United States General Accounting Office

GAO

Report to the Chairman, Subcommittee on VA, HUD, and Independent Agencies, Committee on Appropriations, House of Representatives

September 2000

ENVIRONMENTAL RESEARCH

STAR Grants Focus on Agency Priorities, but Management Enhancements Are Possible

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GAO/RCED-00-170

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Abbreviations

EPA	Environmental Protection Agency
ORD	Office of Research and Development
STAR	Science to Achieve Results

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United States General Accounting Office
Washington, D.C. 20548

Resources, Community, and
Economic Development Division

B-142370

September 11, 2000

The Honorable James T. Walsh
Chairman, Subcommittee on VA, HUD,
and Independent Agencies
Committee on Appropriations
House of Representatives

Dear Mr. Chairman:

The Environmental Protection Agency (EPA) has significantly changed the way it conducts scientific research to fulfill its mission of protecting human health and the environment. Responding to criticisms of its research quality and focus, EPA established the Science to Achieve Results (STAR) grant program in 1995, which is administered by EPA's Office of Research and Development (ORD). The three objectives of the program are to (1) ensure that the agency involves the best non-EPA scientists in its research efforts, (2) provide useful research support to the agency's program offices, and (3) train a cadre of environmental scientists for the future. The STAR program accounted for about 20 percent of the funds ORD obligated for research for fiscal year 1999. ORD awards STAR grants to scientists on the basis of 10 broad strategic goals as set out by EPA's annual performance plan,[1] ORD's six priority topics for scientific research at the agency, and the specific research priorities of each program office. STAR grants are available for (1) basic exploratory environmental research, (2) research focused on specific environmental topics (STAR focused grants), and (3) fellowships to graduate students to develop the nation's capacity for addressing future environmental concerns. As of January 2000, about 800 exploratory and focused grants had been awarded and 53 of them completed; in addition, about 600 fellowships had been awarded and about 200 completed.

You asked us to review the status of the STAR grants program. Specifically, we are providing information on (1) whether funding amounts awarded for the grants align with EPA's strategic goals, ORD's research priorities, and

[1] The Government Performance and Results Act of 1993 requires each federal agency to prepare an annual plan that includes the performance goals to be achieved. See table 1 for a complete listing of EPA's strategic goals.

program office priorities; (2) the extent to which the completed focused grants have provided research that is being used by EPA's program offices; and (3) ways in which ORD could enhance its management of the program to help ensure that it meets its objectives. Because the STAR program is new and relatively few grants have been completed, it is too early to definitively judge the program's long-term effectiveness.

To address your questions, we analyzed program data; interviewed EPA officials knowledgeable about STAR grants; and reviewed studies by independent scientific groups—specifically, a March 2000 report on the STAR program by a joint subcommittee of EPA's Science Advisory Board and ORD's Board of Scientific Counselors and a draft report on EPA's research management by the National Research Council.[2] To further examine the extent to which STAR grants were being used by EPA's program offices, we compiled a list of the 53 focused and exploratory grants completed as of December 6, 1999, from the National Center for Environmental Research's Web site, as identified by STAR program managers. We discussed the usefulness of 25 completed grants that were focused on specific environmental topics with potential users of the research in EPA, as identified by the STAR program managers. We limited our review to focused grants because they were more likely to be of more immediate use to the program offices than those grants related to exploratory research. Because providing useful research to the program offices is only one of the program's three objectives, our observations on whether the research support is being used by the program offices should not be the only measure of judging the program's overall effectiveness. We also recognize that scientific research can have long-term benefits but may not be immediately useful. Our detailed scope and methodology are discussed in appendix I.

Results in Brief

STAR grant funding has generally been aligned with EPA's, ORD's, and the program offices' broadly defined priorities. Since the STAR program began in 1995 through March 2000, about two-thirds of the approximately $415 million in funding for STAR grants has addressed EPA's multipurpose

[2] *A Joint SAB/BOSC Report*: *Review of the Science to Achieve Results* (*STAR*) *Program*, Joint Subcommittee of the Science Advisory Board and the Board of Scientific Counselors, March 2000; and *Strengthening Science at the U.S. Environmental Protection Agency: Research Management and Peer Review Practices*, National Research Council (draft report).

strategic goal of ensuring that EPA uses sound science in addressing environmental hazards and improving environmental protection. Another 21 percent has addressed the strategic goal aimed at achieving clean air, and the remaining grant funding has addressed six of EPA's other strategic goals. STAR grant funds also generally have been aligned with one or more of ORD's six research priorities, such as achieving safe drinking water, and with the program offices' main priorities. Some program office research needs, such as reducing acid rain, were not addressed by STAR grants because EPA determined they had a lower research priority and because STAR funding was limited.

