

March 27, 2000

EPA-SAB-EC-00-008

Honorable Carol M. Browner
Administrator
U.S. Environmental Protection Agency
1200 Pennsylvania Ave., NW
Washington, DC 20460

Subject: An SAB/BOSC Report: Review of the Science to Achieve Results
(STAR) Program of the Environmental Protection Agency

Dear Ms. Browner:

On January 12-13, 2000 a joint subcommittee of the Science Advisory Board (SAB) and the Board of Scientific Counselors (BOSC) of the Office of Research and Development (ORD) met to review the Agency's Science to Achieve Results (STAR) Program. The STAR Program, which was established in Fiscal Year 1995, has the mission to include this country's universities and non-profit centers in EPA's research program and to ensure the best possible quality of science in areas of highest risk and greatest importance to the Agency. The STAR Program is administered by ORD's National Center for Environmental Research (NCER). The joint STAR Review Subcommittee (the Subcommittee) was charged to evaluate whether or not the STAR Program is structured appropriately to achieve the stated purpose, to evaluate whether the program is integrated effectively with Agency strategic plans and programs, and to examine the adequacy of efforts to communicate with the external scientific and regulatory communities regarding STAR research opportunities and outputs. Although the Agency and the Subcommittee agreed that the STAR Program has not been in operation for long enough to allow evaluation of its impact on the Agency and the broader research community, the Subcommittee was asked to recommend measures and systems that should be used to monitor the STAR Program's impacts, costs, credibility, and effectiveness in later program reviews.

The SAB's Research Strategies Advisory Committee has provided advice to the Agency on the Science and Technology Budget, implementation of peer review, and other issues that are relevant to the STAR Program. The BOSC, which was established to advise the Assistant Administrator for Research and Development on the management and operation of ORD's research programs, has conducted reviews of the ORD centers, including the National Center for Environmental Research that administers the STAR Program. Thus, the leadership of SAB and BOSC agreed to form a joint SAB/BOSC subcommittee that would tap the knowledge and expertise of both advisory bodies for this

review.

The Subcommittee's overall assessment is that the STAR Program is structured and managed so as to generate high-quality science, conducted by well-qualified scientists, on topics that are relevant to the environmental problems identified in the EPA Strategic Plan. Research Coordination Teams are an excellent mechanism for planning solicitations, and there has been significant and beneficial coordination with other agencies. Outreach to potential STAR applicants is strong, and the peer review of proposals is rigorous. NCER has been exploring some new management procedures such as multi-year program planning, web site key word search capabilities, and state-of-the-science reports on selected topics. The Subcommittee encourages the use of these pilot processes to strengthen planning and communication. In sum, the Subcommittee believes that the STAR Program is well planned, well organized, and well managed.

It is in this spirit that we provide constructive suggestions for program management improvements. The report describe a series of recommendations from the Subcommittee that are designed to make improvements to the STAR Program in the areas raised in the charge questions. The Subcommittee also recommends measures and systems that should be used to monitor the STAR Program's impacts, costs, and effectiveness. Data of this sort should form the basis of a subsequent review of the Program's impacts, both within and outside of the Agency.

We emphasize two overarching and inter-related issues relative to staff resources and information transfer. Regarding information transfer, the Agency must develop a comprehensive approach for effective transfer of STAR results to Agency users. While it is too early to measure the impacts of the grants awarded to date, it is not too early to focus on better processes, mechanisms, and tools to transfer STAR results and information to Agency users. The Subcommittee applauds NCER's ongoing initiatives to improve communication of results, such as State of the Science Reports, workshops, program office liaisons and Internet tools. Even more emphasis is needed, however, on developing additional tools, management processes, and procedures for the information transfer aspects of the program in order to achieve the intended results. The Subcommittee recommends that the Agency select several STAR research grants as case examples and evaluate the effectiveness of the coordination with the relevant client offices and the degree to which the awards are supporting the Agency's strategic goals. In addition, NCER should be looking for ways to shorten the time frames for getting peer reviewed information to users and making the information easily accessible by potential users.

The second over-arching issue relates to staff resources. The workload of the project officers has increased significantly since 1995, as the STAR Program has grown. The high workload threatens to hinder the ability of the STAR Program to promote communication among researchers and EPA offices regarding the nature of the funded research and likely applications of the results. In addition to information transfer activities, project officers' responsibilities include planning, preparation of solicitations, review of proposals, and monitoring and oversight of awarded grants. As noted above, a

more thorough and systematic approach to the information transfer task is critical to the STAR Program's success. This clearly will be a challenge for NCER given the limitations on staff resources but will likely make a difference in the overall success of the program.

We appreciate the opportunity to review and provide advice on the Agency's Science to Achieve Results Program. The STAR Review Subcommittee would be pleased to expand on any of the findings in the attached report, and we look forward to your response.

Sincerely,

/signed/
Dr. Costel D. Denson, Chair
Board of Scientific Counselors

/signed/
Dr. Morton Lippmann, Interim Chair
Science Advisory Board

/signed/
Dr. Marilyn A. Brown, Co-Chair
STAR Review Subcommittee

/signed/
Dr. William Randall Seeker, Co-Chair
STAR Review Subcommittee

March 27, 2000

Norine E. Noonan
Assistant Administrator for
Research and Development
U.S. Environmental Protection Agency
1200 Pennsylvania Ave., NW
Washington, DC 20460

Subject: An SAB/BOSC Report: Review of the Science to Achieve Results
(STAR) Program of the Environmental Protection Agency

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Dr. Costel D. Denson, Chair
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Dr. Marilyn A. Brown, Co-Chair
STAR Review Subcommittee

Dr. William Randall Seeker, Co-Chair
STAR Review Subcommittee

NOTICE

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**U.S. Environmental Protection Agency
Science Advisory Board and
Board of Scientific Counselors
Joint STAR Review Subcommittee**

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1. EXECUTIVE SUMMARY

This report presents the results of a review of the U.S. Environmental Protection Agency's Science to Achieve Results (STAR) Program. The review was conducted by the STAR Review Subcommittee, a joint subcommittee of the Science Advisory Board (SAB) and the Board of Scientific Counselors (BOSC) of the Office of Research and Development (ORD).

Background and Purpose

The STAR Program was established in Fiscal Year 1995 for the purpose of including this country's universities and non-profit centers in EPA's research program and to ensure the best possible quality of science in areas of highest risk and greatest importance to the Agency. It is managed by EPA's National Center for Environmental Research (NCER). Because the Program has operated for only 5 years, the STAR Review Subcommittee concluded that it was too soon to evaluate the quality and impact of the STAR Program's research results. Instead, the Subcommittee focused on the Program's structure, managerial approaches, and the processes used to request, select, and communicate research projects.

Specifically, EPA's Charge to the STAR Review Subcommittee was to evaluate whether or not the STAR Program is structured appropriately to achieve its goals, to evaluate whether the Program is integrated effectively with other Agency programs, and to examine the adequacy of efforts to communicate with the external scientific and regulatory communities regarding STAR research opportunities. The Subcommittee was also asked to recommend measures and systems that should be used to monitor the Program's impacts, costs, credibility, and effectiveness in later program reviews.

