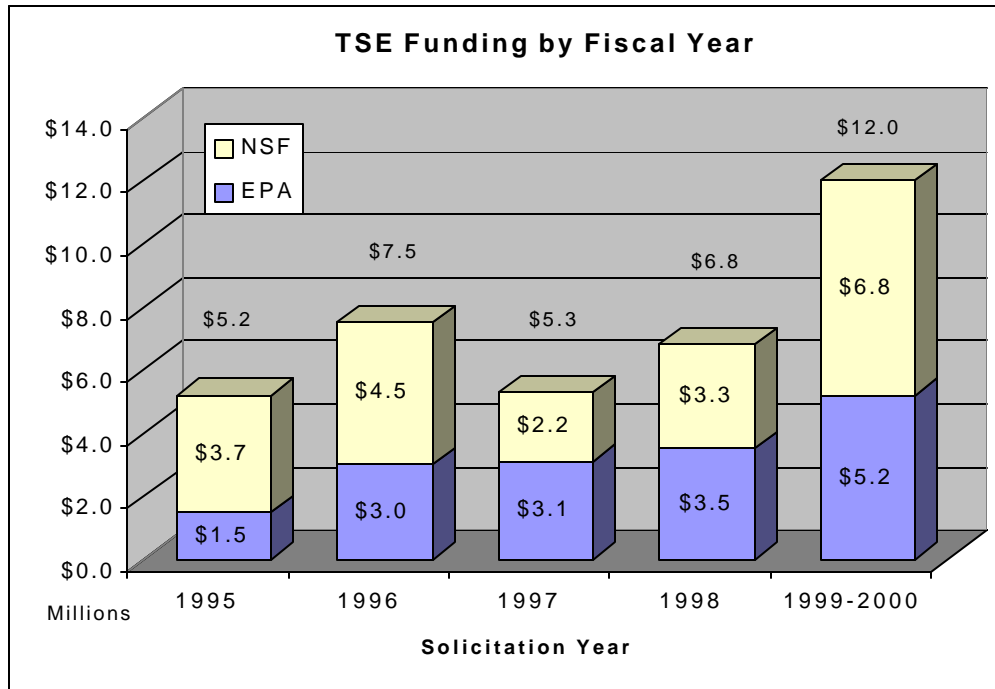


Figure 2

Figure 2 indicates funding from the two agencies during the period 1995-2000. Grants are typically for three years at a level of \$120,000 per year. A total of about 1,000 proposals have been submitted to the TSE solicitations in the past five rounds of competition, and about 13% of the proposals have been funded.

Abstracts of grants funded in the past may be found at: <http://www.nsf.gov/tse> or <http://www.epa.gov/ncerqa>.

The general areas of this solicitation cover:

- Chemistry and Chemical Reaction-based Engineering for Pollution Avoidance or Prevention;
- Non-reaction-based Engineering for Pollution Avoidance and Prevention; and
- Green Design, Manufacturing, and Industrial Ecology for Sustainable Product/Services Realization

2.2 Description of Possible Research Projects

2.2.1 Chemistry and Chemical Reaction-based 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 utilize toxic feedstocks, reagents or solvents, or processes that reduce the production of toxic byproducts or co-products.

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; reaction mechanisms; and environmentally benign materials.

Some specific examples are:

- *Catalysis or 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; novel heterogeneous catalysts that replace state-of-the-art homogeneous ones; new photo- or electro-catalysts that operate at low temperatures with high selectivity; and novel catalysts for currently uncatalyzed reactions. The use of combinatorial technologies in catalyst development is an emerging area where research efforts have focused on optimizing catalyst performance.
- *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 such that they are less toxic to health and the environment or safer with regard to accident potential is of interest.
- *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 control are of interest.
- *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 of raw materials or the use of less hazardous solvents in organic coatings, materials less harmful to the environment, and materials substitutions in metal plating systems. Nano-scale materials can be used in a number of

environmentally useful ways to develop better catalytic systems in terms of selectivity and ease of recyclability, and better environmentally functional and robust sensors.

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.

2.2.2 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, and in-process changes.