Although STAR grants were generally aligned with the agency's strategic priorities and those of ORD and the program offices, EPA's program officials varied in the extent to which they believe the grants' results are useful to them. Of the 25 completed focused grants we examined, 6 were being used and 4 were not expected to be used at all, according to program officials. For the remaining 15 completed grants, the officials were uncertain whether the grants would prove useful or not to their programs, but they stated they might be useful in the future—by serving as building blocks for research, for example. According to the officials, the grants varied in their usefulness to the program offices largely because the STAR program's goals—meeting program office needs specifically and advancing environmental science generally—may be in conflict.

ORD could enhance its management of the program to help ensure it meets its objectives in several areas. First, ORD has not consistently tracked the STAR grants to ensure that they are completed on time and that the results are available for use by EPA's program offices. Second, according to several EPA program officials, ORD could improve its communication with the program offices during the grant process. ORD has not consistently obtained information from cognizant program officials when designing the requests for grant applications or reviewing grant proposals for relevancy during the grant selection process, nor has ORD adequately communicated the results of the completed grants. ORD recognizes these concerns and has several initiatives under way. These include establishing a Web site to improve communication and involving more program officials in grant application design and review. Because the STAR program is relatively new, ORD's primary focus has been on establishing a framework and processes for the program and not on setting program criteria to measure its overall effectiveness. Recent reports by two independent scientific organizations agree that while the program is well structured to achieve its goals, communications between ORD and EPA's program offices should be

improved. Accordingly, we are making several recommendations to EPA for enhancing its management of the STAR program. We believe these will help improve the program's potential usefulness and effectiveness.

We provided a draft of this report to EPA for its review and comment. EPA generally agreed with the report's conclusions that the grants aligned with EPA's, ORD's, and the program offices' broadly defined priorities and that funding for STAR grants falls within priority research areas. EPA also agreed with two of the three recommendations in this report and said it is taking steps to implement them. EPA did not agree with the basis for the third recommendation regarding the need for improved tracking and availability of final grant reports to program offices. Specifically, EPA stated that its review of grant files showed that more final reports were completed than indicated by our analysis. However, at the time of our review, a STAR program official charged with posting reports to the Web site represented that our list of final reports, compiled from those posted on EPA's Web site and available to program officials, was complete. Because it now appears that a significant number of completed final reports had not been posted to EPA's Web site, which was not represented to us at the time of our review, we believe the recommendation is still warranted. Finally, EPA identified several aspects of the draft report that it believed needed modification; for example, it stated that we negatively characterized the data on the usefulness of STAR grants to the program offices. We clarified and presented additional information to address EPA's comments and made technical changes as appropriate.

Background

Credible scientific research is critical to EPA's decisions on environmental regulations. EPA relies on agency-funded research as well as on research funded by others, including government agencies, such as the National Science Foundation and National Institutes of Health, and private sources. Prior to the STAR program, EPA mainly funded research through cooperative agreements with outside entities, issued through its laboratories, to supplement the research EPA scientists performed. In addition, ORD funded a relatively small number of grants, managed by ORD headquarters staff, for longer-term exploratory research.

During the early 1990s, EPA's independent Science Advisory Board, the National Academy of Sciences, and other groups reviewed the status of scientific research at EPA. The groups recommended that EPA make changes to strengthen the quality of its scientific research, such as better balancing its short- and long-term research and taking steps to train the

next generation of scientists. EPA responded, in part, by establishing the STAR program in 1995. In doing so, EPA shifted much of its funding for external research away from noncompetitively awarded cooperative agreements administered by ORD's laboratories and placed more emphasis on competitively awarded, peer-reviewed grants. EPA believed that this realignment would allow ORD scientists to spend less time administering contracts and more time conducting research, while the STAR program would involve top-quality scientists from outside EPA in helping to meet the agency's research needs.