The Subcommittee's evaluation is based on several sources of information. These include:

- a) the NCER responses to a set of questions posed by the Subcommittee (EPA, 1999);
- b) a 1998 evaluation of the National Center for Environmental Research and Quality Assurance (the predecessor of NCER) by the BOSC (BOSC, 1998);
- c) information on the NCER web site (www.epa.gov/ncerqa); and
- d) briefings and information provided by Agency staff at a Subcommittee meeting on January 12-13, 2000.

In addition, the Subcommittee evaluated a sample of STAR grant folders containing grant proposals, peer reviewer comments, and decision documentation.

Conclusions

The Subcommittee concludes that the STAR Program is of vital importance to the Agency's mission and to the national objective of improving the knowledge base for environmental assessment and management. The Subcommittee's overall assessment is that the STAR Program is structured and managed so as to generate high-quality science, conducted by well-qualified scientists, on topics that are relevant to the environmental problems identified in the EPA Strategic Plan (EPA, 1997). Research Coordination Teams are an excellent mechanism for planning solicitations, and there has been significant and beneficial coordination with other agencies. Outreach to potential STAR applicants is strong, and the peer review of proposals is rigorous. NCER has been exploring some new management procedures such as multi-year program planning, web site key word search capabilities, and state-of-the-science reports on selected topics. The Subcommittee encourages the use of these pilot processes to strengthen planning and communication for the STAR Program. In sum, the Subcommittee believes that the Program is well planned, well organized, and well managed.

It is in this spirit that we provide constructive suggestions for program management improvements. The following sections describe a series of recommendations from the Subcommittee that are designed to strengthen the program in the areas raised in the charge questions. Two overarching observations worthy of more significant consideration are summarized first. They pertain to staff resources and information transfer.

Staff Resources. Greater NCER staff resources are required to maximize the public's return on investment in the STAR Program. Since its founding in 1995, the budget for the STAR Program has grown from approximately \$50 million in 1995 to over \$100 million in FY99. The staff available to manage the program, however, has remained at approximately 36 FTEs, including 18 Project Officers. Thus, the staff's workload has grown significantly. The potential for significant increases in management efficiencies within NCER appears to be small. The resulting staff resource deficiency threatens to hinder the ability of the STAR Program to promote communications among researchers and EPA offices in need of the research results. This staffing need was identified previously in the BOSC's 1998 review of NCERQA (BOSC, 1998). It appears that the problem has continued unabated since that report was published.

Information Transfer. Greater emphasis and attention needs to be placed on developing and implementing the tools, management processes and procedures for ensuring that the information and results of the STAR Program are being rapidly and effectively transferred to Agency users. The Subcommittee found the procedures for this to be uneven and insufficient. NCER has already been exploring some procedures to strengthen information transfer, such as multi-year program planning for Particulate Matter and other programs, web site key word searches, and state-of-the-science reports. The Subcommittee endorses these pilot processes and suggests additional mechanisms, such as the establishment of STAR points-of-contact throughout the Agency. The Subcommittee strongly encourages NCER to place even more emphasis on such tools and procedures. This will likely make a

difference to the overall success of the program.

Recommendations

Keeping in mind the Subcommittee's overall favorable assessment of the STAR Program's structure and management, a selection of additional recommendations for program management improvements are presented below. Several of these recommendations refer to the need for stronger information transfer.

- a) The Agency should provide additional information in RFAs on research goals and objectives and on budget and relevancy criteria that will be used to evaluate proposals in order to raise the low proposal acceptance rate, increase the success rate of the best quality applications, and enhance the relevance of the research.
- b) The Agency should take steps to accelerate the peer review process for STAR results so that the results are available to support Agency decisions in a timely manner.
- c) The Agency should select several STAR research grants as case examples and evaluate the effectiveness of the coordination with the relevant client offices and the degree to which the awards are supporting the Agency's strategic goals. This could be part of a broader evaluation of the effectiveness of current STAR Program communication, technology transfer, and outreach efforts.
- d) The Agency should consider means of strengthening communications between Agency program staff and STAR grant recipients, such as: (1) meetings between principal investigators and Agency program staff to discuss integration opportunities, and (2) establishment of STAR points-of-contact at ORD laboratories and centers, as well as in Agency program and regional offices.
- e) The Agency should assess how well the needs and issues of the regional offices are factored into the STAR planning process and consider additional mechanisms for ensuring adequate regional involvement in STAR Program activities.
- f) The Agency should request feedback on the success of the program review workshops and should expand the workshop proceedings to include a record of discussions regarding the relevancy of STAR results to the Agency's research and regulatory agenda and to environmental decision-making.
- g) Given the recent growth of STAR Program grants to academic researchers and the evolving set of environmental issues facing the Agency, the Agency should develop and implement a process for periodically assessing the Agency's portfolio in terms of its use

of different funding instruments (contracts, grants, inter-agency agreements, and cooperative agreements) and the reliance on different R&D performers (universities, for-profit contractors, others).

- h) The Agency should continue and expand its partnerships with other agencies and funding organizations, including possible joint funding of STAR research with private foundations and with international agencies and research organizations.
- i) The Agency should seek assistance from program evaluation and decision-analysis experts to help ORD develop a monitoring and evaluation system for the STAR Program. The evaluation system should include measures of the STAR Program's contributions to Sound Science (i.e., measures of science quality and quantity) and to Mission Advancement.
- j) The Agency should budget sufficient resources to secure the services of a qualified, highly respected, and independent organization to conduct and publish an evaluation of the STAR Program's results, effectiveness, and impact. This evaluation could begin in approximately two years, at which point sufficient time should have passed (approximately seven years) for the results from the initial cohorts of STAR grants to have been published and used.

2. INTRODUCTION

In Fiscal Year 1995, the Office of Research and Development (ORD) launched a competitive grants program called Science to Achieve Results (STAR). The STAR Program's mission is to include this country's universities and non-profit centers in EPA's research program and to ensure the best possible quality of science in areas of highest risk and greatest importance to the Agency. The STAR Program, which is administered by ORD's National Center for Environmental Research, NCER (formerly called the National Center for Environmental Research and Quality Assurance, NCERQA), consists of four components:

- a) Focused Requests for Applications (RFAs) targeted to national environmental science needs as related to the mission of the Agency;
- b) The Exploratory Research Grants Program, which provides support for investigator-initiated grants in broad areas of environmental science;
- c) The Graduate Fellowship Program, which provides support for master's and doctoral students in environmental science, engineering and policy; and
- d) The Environmental Research Centers Program, which focuses on long-term, multi-disciplinary research issues.

Together, these components are designed to support the EPA's goals as they are described in the Agency's Strategic Plan (EPA, 1997). Specifically, the STAR Program seeks to support the Agency goal of "Sound Science" (Goal 8) through the improved understanding of environmental risk and greater innovation to address environmental problems. In addition, the Program seeks to support the Agency's various mission-oriented goals such as clean air, clean and safe water, and better waste management. As an extramural program, STAR was intended to expand the relevant research community outside the Agency to complement the intramural program and thereby to enhance the scientific rigor and credibility of the research available to assist and inform its regulatory mission.