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: research to convert waste biomass into useful products; genetic engineering to produce more specific biocatalysts; and bioprocessing to increase energy efficiency, decrease use of hazardous reactants or byproducts, or develop more cost effective methods of producing environmentally benign products. Bio-remediation research is not covered by this solicitation.
- *Separations, Mass Transport, and Interfacial Phenomena*: Examples are: non-reactive mass transport and interfacial processes which can include: use of special surfactant systems for surface cleaning and reactions; solution thermodynamics of environmentally benign solvents such as ionic or near critical solutions; novel, cost-effective methods for the highly efficient in-process separation of useful materials from the components of the process waste stream, for example, field enhanced and hybrid separation processes; novel processes for molecularly controlled chemical and materials synthesis of thin films; and developing separation methods that reform feedstocks for improved efficiency. Development of advanced in-process sensors that have potential application in 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 transcritical 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.)

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.

2.2.3 Green Design, Manufacturing, 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 cycle from design and manufacture of product, through use and re-manufacture, to recycling and final 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 usage and capture; cradle-to-grave budgets and cycles; material and energy 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 upon 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; design for disassembly, reuse, recycling and remanufacturing.
- *Environmentally Benign Manufacturing*: Research in evaluating the environmental impact of new or modified manufacturing processes that includes links with manufacturing competitiveness. This includes design for material and energy minimization and indirect as well as direct impacts over the life cycle. Examples include: novel joining/welding processes that render fumes harmless; reduction of contaminant and sludge generation in processes such as electrochemical machining; modified foundry approaches that reduce or reuse current waste streams; joining and fastening processes

that improve disassembly/separation; novel hybrid processes including plasma or beam processing that minimize waste production and improve material/energy use or reuse; advances in additive processing, such as solid freeform fabrication; dry machining; and nanotechnologies that address pollution prevention or remanufacturing.

2.3 Additional Considerations

2.3.1 Industrial-Academic, Government, and International Collaboration

A clearer understanding of problems and more creative solutions often result from collaboration between academic 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. In some cases, government agencies or professional organizations may be an appropriate substitute for an industrial partner. The NSF General Grants Opportunities for Academic Liaison with Industry (GOALI) program announcement (NSF 98-142) outlines 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.

The TSE Program will also entertain proposals that include international collaborative activities, by using a variety of NSF mechanisms.

2.3.2 New Grants for Past and Current TSE Projects/Industrial Collaboration

Proposals that request new grants for past or on-going TSE projects related to research activities described in section 2.2 above, **MUST** include some form of academic-industrial collaboration, partnership or involvement. Section 2.2 outlines potential research areas for collaboration and what is currently allowed for all awards. Refer to it to determine if a past or current TSE project can qualify for potential continuation of TSE funding.

2.3.3 Exploratory Proposals

NSF will accept TSE proposals to this solicitation to explore pollution avoidance issues or concepts in the above technical areas at an early or proof-of-concept stage. These proposals can be prepared according to NSF Small Grants for Exploratory Research (SGER) proposal guidelines; however, this class of proposal will be reviewed in the same panels as regular TSE proposals. The level of support for exploratory projects will range up to \$50,000 per year for one or two years. See Section A in the following NSF URL for more information and format: http://www.nsf.gov/pubs/2001/nsf012/nsf0102_2.html#IIC11.

Successful exploratory proposals may be supported by NSF. If the concept is successful, a full proposal may be submitted to NSF and EPA in response to a subsequent Partnership solicitation or to a regular NSF program.

2.3.4 Multidisciplinary Proposals

Environmental problems will often cross disciplinary boundaries. This solicitation welcomes cross-disciplinary proposals that address the TSE topic areas. Proposals may be submitted either by individuals or small cross-disciplinary groups of investigators working on projects that will advance the concepts and technologies of pollution avoidance/prevention at the source.

2.3.5 Student Involvement

Researchers from both academic and non-profit institutions located in the U.S. and Puerto Rico may apply for support (see Section III). Projects involving the training and education of junior scientists and engineers (such as graduate students) in academia through the research experience are very strongly encouraged.

2.3.6 Impact of the Proposed Research

The TSE proposal **MUST** include a section entitled "Potential Impact."

While the research supported by this program 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 industrial 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.

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 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.