A joint subcommittee comprised of members from the Research Strategies Advisory Committee (RSAC) of the Science Advisory Board and from the Board of Scientific Counselors (BOSC) of the Office of Research and Development (ORD) was established to conduct a review of the Agency's initial efforts to develop and implement the STAR Program. This joint subcommittee is called the STAR Review Subcommittee.

This initial review should be viewed as part of a broader, longer term effort to examine all aspects of the STAR Program. At this time there are an insufficient number of STAR grants completed to evaluate the quality and impact of the STAR research results. The time lag between release of

RFAs, selection and funding of research projects, completion of research, and availability of published research results in some cases can be 7-10 years. At this point in the STAR Program, the Subcommittee can only assess expected programmatic impacts of management decisions based on existing structure and managerial approaches. The first review, therefore, focused on the processes used in the STAR Program to request, select, and communicate research projects. Later reviews should focus on the results, effectiveness, and impacts of the STAR Program. Nevertheless, the initial review also addressed the question of metrics for which data should be collected to support subsequent evaluations of the broader impact of the STAR Program.

Specifically, EPA's Charge to the STAR Review Subcommittee was:

- a) Is the STAR Program structured to support outstanding scientists and technically meritorious research? Is the outreach to potential applicants, the review of proposals, and the management of awards structured to foster high quality science?
- b) Is the STAR Program effectively integrated with ORD's in-house programs and with other EPA programs? Are the topics for STAR solicitations selected consistent with the priorities identified in the Agency's Strategic Plan? Are there other opportunities where the STAR Program could significantly contribute to the Agency's strategic goals?
- c) Is the STAR Program communicating well within the Agency, with the external scientific and regulatory communities, and with other stakeholders? Is there sufficient leveraging and coordination of research efforts?
- d) What systems should be in place to monitor the Program's impacts, costs, credibility, and effectiveness, and to what extent are these in place already? What metrics of success in determining the effectiveness of grants to have impacts on Agency decisions should be developed? What information should be collected today on metrics of success for the STAR grants? How should program offices and other agency customers for the grant products be involved in the establishment of criteria for measuring the impacts of the program?

Prior to the meeting, the Subcommittee developed a list of self-study questions for the Agency. The NCER responses to these questions (EPA, 1999), along with a previous evaluation of the NCERQA by the BOSC (BOSC, 1998), information on the NCER web site (www.epa.gov/ncerqa), and briefings and information provided by Agency staff at the meeting, formed the basis for deliberations during the Subcommittee meeting on January 12-13, 2000. At the public meeting the discussions included clarifying questions relative to the self-study responses and additional discussion on issues arising from the discussions. In addition, the Subcommittee evaluated a sample of STAR grant folders (containing grant proposals, peer reviewer comments, and decision documentation) in order to assess the nature of the documentation, including that relating to relevancy review. At the meeting, the

Subcommittee was also briefed on the Government Accounting Office's (GAO) on-going evaluation of the STAR Program, which is expected to produce a report in July 2000.

3. OVERVIEW OBSERVATIONS AND COMMENTS

The Subcommittee concludes that the STAR Program is a program of vital importance to the Agency's mission, as well as to the national objective of improving the knowledge base for environmental assessment and management. The program is structured and managed so as to play a key role in generating high quality science, conducted by highly qualified scientists, on topics that are relevant to the environmental problems identified in the EPA Strategic Plan (EPA, 1997). In materials provided to the Subcommittee, the STAR Program's mission is defined as "to include this country's university and non-profit centers in EPA's research program and to ensure the best possible quality of science in areas of highest risk and greatest importance to the Agency" (EPA, 2000).

The Agency has created the infrastructure and management systems to accomplish this mission in a rapid manner and has implemented an extensive extramural program without appreciable increases in internal staffing. Primarily because of this mismatch in growth rates within NCER of grant dollars relative to staffing levels, it is not surprising that some potential areas of concern have arisen in the implementation of the Program. The Subcommittee's overall assessment is that the planning and execution of the STAR program is well developed and appropriate. It is in this spirit that we provide constructive suggestions for program management improvements. The following sections describe a series of recommendations from the Subcommittee that are designed to make improvements in the program in the areas raised in the charge questions. Two overarching observations worthy of more significant consideration are noted below relative to staff resources and information transfer.

a) **Staff Resources**

Since its founding in 1995, the budget for EPA's Science to Achieve Results (STAR) program has grown from approximately \$50 million in FY95 to over \$100 million in FY99. During each of the last three years, the program processed 3,000 to 3,500 grant applications, awarded approximately \$95 million in grants to about 300 grantees, and managed approximately 1,000 active research grants and fellowships. Three NCER divisions administer the STAR Program: the Environmental Science Research Division, the Environmental Engineering Research Division, and the Peer Review Division. There is a total of approximately 36 staff in these three divisions, including 18 Project Officers. These 36 staff members manage the STAR Program as well as the EPA Small Business Innovation Research (SBIR) Program and several university-based research centers that are not part of the STAR Program.

According to the NCER Director, the ratio of STAR Program applicants per Project Officer and the ratio of active grants per Project Officer are comparable to ratios associated with the NSF grants program. However, unlike NSF, the STAR Program is embedded within a mission-oriented agency. As a result, the NCER Project Officers have a critical information transfer responsibility to maximize the value of the STAR grants to the Agency. NSF grant officers do not have this additional responsibility.

It is the Subcommittee's understanding that STAR Program Project Officers' responsibilities include:

- (1) planning, through participation on Research Coordination Teams (RCTs) and interagency committees;
- (2) preparation of solicitations, outreach to potential applicants, and proposal review;
- (3) monitoring and quality assurance during the life of the projects; and
- (4) summarizing, communicating and marketing project results to promote their use by the Agency (i.e., information transfer).

The workload of the project officers has increased significantly since 1995, as the STAR Program has grown. The high workload threatens to hinder the ability of the STAR Program to promote communication among researchers and EPA offices in need of the research results. A more thorough and systematic approach to the information transfer task is critical to the STAR Program's success, and EPA staff increases likely will be required to follow through with the information transfer process.

The potential for significant increases in management efficiencies among NCER staff appears to be small. The only task that the Subcommittee thought possibly could be scaled back is the visits of Project Officers to STAR grantees. Perhaps a sorting process could be developed to identify and eliminate the site visits that would offer the lowest return-on-investment. With the exception of this one possible budget-tightening opportunity, it appears that greater EPA staff resources are required to maximize the public's return on investment in the STAR Program. This staffing need was previously identified in the BOSC's 1998 review of NCERQA (BOSC, 1998). It appears that the problem has continued unabated since that report was published. Future in-depth evaluations of the STAR Program should assess the workload and responsibilities of the project officers.

b) Information Transfer

Greater emphasis and attention needs to be placed on developing and implementing the tools, management processes and procedures for ensuring that the information and results of the STAR program are being rapidly and effectively transferred to the Agency and other potential users. As the acronym STAR implies, the focus is on the achievement of results through the science supported by the program. Thus, it is critical to the Agency users and customers that the peer reviewed information and results be transferred in a rapid and effective manner. The Subcommittee provides suggestions on potential metrics and procedures for measuring the effectiveness of the program in Section 4.4. An evaluation of the STAR Program's impact could begin in approximately two years, at which point sufficient time should have passed (approximately seven years) for the results from the initial cohorts of STAR grants to have been published and used.