2.3.7 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 byproducts
- Develop and demonstrate pollution prevention technologies for green manufacturing in high-risk industrial and commercial sectors such as electronics, polymers, steel, petroleum, coatings, automotive, metal parts industries

- Replace environmentally unacceptable materials used in buildings, industrial, chemical, and 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 LCA 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.

III. ELIGIBILITY INFORMATION

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.

Federal employees may cooperate or collaborate with eligible applicants within the limits imposed by applicable legislation and regulations. However, federal agencies, national laboratories funded by federal agencies (FFRDCs), and federal employees are not eligible to submit applications to this program and may not serve in a principal leadership role on a grant. Under exceptional circumstances the principal investigator's institution may subcontract to a federal agency or FFRDC to purchase unique supplies or services unavailable in the private sector. Examples are purchase of satellite data, census data tapes, chemical reference standards, unique analyses or instrumentation not available elsewhere, etc. A written justification for such federal involvement must be included in the application, along with an assurance from the federal agency that commits it to supply the specified service. Federal employees may not receive salaries or in other ways augment their agency's appropriations through grants made by this program. Potential applicants who are uncertain of their eligibility should contact Dr. Barbara Karn at EPA (address listed in Section I).

EPA and NSF welcome applications on behalf of 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.

IV. AWARD INFORMATION

Estimated program budget, number of awards and average award size/duration are subject to the availability of funds. However, the NSF/EPA Partnership expects about \$5.5 million in

combined funding to be available for this solicitation (approximately \$2.5 million from NSF and \$3.0 million from EPA).

Award size and duration: Approximately 20 Standard and Continuing grants ranging from \$50,000 to \$125,000 per year for one to three years. Anticipated date of awards: September 2001.

V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions

Full Proposal:

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 Web Site at: <http://www.nsf.gov/cgi-bin/getpub?nsf012>. Paper copies of the GPG may be obtained from the NSF Publications Clearinghouse, telephone (301) 947-2722 or by e-mail from pubs@nsf.gov.

Supplemental Guidelines for TSE Proposals:

Principal Investigators are encouraged to review past TSE award lists on the Web at <http://www.nsf.gov/tse> and may informally contact program directors by e-mail regarding suitability of their ideas to this solicitation.

5.1 Sorting Codes

In order 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:

- Chemistry and Chemical Reaction-based Engineering for Pollution Avoidance or Prevention
 - Chemistry - TSE01-A
 - Materials - TSE01-B
 - Chemical Processes and Reaction Engineering - TSE01-C
- Non-reaction-based Engineering for Pollution Avoidance and Prevention:
 - Biological Engineering - TSE01-D
 - Fluid and Thermal Systems - TSE 01-E
 - Interfacial, Transport, and Separations - TSE01-F

- Green Design, Manufacturing, and Industrial Ecology for Sustainable Product/Service Realization:
 - Life-Cycle-Assessment (LCA) - TSE01-G
 - Green Design and Materials Cycles - TSE01-H
 - Environmentally Benign Manufacturing - TSE01-I

The Sorting Code must be placed at the end of the proposal title and enclosed in parentheses, e.g., "Supercritical CO₂ and CHF₃ as Alternative Solvents for Pollution Prevention" (TSE01-C); and this title and code must also be placed on the 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.

5.2 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 5.4 below, entitled *How to Apply*.

To fulfill the requirements of section 5.3 below, 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 section.

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.

5.3 Additional Pages - EPA Quality Assurance Narrative

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 and 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 may be defined as data previously collected for other purposes or from other sources, including the literature, compilations from computerized data bases, 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 utilized 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 prior to data collection.

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, phone 1-800-248-1946, item T55. 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 for STAR grants. This may be found on the Internet at <http://www.epa.gov/ncerqa>.

These additional pages (mandated by EPA) should be submitted as Supplementary Documentation in the FastLane submission to NSF, as detailed in Section I of the GPG, and do not count against the fifteen (15) page limit NSF has established for the Project Description section of proposals.

5.4 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 at <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 May 21, 2001. 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 signed Cover Sheet, postmarked 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 solicitation number (NSF 01-76) in the program announcement/solicitation block on the proposal Cover Sheet (NSF Form 1207). Compliance with this requirement is critical to determining the relevant proposal processing guidelines. Failure to submit this information may delay processing.

B. Budgetary Information

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

Budgets should include travel funds to Washington DC for one TSE conference or workshop annually.

Cost sharing with NSF at a level of 30% of total eligible equipment costs is required for all *equipment* expenses above \$10,000 submitted in response to this solicitation.

EPA grants will not require any cost sharing. However, all TSE proposals must be submitted with NSF cost sharing information included.

The proposed cost sharing must be shown on Line M on the proposal budget. Documentation of the availability of cost sharing must be included in the proposal. Only items which would be allowable under the applicable cost principles, if charged to the project, may be included as the awardee's contribution to cost sharing. Contributions may be made from any non-Federal source, including non-Federal grants or contracts, and may be cash or in-kind (see OMB Circular A-110, Section 23). It should be noted that contributions counted as cost-sharing toward projects of another Federal agency may not be counted towards meeting the specific cost-sharing requirements of the NSF award. All cost-sharing amounts are subject to audit. Failure to provide the level of cost-sharing reflected in the approved award budget may result in termination of the NSF award, disallowance of award costs and/or refund of award funds to NSF.

C. Deadline/Target Dates

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

Full Proposals by 5:00 PM local time: May 21, 2001

Electronic proposals **MUST** be submitted in NSF's FastLane by **5:00 PM local time, May 21, 2001**. (Local time is at the institution submitting the proposal.) Copies of the signed proposal Cover Sheet **MUST** be mailed within five (5) working days following electronic proposal submission. See details below.

D. FastLane Requirements

Proposers are required to prepare and submit all proposals for this Program 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 1-800-673-6188.

Submission of Signed Cover Sheets. The signed copy of the proposal Cover Sheet (NSF Form 1207) must be postmarked (or contain a legible proof of mailing date assigned by the carrier) within five working days following proposal submission and be forwarded to the following address:

National Science Foundation
DIS – FastLane Cover Sheet
4201 Wilson Blvd.
Arlington, VA 22230

VI. PROPOSAL REVIEW INFORMATION

A. NSF Proposal Review Process

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.

Proposals will be reviewed against the following general review criteria established by the National Science Board. Following each criterion are potential considerations that the reviewer may employ in the evaluation. These are suggestions and not all will apply to any given proposal. Each reviewer will be asked to address only those that are relevant to the proposal 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?

Principal Investigators should address the following elements in their proposal to provide reviewers with the information necessary to respond fully to both of the above-described NSF merit review criteria. NSF staff will give these elements careful consideration 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

Industrially Relevant Issues and Impact

TSE has been established to address problems related to industrial pollution prevention and avoidance at the source. Therefore, each 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.

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

NSF/EPA Post-Review

Following the review panel, a joint EPA/NSF 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 National Center for Environmental Research (NCER) (<http://es.epa.gov/ncerqa/>).

Staff from NSF and EPA will contact the potential grantee regarding possible clarifications of the budgets, format, scope, and format. Copies of the evaluations by the technical reviewers will be provided to each applicant by mail. In the case of proposals that may be funded by EPA, some different forms will be necessary to conform to EPA format and policy requirements. This procedure has been followed for the past six years, as the primary administration of this joint agency research activity rotates between the two agencies. 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 September 2001, with some awards possibly made in early fiscal year 2002. The approximate total funding from each agency will be: EPA: \$3,000,000; NSF; \$2,500,000, subject to 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.

A summary rating and accompanying narrative will be completed and signed 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.

B. Review Protocol and Associated Customer Service Standard

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.

NSF will be able to tell applicants whether their proposals have been declined or recommended for funding within six months for 95 percent of proposals. The time interval begins on the proposal deadline or target date or from the date of receipt, if deadlines or target dates are not used by the program. 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 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 its own risk.

VII. AWARD ADMINISTRATION INFORMATION

A. Notification of the Award

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. Award Conditions

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 Web site at http://www.nsf.gov/home/grants/grants_gac.htm. Paper copies may be obtained from the NSF Publications Clearinghouse, telephone (301) 947-2722 or by e-mail from 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 Web site 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 Web site 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, annual and final reports and their summaries are to be submitted electronically. Summaries will be posted on the NCER home page on the Internet at <http://www.epa.gov/ncerqa>.