While it is too early to measure the impacts of the grants awarded to date, it is not too early to focus on better processes, mechanisms, and tools to transfer the information and knowledge to Agency users. NCER should be looking for ways to shorten the time frames for getting peer reviewed information to users and making the information easily accessible by potential users. The Subcommittee found the procedures to transfer STAR-generated information to Agency users to be uneven, with some users having procedures such as liaisons and teams ready to accept the information and others with no formal mechanisms. NCER has already been exploring some procedures such as multi-year program planning for Particulate Matter and other program areas, web site key word searches, and state-of-the-science reports and the Subcommittee endorses these pilot processes. The Subcommittee strongly encourages NCER to place even more emphasis on developing additional tools, management processes and procedures for the information transfer aspects of the program in order to achieve the intended results. This clearly will be a challenge for NCER given the limitations on staff resources presented above but will likely make a difference in the overall success of the program.

4. RESPONSE TO THE CHARGE

4.1 Supporting High Quality Science

Charge Question 1: Is the STAR Program structured to support outstanding scientists and technically meritorious research? Is the outreach to potential applicants, the review of proposals, and the management of awards structured to foster high quality science?

The answer to this charge question is provided in three parts, corresponding to the STAR Program's outreach to potential applicants, review of proposals, and management of awards.

Outreach to Potential Applicants. ORD uses the NCER web site and the maintenance of an electronic announcement server for disseminating information about research opportunities. NCER also publishes notices of research opportunities in scientific journals and in the Federal Register. The Subcommittee did not have sufficient information or resources to assess the effectiveness of these communication mechanisms for the majority of potential applicants. The Subcommittee noticed, however, that a number of the NCER web pages had not been updated recently, even though newer information should be available (for more discussion of the web site see 4.3). Subcommittee members noted that some of the STAR information was updated on the web site following the January Subcommittee review meeting.

The sheer number of applicants responding to STAR Program RFAs and the widespread distribution of universities receiving STAR grants and fellowships is an indication that the Agency is doing a good job of outreach, notification, and cultivation of interest in the STAR Program. In order to determine whether additional outreach is needed to attract the best scientists and research, the Agency should conduct a more thorough analysis of the sources of proposals and the success rate of those sources.

Review of Proposals. While the Subcommittee did not conduct an independent review of the scientific merits of rejected versus funded proposals, the STAR proposal review process does appear to be well structured. The review process is structured similarly to high quality programs at the National Science Foundation and the National Institutes of Health, and so in principle should be able to achieve comparably meritorious results. Further, the criteria used in the grant review process seem both appropriate and clearly stated. Whether or not the review process in fact has resulted in the selection of the best scientific proposals is more difficult to ascertain. (Various measures of quality, merit, and impact are discussed in Section 4.4.)

The responses to specific topical RFAs are evaluated using a two-tiered approach. First, proposals are peer reviewed by independent panels to determine their scientific and technical merit. Rating Categories consist of Excellent, Very Good, Good, Fair, and Poor. Following the technical

review, proposals undergo relevancy review to ensure that the proposed research will address Agency priorities and will complement in-house research efforts. Because of the significant number of proposals received, only the proposals receiving Excellent or Very Good ratings by the peer review panel undergo a relevancy review by the Agency before final funding decisions are made. The use of such a cut-off for subsequent relevancy review seems appropriate. The Subcommittee's comments on the relevancy review process are contained in Section 4.2.

The Subcommittee analyzed the success rates of STAR Program grant proposals for solicitations closing in FY1998, based on summary information provided by the Agency at the Subcommittee meeting (EPA, 2000). Of approximately 1,721 proposals received, approximately 181 (10.5%) were funded. This success rate is lower than those experienced by the National Science Foundation (NSF), which is one of the largest funders of environmental research. NSF success rates have averaged approximately 30 percent (<http://www.nsf.gov/bfa/bud/fy1998/resprj02.htm>). The difference is due, in part, to the inclusion of an EPA relevancy review in the STAR Program. The STAR Program data for FY 1998 indicate that scientific merit peer review approved approximately 23% of the proposals (average ratings of Excellent or Very Good are required for approval). The subsequent relevancy review, in combination with budgetary limitations, resulted in approximately 45% of these highly rated proposals being funded.

Success rates varied from topic to topic (see Table 1). In general, proposals to the STAR Exploratory Research Grant Program had lower than average success rates. This is not surprising. One would expect a larger number of the exploratory grant proposals to score lower during the relevancy review if the same criteria are applied as are used to evaluate proposals under the Focused Requests for Applications.

The low overall success rate means that a considerable amount of time is being invested in the preparation of unsuccessful proposals, which constitutes a significant drain on the nation's environmental scientists. It also constitutes an extra burden on NCER staff. The Subcommittee suggests that the Agency provide additional information in RFAs on research goals and objectives and on budget and relevancy criteria that will be used to evaluate proposals so that the success rate of the best quality applications increases while ensuring the relevance of the research to the Agency. This should be done in a manner that preserves the principal investigators' freedom to frame the research problem in novel ways and to invent new strategies for implementing the research.

The Subcommittee also encourages the Agency to prepare more detailed documentation of the relevancy review so that the applicants will be better informed about what is being sought. This could include defining relevancy criteria used and providing links to strategic plans and funding limitations in order to open the relevancy decision process. In addition, it is recommended that applicants whose proposals are not funded receive specific information about the reasons (including budgetary and relevancy considerations) for their rejection. This was not done by NCER staff in the letters going to applicants whose Center proposals were reviewed by the Subcommittee. Since their proposals were

judged to be technically meritorious, it is important that the decision-making for these proposals be explained clearly to their authors. The Subcommittee also encourages the Agency to provide individual reviewer comments to the applicants who are declined, rather than just a summary of these documents. Applicants would learn more if they receive the individual review comments from all principal reviewers (in an anonymous fashion).

Table 1. Success Rates in 1998 of Various STAR RFAs

RFA Topic	Proposals Received	Proposals Forwarded to Relevancy Review	Proposals Funded	Overall Success Rate
Topics with Lowest Success Rates				
Indicators of Global Climate Change	~27	3	0	0%
Exploratory Environmental Engineering	~199	30	10	5.0%
Chemical Mixtures Toxicology	~79	16	4	5.9%
Bioremediation	~49	7	3	6.1%
Exploratory Environmental Biology	~193	41	~12	6.2%
Topics with Highest Success Rates				
Hexavalent Chromium Risk Reduction	21	4	4	48%
Urban Air Toxics	~18	9	5	28%
Children's Environmental Health Centers	~64	8	8	26%
Drinking Water	~54	16	10	19%
Regional Scale Analysis and Assessment	~22	4	4	18%

Source: EPA, 2000.