EPA Mission and Research and Development Strategy

The mission of EPA is to protect both environmental quality and human health through effective regulations and other policy initiatives. 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 end-of-pipe controls to 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.

EPA's extramural research grant program, the STAR Program, is administered by the Office of Research and Development's National Center for Environmental Research (NCER). Announcements of specific programmatic announcements will be found on the internet at <http://www.epa.gov/ncerqa>.

C. Reporting Requirements

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.

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

Within 90 days after the expiration of an award, the PI also is required to submit a final project report. Approximately 30 days before expiration, NSF will send a notice to remind the PI of the requirement to file the final project report. Failure to provide final technical reports delays NSF review and processing of pending proposals for that PI. PIs should examine the formats of the required reports in advance to assure availability of required data.

NSF has implemented an electronic project reporting system, available through FastLane. 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.

VIII. CONTACTS FOR ADDITIONAL INFORMATION

General inquiries regarding 2001 Technology for a Sustainable Environment should be made to:

- Robert Wellek, NSF, Deputy Division Director, Engineering, Chemical and Transport Systems, 525, telephone: Fax (703) 292-9054, e-mail: rwellek@nsf.gov.
- Barbara Karn, EPA, EPA Environmental Research Division, telephone: (202) 564-6824, e-mail: karn.barbara@epamail.epa.gov.

For questions related to the use of FastLane, contact:

- FastLane HELP DESK, telephone: (800) 673-6188.

- Florence I. Rabanal, FastLane Project Coordinator, Directorate for Mathematical and Physical Sciences, telephone: (703) 292-8808, e-mail: frabanal@nsf.gov.

IX. OTHER PROGRAMS OF INTEREST

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 web site 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 NSF and EPA 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.

A.1 Environmental Protection Agency

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

Green Chemistry Program: This 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.

Design For the Environment and the Green Engineering Programs: Through the Design for the Environment (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.

A.2 National Science Foundation

The National Science Foundation 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.nsf.gov/home/crssprgm/be/>.

The Technology for a Sustainable Environment (TSE) program is an integral part of NSF's Environmentally Benign Chemical Synthesis and Processing (EBCS&P) activity and its Environmentally Conscious Manufacturing (ECM) program activity, described below.

Environmentally Benign Chemical Synthesis and Processing (EBCS&P): This program, described in NSF 92-13 <http://www.nsf.gov/pubs/stis1992/nsf9213/nsf9213.txt>, is aimed at preventing pollution by providing financial support for fundamental research in the identification of environmentally benign chemical and material synthesis and related manufacturing processes. For the NSF Engineering Directorate's Chemical and Transport Systems Division (CTS), the Technology for a Sustainable Environment (TSE) activity subsumes the EBCS&P activity in Fiscal Year 2001. For the NSF Directorate of Mathematics and Physical Science's Division of Chemistry, research proposals are also accepted for EBCS&P activities as part of its normal review process, as well as through this special NSF/EPA TSE activity. Proposals submitted directly to the Chemistry Division must be received between July and January of each year.

The *Environmentally Conscious Manufacturing (ECM)* NSF Engineering competition addressed specific aspects of the ECM Announcement NSF 95-91. In Fiscal Year 2001, the ECM activity is largely subsumed in this solicitation. However, only those areas described in this solicitation will be considered; proposals in all other ECM topic areas may be submitted under the normal procedures for unsolicited NSF proposals (Grant Proposal Guide, NSF 01-2) to the relevant divisions. Copies of the NSF 95-91 or 01-2 announcements can be obtained via the World Wide Web at <http://www.nsf.gov/cgi-bin/pubsys/browser/odbrowse.pl>.

New Technologies for the Environment: The NSF Engineering Directorate introduced an

initiative in FY 2000 (NSF 00-49) seeking high risk/high return, exploratory research feasibility studies on new technologies applied to the environment. This initiative focused on new technologies that can be applied to environmental sensing, remediation, and environmentally benign manufacturing. This solicitation was for Phase I feasibility studies; successfully completed Phase I studies are to be eligible to compete for Phase II awards. The Engineering Directorate of NSF may solicit Phase II proposals in FY 2002.

See: <http://www.nsf.gov/pubs/2000/nsf0049.htm>.

A special NSF competition on *Biocomplexity in the Environment* (NSF 01-34) is being held in FY2001. Proposals are due March 16 or March 29, 2001, and they are sought in the following areas: Dynamics of Coupled Natural and Human Systems; Coupled Bio-geochemical Cycles; Genome-Enabled Environmental Science and Engineering; and Instrumentation Development for Environmental Activities. Those interested in environmental technologies may find opportunities in each of these four 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?nsf0134>.

Environmental Molecular Science Institutes (EMSI) and Collaborative Research Activities in Environmental Molecular Science (CRAEMS): This program, described in NSF 00-68 <http://www.nsf.gov/mps/chem/emsi98.htm>, is aimed at increasing fundamental understanding of natural processes resulting from human activities in the environment at the molecular level. The program supports cohesive interdisciplinary group efforts by universities in partnership with industry in basic research on 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 Mathematical and Physical Sciences Directorate, and were also supported by the Office of Sciences (SC), Department of Energy (DOE).

A.3 Joint NSF and EPA Metabolic Engineering Activities

Interagency Announcement of Opportunities in Metabolic Engineering: This Announcement is described in NSF 01-19 and provides an Interagency definition of Metabolic Engineering. The Announcement focuses on three topic areas of Metabolic Engineering that are of particular interest to the eight participating agencies, including EPA and NSF. Metabolic Engineering proposals will not be supported in TSE and should be directed to the NSF 01-19 announcement. Many of the Research Directorates at NSF are participating in this Activity, which is designed to allow two or more of the participating Agencies to support projects of common interest. The topic areas of Metabolic Engineering mentioned in its Announcement have applications in bio-remediation, environmentally conscious manufacturing, and pollution prevention. Full proposals are due March 2, 2001 and authors are strongly suggested to consult with contacts in two or more participating agencies prior to submitting a proposal.

A.4 Other Agencies

This research solicitation can be viewed as part of an evolving national network of Federal research support and industry collaboration that is becoming a "research stewardship network" in Green Chemistry and Engineering. Although still developing, a set of research plans or roadmaps is evolving through joint efforts of federal agencies, industry and academia that can form the basis for a coordinated research network. A series of research workshops to discuss research results and needs in each of several research components or areas of Green Chemistry and Engineering is emerging. For example, workshops have been held or are planned addressing polymer chemistry, catalysis, dense phase fluids, electro-technologies, bioprocessing and bioseparations, solid/liquid separations, and synthesis and processing using alternate resources. These workshops, which are hosted or sponsored by different stakeholder organizations, link directly to the industry's Vision 2020 strategy.

Information on Vision 2020 roadmaps may be found at <http://www.ccrhq.org/vision>.

Another important part of the developing research network is the National Green Chemistry and Engineering Conference presented by the American Chemical Society with support from EPA, NSF and co-sponsorship by 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 these areas. The next scheduled conference will be held on June 26-28, 2001, at the National Academy of Sciences in Washington, D.C.

The federal research support programs in this area are complementary. For example, the research supported in this solicitation is on the more fundamental end of the research continuum, though oriented toward long-term improvement of environmental sustainability of the chemical and other industries. Collaboration with industry researchers is encouraged. Funding from other agencies such as the Departments of Energy and Commerce tends to support more applied stages of research and requires collaboration and co-funding by industry.

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 (unless otherwise specified in the eligibility requirements for a particular program).

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 program announcement/solicitation for further information.

The National Science Foundation has Telephonic Device for the Deaf (TDD) and Federal Information Relay Service (FIRS) capabilities that enable individuals with hearing impairments to communicate with the Foundation about NSF programs, employment or general information. TDD may be accessed at (703) 292-5090, FIRS at 1-800-877-8339.

The National Science Foundation is committed to making all of the information we publish easy to understand. If you have a suggestion about how to improve the clarity of this document or other NSF-published materials, please contact us at plainlanguage@nsf.gov.

PRIVACY ACT AND PUBLIC BURDEN STATEMENTS

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.

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