Another recommendation for improvement pertains to the initial assignment of proposals to reviewers. For example, in some programs at NSF, panelists have been asked to designate which

proposals they might feel most comfortable reviewing based only on titles, as is done for the STAR review process. Sometimes this results in mismatches. For this reason, at least one NSF program sends reviewers the proposal abstract/summary at this first stage in order to enable the reviewers to judge more confidently the content of the proposal and the match with their capabilities. A similar process of sending abstracts to reviewers should be considered by EPA.

In addition, one program at NSF has found that, despite instructions, different panelists use the 5-point rating scale differently, and that normalizing the scores given by each panelist can produce different overall ratings for a proposal. The Agency should examine if the tendency of some reviewers to "grade on the curve" is impacting the overall rating levels. This could be done at the time of the Panel meeting and could be discussed during the Panel's overall deliberations.

The configuring of review panels with high quality expert reviewers is a difficult challenge given the number of reviewers needed. The ORD appears to be managing this well with a combination of its own data base, with nearly 10,000 potential reviewers and a key-word search capability, combined with a more recent reliance on the Community of Science (COS) data base. The review panel selection also could be expanded to include more international experts. This would allow the process to tap into the strong international expertise that exists in many environmental research areas¹. In addition, ORD should consider the use of ad hoc reviewers (i.e., reviewers who receive only one proposal to review and do not attend panel meetings) in addition to panel reviews. Ad hoc reviewers might be appropriate when proposals are highly diverse or in fields where recruitment of panelists is difficult.

Management of Awards. The Subcommittee encourages the Agency to adopt computerized management systems to the maximum extent possible to manage the already heavy workloads and the increasing demands made of the NCER staff. Electronic filing of grant applications and electronic distribution of proposals to reviewers, when available, will be helpful in this regard.

4.2 Supporting the Agency's Strategic Goals

Charge Question 2: Is the STAR Program effectively integrated with ORD's in-house programs and with other EPA programs? Are the topics for STAR solicitations selected consistent with the priorities identified in the Agency's Strategic Plan? Are there other opportunities where the STAR Program could significantly contribute to the Agency's strategic goals?

Integration with ORD's in-house and Other EPA Programs. The involvement of ORD, program offices and regional offices in the STAR Program occurs primarily during the planning process

¹Only researchers at academic or non-profit institutions located in the U.S., or with state or local governments in the U.S., are eligible to apply for STAR grants.

through the use of Research Coordination Teams (RCTs). The RCTs, which are organized largely along media lines, include representatives from ORD, program offices and regional offices. These teams develop the plan for research to be accomplished, consistent with Agency-wide and ORD strategic plans, whether via intramural or extramural (e.g., STAR) means. This group also conducts the final relevancy review of STAR applications that have received Very Good or Excellent ratings by independent peer reviewers.

NCER has initiated a number of innovative activities to improve the integration of STAR Program efforts and the communication of results to target audiences in the EPA and elsewhere. These include:

- a) joint solicitations with other federal agencies and organizations;
- b) program review workshops, where grantees present interim results to other STAR grantees working in related research areas, as well as to interested Agency staff;
- c) research-in-progress reports;
- d) state-of-the-science reports, which gather and integrate the research findings from several grantees on related topics; and
- e) a web site that posts STAR Program annual reports and summaries of final reports.

We applaud these efforts and recommend that NCER continue to expand cooperation and partnerships with other parts of ORD, with EPA program and regional offices, and other federal, private, and international research organizations as discussed in more detail below (4.3).

Planning. The process used to select RFA topics appears to be robust, appropriate, and well integrated with program office needs and ORD and Agency-wide strategic plans. The use of the RCT involving representatives from ORD, program offices, and regional offices appears to be a good, direct approach for involving the key players and stakeholders.

One issue that warrants further examination is the extent to which regional office needs and issues are factored into the planning process, given the wide diversity of EPA regions and the remote locations that make their involvement difficult. There is only limited regional representation on the RCTs and therefore involvement in RFA definition and relevancy reviews. The Agency should assess how well their needs and issues are factored into the process and consider other mechanisms for ensuring adequate regional involvement in STAR program planning and technology transfer activities.

NCER's self-study (EPA, 1999) also mentions an apparently new multi-year planning initiative designed to demonstrate more clearly how the outputs of the STAR Program and other ORD efforts support the strategic plan. This process would appear to be an effective mechanism for identifying potential future RFA topics for STAR and the needs for information transfer from results of STAR programs.

Although the activities described in the self-study suggest that the STAR Program is indeed effectively integrated with in-house research programs and with the strategic goals of the Agency, the Agency should select several STAR research grants as case examples and evaluate the effectiveness of the coordination with the relevant client offices and the degree to which the awards are supporting the Agency's strategic goals. Case examples selected at random might be augmented by some examples considered *a priori* to be exemplary. This self assessment could lead to ideas for further improvements in integration.

Relevancy Review. The involvement of representatives from ORD, program offices, and regional offices in conducting the relevancy evaluation of the highest scientifically rated proposals is another important means of keeping the EPA stakeholders involved in the STAR Program.

To strengthen the relevancy review and foster integration within ORD and across the Agency, EPA might consider strengthening the involvement of ORD staff in the relevancy review. This could be achieved by having EPA staff review the full proposals and peer reviews for all scientifically meritorious STAR applications, instead of simply having the relevancy review conducted on the basis of the abstracts and the peer review panel's summary comments. This would increase ORD staff awareness of the contents of highly rated STAR proposals.

Interactions During the Course of the STAR Grant. Once the grants are awarded, there are limited interactions between the grantee and the Agency. The interactions are generally reporting-out type functions such as annual meetings, annual reports, project officer meetings with grantees (held once during the grant cycle), and participation in a program review workshop. While there is encouragement of the Agency scientists to work with the grantee and tools are made available (such as web-based reporting and searches) for Agency personnel to follow the work, there are no specific mechanisms to ensure closer working relationships and an ongoing awareness of EPA's evolving needs.

Two possible new activities should be considered for strengthening communication between Agency personnel and grant recipients: (1) meetings between STAR Program principal investigators and Agency staff to discuss integration opportunities, and (2) establishment of STAR points-of-contact at ORD's Labs and Centers, as well as in Agency program offices.

Program Review Workshops. Workshops are held approximately annually for each major RFA area so that grantees can share information among themselves and with Agency staff on the progress of STAR-funded research. Feedback on the success of the workshops relative to increasing interactions between STAR researchers and relevant EPA personnel would be useful. Expansion of the proceedings should include a record of discussions, exchange of ideas, integration across research projects, and their relevancy for environmental decision-making.

These workshops also are used by NCER as an opportunity for the grantee to be briefed on EPA's evolving needs, as a means of encouraging grantees to keep in mind the regulatory context of their research. The Subcommittee notes that this process is critically important to the success of the STAR Program. Such mechanisms to facilitate the ongoing consideration of Agency goals are appropriate for a mission-oriented agency. The workshops help to address a potential weakness—the distancing of research from Agency goals, which can occur if the grantees do not completely understand or are not following EPA evolving needs. It also avoids the micro-management and project re-direction that could result from more heavy-handed oversight.

Balancing the Research Portfolio. The allocation of available research dollars between intramural research, contract activities, and STAR grants is important and has been shifting, partly as a result of the STAR Program's growing budget. As noted in EPA's 1996 Report to Congress on the STAR Program (EPA, 1996, p. 8), "the growth of the STAR program has been accomplished largely through the re-direction of cooperative agreements and inter-agency agreements." This has resulted in a significant shift in the nature of the Agency's extramural R&D performers (toward university and non-profit centers and away from for-profit contractors and interagency agreements) and in the financial mechanisms used to secure these R&D resources. There is no fundamental reason why the STAR Program should limit eligibility of applicants to academic and non-profit research organizations. The Subcommittee recommends that the Agency assess and evaluate, on an on-going basis, the allocation of resources across types of research organizations and funding mechanisms.

The Subcommittee commends EPA's new initiative to develop multi-year plans (e.g., for Particulate Matter and other programs) that will relate STAR and intramural research products to the Agency's strategic goals for different program areas. These plans will help provide a framework for the Agency to consider, and to explain, the balance of R&D performers in individual research areas. The Subcommittee is aware that there are specific rules governing the use of grants, contracts, and cooperative agreements. However, in selecting among available funding vehicles, the Agency also should consider:

- a) the extent to which the Agency researchers have unique expertise and/or laboratory facilities;
- b) the need for the Agency to establish and maintain a world class research credibility and leadership role in areas within its mandate;
- c) the extent to which the research is basic or more applied or product-oriented; and
- d) the extent to which the enhanced credibility associated with independent research institutions is needed.

The definition of RFA topics, and their budget levels, should be a reflection of the Agency's judgment as to the appropriate balance between intramural and extramural research, and among different types of extramural R&D performers and funding vehicles. To this end, the multi-year program planning (or "research roadmapping") process being piloted by ORD should be expedited and completed as quickly as possible.

Transfer of STAR Results. One of the most important components of the integration of the STAR Program is the transfer of the results of the individual grants to potential users within and outside the Agency. This information transfer will be critical to the success of the STAR Program in the future as more grants are completed. In some program offices and for some research areas (e.g., particulate

matter research in support of the Office of Air and Radiation), the STAR Program activities are closely tied to ongoing program activities and mechanisms are in place to readily transfer information to meet the needs of the office. Other program offices (e.g., the Office of Wetlands, Oceans, and Watersheds) have defined a liaison to work with the STAR Program and prepare for the receipt of the results. However, other program offices are less active. The Agency must fully develop the strategy and mechanisms for effective transfer of STAR results from every RFA and grant to the Agency users (Program Offices, Regions and Researchers).

NCER has taken a number of initiatives to enhance the transfer of STAR results. For example, the NCER web site includes annual reports and summaries of final reports and program offices are invited to annual workshops. In addition, NCER conducts targeted web searches for Agency personnel to allow them to readily identify relevant STAR grants. Nonetheless, more needs to be done to effectively integrate results.

The Agency's Peer Review Policy (June 1994 policy, contained in EPA, 1998) states that major scientific and technically based products generated by the Agency that will be used to support Agency decisions should be peer reviewed. Thus, it is "critical to quality" that the STAR Program lead to peer reviewed information in a timely manner. Currently the Agency is relying on grant recipients to publish their results in peer reviewed journals, a process which may take several years from the time that research results are reported to the Agency under the terms of the grant. The Agency should take steps to expedite the peer review process for STAR results. NCER is exploring the use of "State of the Science" reports which independently gather and integrate the research findings from several grants on related topics; these synthesis reports could be peer reviewed prior to release. The Subcommittee identified several other techniques that might result in more rapid peer review of STAR research results, including arranging for special issues of journals to accelerate review and publication of results, and conducting peer review panels of STAR research results in the same manner as the initial review of the STAR applications.

4.3 Communication and Coordination

Charge Question 3: Is the STAR Program communicating well within the Agency, with the external scientific and regulatory communities, and with other stakeholders? Is there sufficient leveraging and coordination of research efforts?

Communication. ORD fosters communication about the STAR program within and outside the Agency through the Internet, publications, and workshops, as well as site visits, informal communications, and other means. It highlights the NCER web site as perhaps its flagship communication device. The proposed "state-of-science reports," and STAR program review workshops, to which investigators and selected persons outside the STAR community are invited, are ways in which the program communicates with both internal and external scientists. These mechanisms are appropriate communication techniques; all but the workshops, however, are relatively passive and

rely on an interested audience that will actively search for new information. Other, more pro-active mechanisms should be identified and tested to further enhance this critical component of the program.

The NCER web site could benefit from updating and possibly from further promotion. It is not clear how widespread the use of this web site is outside ORD, including among grant recipients, although the site receives thousands of "hits" a month (see Appendix A). The Agency might benefit from surveying a representative group of potential users of STAR results to measure awareness of the program and evaluate the effectiveness of its communication strategies. Informal surveying by members of the STAR Review Subcommittee suggests that potential users and investigators are aware of the STAR program, but formal investigations of the effectiveness of STAR communication efforts are warranted. Follow-up also is needed on the discussion of the NCERQA communications plan contained in the BOSC review of NCERQA (BOSC, 1998). At a minimum, evaluation of the program review workshops might be done using a simple questionnaire of the sort used at many conferences. Internal evaluation of the program's outreach effectiveness could provide insight into how to improve current efforts, raise program offices' awareness of the STAR Program's potential usefulness to them, and even suggest new ways of ensuring that STAR results reach the appropriate EPA users.

Partnerships with other Agencies. The partnerships established with other federal agencies for joint research solicitations during the past five years, and more recently with private-sector organizations, have the potential for multiple benefits. These partnerships foster coordination of national efforts for research on environmental issues and have allowed NCER to leverage its resources for extramural support by more than 20 percent. They also help to establish credibility (due to the additional agency affiliation), increase STAR Program visibility, share the EPA workload of program management, and attract an additional cadre of researchers who have worked with the partnering agency. These partnerships appear to be appropriate and should be continued to the maximum extent possible. As the STAR Program becomes more amenable to quantitative assessments of costs and benefits, the relative payback to these partnerships should be appraised.

Leveraging was seen by the Agency as especially important at the beginning when the STAR Program was first created, to establish credibility. The Decision Making and Valuation for Environmental Policy program with the National Science Foundation (NSF) has attracted a large number of applications from top researchers; the program is currently being evaluated by NSF and EPA. Lessons learned from the evaluation may help EPA improve this and future joint efforts. The arsenic program announcement with the American Water Works Association Research Foundation (AWWARF) is also considered a success by EPA staff, but EPA currently has no joint activities with AWWARF. One of the reasons for the demise of such partnerships is that cooperation with other agencies and organizations has a large transaction cost. The more conflicts there are between the goals of EPA and those of the partnering organization, the more difficult the partnership is likely to be. When is it worthwhile and when not? This is an important question that EPA needs to answer before committing to conduct joint programs.

The success of joint endeavors is illustrated by recent outreach to EPA by other agencies interested in developing joint solicitations (e.g., the U.S. Department of Agriculture and the National Institute for Occupational Safety and Health). We encourage ORD to expand its joint endeavors, including possible joint funding of STAR research with private foundations and with international agencies and research organizations. The new EPA-National Institute of Justice joint solicitation looks promising, as does the joint program with USDA, DOD, NSF, and the Office of Naval Research on phytoremediation.

4.4 Metrics of Success

Charge Question 4: What systems should be in place to monitor the Program's impacts, costs, credibility, and effectiveness, and to what extent are these in place already? What metrics of success in determining the effectiveness of grants to have impacts on Agency decisions should be developed? What information should be collected today on metrics of success for the STAR grants? How should program offices and other agency customers for the grant products be involved in the establishment of criteria for measuring the impacts of the program?

The Subcommittee suggests that ORD consider multiple approaches to evaluate the STAR Program's impacts, costs, credibility, and effectiveness. The National Academy of Sciences (NAS) notes in *Evaluating Federal Research Programs* (1999) that there are four important ways that the nation benefits from its investment in federal research: knowledge advancement, knowledge application, human capital development, and mission advancement. The Subcommittee identified several potential metrics of success as they relate to the following groupings used in the NAS report:

- a) the STAR Program's contribution to EPA's Sound Science goal, which includes knowledge advancement, knowledge application, and human capital development; and
- b) the STAR Program's role in supporting EPA's environmental risk assessment and risk management goals, which is the mission advancement benefit noted by the NAS and the impacts of decision making in the EPA Strategic Plan.

Sound Science. Indices that emphasize quantity (number of publications per grant, number of publications per grant dollar, etc.) are commonly utilized to evaluate research programs because the data are easy to obtain. Measures that indicate quality, including the influence of STAR research grants on other researchers or funding organizations, while more difficult to devise and measure, would be powerful indicators. A better measure of scientific excellence is the rate of citations of peer reviewed publications by other scientists. These citations may appear in other grant proposals, peer reviewed papers in professional journals, and as references supporting regulations and legislation. Various citation indices are available that could be used as a good measure of the frequency with which STAR grant studies are referenced by others. However, 4 to 6 years must pass between the completion of the

STAR-funded research and the use of citations to judge success. It takes time for the original research to be published in peer reviewed journals, then it takes another 2 to 3 years for the work to be cited by others in subsequent publications. Another measure of scientific excellence is the frequency of national awards given out by professional research organizations for research conducted by STAR Program awardees.

Possible measures of “influence diffusion” from the STAR Program might include the extent of follow-up funding by other agencies (such as NSF, NIH, or DOE), and the movement of STAR-funded researchers (e.g., doctoral students and post-doctoral fellows) to other research institutions. A potential benefit of the STAR program is the creation of a pool of future environmental professionals who can disseminate the knowledge gained in the grants and apply it to other relevant environmental research. Both students conducting research under STAR grants and the STAR fellows can become part of this pool to transfer the research findings outside the originating institution. ORD could ask grantees and fellows to keep EPA apprised of the employment whereabouts of such students, at least through the first post-university job. The evaluation of the program's success then could include the fraction of the STAR beneficiaries who move on to environment-relevant jobs in academia, government, and the private sector.

Mission Advancement. Relative to the impact of EPA’s research on decision making, The EPA Strategic Plan states the following: "The performance goal is for EPA's research organization to transfer information, findings, and results effectively to users, partners, and the public. Performance measures include:

1. Technical results are disseminated in a timely way to users; and
2. Research is communicated appropriately in formats accessible to a variety of audiences and users in their decision making" (EPA, 1997).

Thus, using the EPA Strategic Plan as guidance, the measures of success of the STAR Program relative to mission advancement should address the timeliness and dissemination of the information to the users, including the program offices, regional offices and EPA researchers. In addition, given the focus on audiences and users, it is critical that program offices and other Agency customers for the grant products be involved in the establishment of criteria for measuring the impacts of the program. The Subcommittee recommends that NCER directly engage these customers, perhaps through a newly constituted RCT, in defining the criteria for evaluating the STAR Program’s contribution to Agency mission advancement.

Ideally, ORD eventually would be able to show how information gained from the STAR Program has enabled the Agency or other regulators to implement better risk assessment and management decisions. Examples of mission advancement would include:

- a) managing hazards that had not been previously identified as conferring significant risks;

- b) implementing more cost-effective remedies for known hazards; or
- c) reducing the stringency of regulations for hazards that are found to be less risky than previously thought.

The Subcommittee recognizes that such a “value of information” (VOI) approach is difficult to apply to research that is often exploratory in nature or useful only over the long term. Nevertheless, the Agency should keep this concept in mind when designing an evaluation system.

In addition to the suggestions above, ORD should consider the following types of metrics and data collection activities:

- a) Conduct a peer review of the results and reports of a sample of STAR grantees in a manner similar to that for the proposals, to see how the research actually rates with respect to scientific quality (poor to excellent). Consider the NAS study as well as the EPA Strategic Plan criteria of relevance, quality, and leadership to evaluate each product.
- b) Evaluate the use of information generated by each grant relative to the EPA and ORD goals. Request that grantees include in their summary reports a self-assessment of how data should or could be used to address strategic goals. This information would allow ORD quickly to assess the relevance of the research product and would force researchers to think about possible applications of their results.
- c) Conduct a relevancy evaluation (perhaps by the RCT) of each grant after review of the products to see if they remain relevant and why or why not.
- d) Evaluate citations to STAR project publications in EPA regulatory documents as another measure of STAR's success with respect to the Agency's mission.
- e) Define lessons learned from these assessments to suggest different proposal review methods, RFA specifications, or interaction mechanisms that can improve the quality and relevance of future efforts.
- f) Determine the time frame required for information from the grant program to reach the program office, regional office, or researcher.
- g) Poll customers within and outside the Agency regarding the value of STAR products. Suggested questions to include in a such a questionnaire are shown in the box below. When a sufficient database of questionnaire responses have been accumulated, it should be analyzed to see how many STAR products have had a discernible impact on EPA or other programs and how these impacts are distributed with respect to degree of impact and size of program impacted.

Implementation Issues. NCER should seek assistance from program evaluation and decision-analysis experts to help ORD develop a monitoring and evaluation system for the STAR (and other Agency research) program. Development of this monitoring system should begin within a year. The monitoring and evaluation system should provide the necessary data for a future evaluation of the impacts of the STAR Program, both within and outside of the Agency. Such an evaluation could begin in approximately two years, at which point sufficient time should have passed (approximately seven

years) for the results from the initial cohorts of STAR grants to have been published and used. To accomplish this future in-depth review of the program, EPA should plan on securing the services of a qualified, highly respected, and independent organization to conduct and publish the evaluation of the STAR Program. Both of these actions have budgetary implications. In particular, sufficient funds should be budgeted to compile and analyze program data, prepare well-documented case studies and a final report, and define continuous improvement techniques.

Suggested STAR Program Evaluation Questions for Program Offices

Have STAR products influenced any of your risk management programs?

If so, which products have influenced which programs?

For each of the top three STAR products, which statement most closely matches its impact on your programs?

- a) Played an essential role in modifying the direction of the program;*
- b) Made an important contribution to directing the program;*
- c) Contributed to the direction of the program in a minor way.*

For the programs affected by the above three STAR products, quantify, to the extent possible, the size of the program in terms of health and/or ecological benefits and costs of implementation.

5. PRINCIPAL RECOMMENDATIONS

Keeping in mind the Subcommittee's overall favorable assessment of the STAR Program's structure and management, recommendations for program management improvements are presented below. Several of these recommendations refer to the need for stronger information transfer.

- a) The Agency should provide additional information in RFAs on research goals and objectives and on budget and relevancy criteria that will be used to evaluate proposals in order to raise the low proposal acceptance rate, increase the success rate of the best quality applications, and enhance the relevance of the research.
- b) The Agency should take steps to accelerate the peer review process for STAR results so that the results are available to support Agency decisions in a timely manner.
- c) The Agency should select several STAR research grants as case examples and evaluate the effectiveness of the coordination with the relevant client offices and the degree to which the awards are supporting the Agency's strategic goals. This could be part of a broader evaluation of the effectiveness of current STAR Program communication, technology transfer, and outreach efforts.
- d) The Agency should consider means of strengthening communications between Agency program staff and STAR grant recipients, such as: (1) meetings between principal investigators and Agency program staff to discuss integration opportunities, and (2) establishment of STAR points-of-contact at ORD laboratories and centers, as well as in Agency program and regional offices.
- e) The Agency should assess how well the needs and issues of the regional offices are factored into the STAR planning process and consider additional mechanisms for ensuring adequate regional involvement in STAR Program activities.
- f) The Agency should request feedback on the success of the program review workshops and should expand the workshop proceedings to include a record of discussions regarding the relevancy of STAR results to the Agency's research and regulatory agenda and to environmental decision-making.
- g) Given the recent growth of STAR Program grants to academic researchers and the evolving set of environmental issues facing the Agency, the Agency should develop and implement a process for periodically assessing the Agency's portfolio in terms of its use of different funding instruments (contracts, grants, inter-agency agreements, and cooperative agreements) and the reliance on different R&D performers (universities,

for-profit contractors, others).

- h) The Agency should continue and expand its partnerships with other agencies and funding organizations, including possible joint funding of STAR research with private foundations and with international agencies and research organizations.
- i) The Agency should seek assistance from program evaluation and decision-analysis experts to help ORD develop a monitoring and evaluation system for the STAR Program. The evaluation system should include measures of the STAR Program's contributions to Sound Science (i.e., measures of science quality and quantity) and to Mission Advancement.
- j) The Agency should budget sufficient resources to secure the services of a qualified, highly respected, and independent organization to conduct and publish an evaluation of the STAR Program's results, effectiveness, and impact. This evaluation could begin in approximately two years, at which point sufficient time should have passed (approximately seven years) for the results from the initial cohorts of STAR grants to have been published and used.

6. REFERENCES CITED

- Board of Scientific Counselors. 1998. Program Review of the National Center for Environmental Research and Quality Assurance. EPA Office of Research and Development, Board of Scientific Counselors, Final Report of the Ad Hoc Subcommittee on the Review of NCERQA. April 30, 1998.
- National Academy of Science. 1999. Evaluating Federal Research Programs. National Academy Press, Washington, DC.
- U.S. Environmental Protection Agency. 1996. Report to Congress: The Science to Achieve Results (STAR) Program. EPA/600/R-96/064.
- U.S. Environmental Protection Agency. 1997. EPA Strategic Plan. EPA/190-R-97-002.
- U.S. Environmental Protection Agency. 1998. Peer Review Handbook. EPA 100-B-98-001. Prepared by the Peer Review Advisory Group of the EPA Science Policy Council.
- U.S. Environmental Protection Agency. 1999. Responses to Self-Study Questions: Board of Scientific Counselors' Review of ORD's Science to Achieve Results (STAR) Program. Office of Research and Development's National Center for Environmental Research and Quality Assurance. December 1999.
- U.S. Environmental Protection Agency. 2000. EPA's Science to Achieve Results (STAR). Briefing Materials for the SAB/BOSC Joint STAR Review Subcommittee Meeting, held January 12-13, 2000. Prepared by EPA/ORD/National Center for Environmental Research. Washington, DC.

APPENDIX A: NCERQA Web Site Statistics for December 1999

Visitors to the NCERQA web site have access to monthly reports containing a wide variety of web site statistics, including visitor profiles and most requested pages. A sample of this information is presented below for December 1999 as an indication of the number and nature of visitors to the site. More in-depth analysis of the site's statistics would be helpful in evaluating the success of the web site as a communication device for the STAR Program and as a source of data for evaluating the impact of the program.

(Source: http://es.epa.gov/stats/ncerqa/ncerqa-Dec99_01_b.htm.)

Hits	Entire Site (Successful)	129,762
	Average Per Day	4,185
Hits by Organization Type	Company (.com)	39.48%
	Education (.edu)	29.36%
	Network (.net)	19.24%
	Government (.gov)	9.01%
Visitor Sessions	Visitor Sessions	30,330
	Visitor Sessions from U.S.	66.56%
	International Visitor Sessions	11.76%
	Sessions of Unknown Origin	21.52%

Most Active Countries

	Countries	Visitor Sessions
1	United States	20,251
2	Canada	544
3	UK	399
4	Japan	233
5	France	154
6	Germany	154
7	Italy	148
8	Spain	134

9	AU	127
10	Netherlands	106

Most Requested Pages

	Pages	Views	% of Total Views	Visitor Sessions	Avg. Time Viewed
1	Welcome to the National Center for Environmental Research and Quality Assurance http://es.epa.gov/ncerqa/	9,788	8.47%	6,788	00:00:48
2	2000 Environmental Research Grant Announcements http://es.epa.gov/ncerqa/rfa/	5,165	4.47%	4,650	00:01:40
3	NCERQA Grants and Cooperative Agreements http://es.epa.gov/ncerqa/grants/	2,669	2.31%	2,541	00:00:27
4	Tabular Query of NCERQA Program and Solicitation Information http://es.epa.gov/ncerqa/ru/	2,193	1.89%	2,038	00:02:03
...					
11	Science to Achieve Results (STAR) Graduate - Fellowships http://es.epa.gov/ncerqa/fellow/	1,048	0.9%	983	00:00:58
...					
15	FY 2000 Science to Achieve Results http://es.epa.gov/ncerqa/rfa/forms/download.html	632	0.54%	582	00:04:05



A JOINT SAB/BOSC REPORT: REVIEW OF THE SCIENCE TO ACHIEVE RESULTS (STAR) PROGRAM

**PREPARED BY THE STAR
REVIEW SUBCOMMITTEE, A
JOINT SUBCOMMITTEE OF
THE SCIENCE ADVISORY
BOARD AND THE BOARD OF
SCIENTIFIC COUNSELORS**