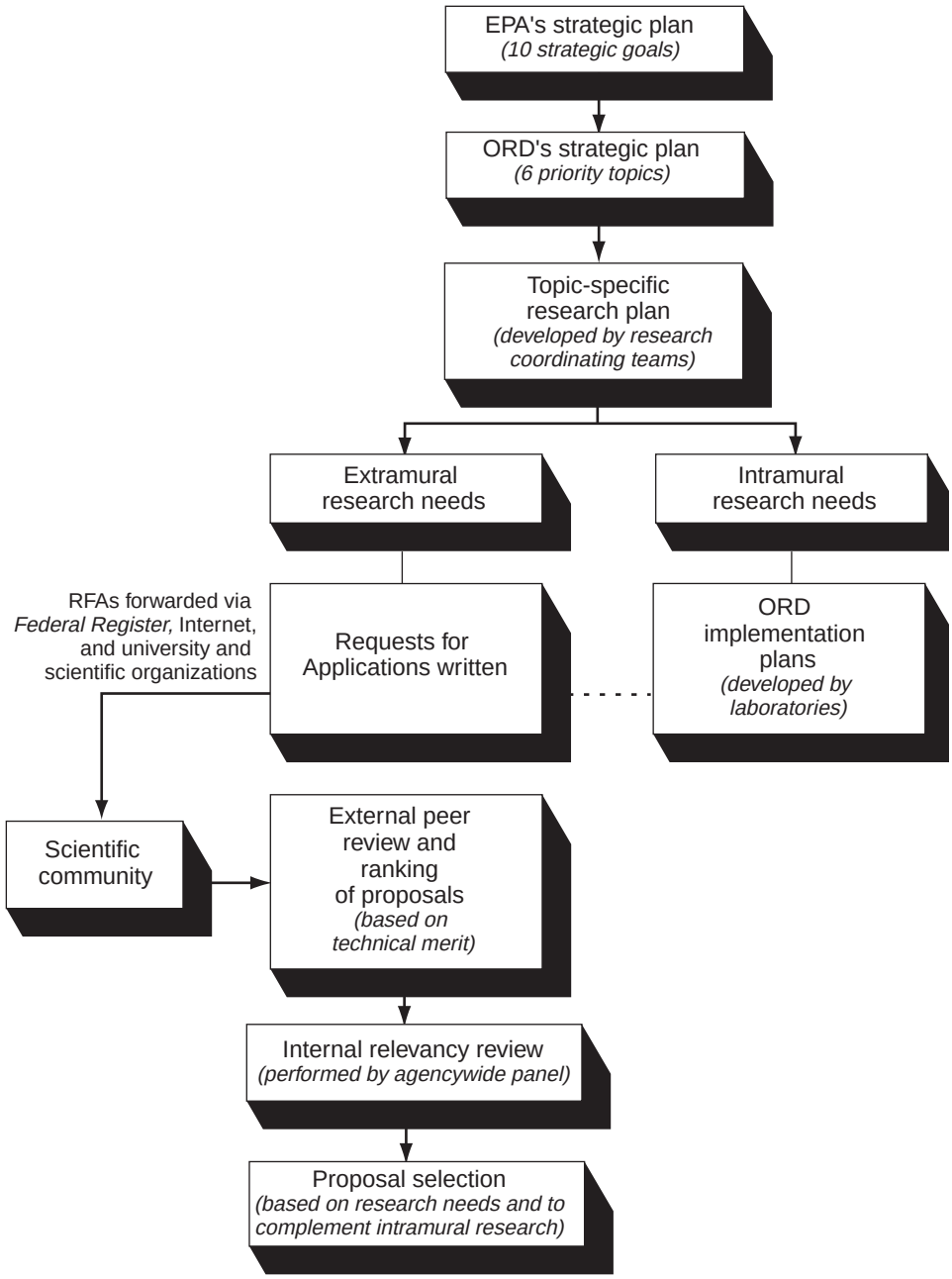
The STAR program has three principal objectives. First, through the program, EPA attempts to make the nation's academic research community an integral part of its research program, thereby ensuring that the agency has the highest quality science for its use. Second, EPA seeks to supplement and complement its internal research program, thereby supporting its mission by meeting the scientific and technical needs of the program offices. Finally, EPA attempts to support higher education in selected scientific fields, thereby developing a stronger scientific community for the future.

To achieve these objectives, the STAR program relies on three types of grants: exploratory grants, focused grants, and graduate fellowships. Exploratory grants are for fairly broad areas of environmental science, such as environmental chemistry and physics. Focused grants are targeted more specifically at particular research needs, such as developing standards for safe drinking water, that have been identified in ORD's strategic plan. Focused grants can be awarded to environmental research "centers," such as the Airborne Particulate Matter Centers. These centers comprise multiple scientists—usually from different disciplines—who are concerned with longer-term and cross-issue research. Finally, fellowships are given to graduate students in specified environmental disciplines, such as toxicology, chemistry, and economics. Fellowships for master's and doctoral students are for 2 and 3 years, respectively. For fiscal year 1999, ORD obligated about $91 million in STAR grants for externally conducted research. This represented about 20 percent of ORD's overall obligations of about $458 million for research. Other resources within and outside of EPA also provide funding for environmental research. Additional information on overall environmental research funding and funding levels for the three types of STAR grants is provided in appendix II.

EPA solicits STAR grants through annual requests for grant applications. Proposals for exploratory and focused grants are reviewed for their

scientific and technical merit by panels of non-EPA scientists, which reject those that are not considered scientifically sound. Next, panels of EPA officials from ORD and other offices review and rank the proposals for relevance to their research needs. ORD then selects proposals to be awarded, taking into consideration both scientific merit and relevance to research needs. ORD follows a similar process for fellowship proposals. EPA's process for awarding STAR grants is illustrated in figure 1.

Figure 1: EPA's Process for Awarding STAR Grants



STAR Grant Funding Is Aligned With EPA's, ORD's, and Program Offices' Broad Goals

Because EPA's, ORD's, and the program offices' priorities are broadly defined, most STAR grant funding has generally been aligned with them. Since the STAR program began in 1995, ORD has funded grants aligned with 8 of EPA's 10 strategic goals. Most of the grant funds have been aligned with EPA's strategic goal of ensuring that the agency uses sound science in addressing environmental issues, followed by the goal aimed at achieving clean air. Furthermore, all of the funding for STAR grants awarded falls within one or more of ORD's six priority research topics, and grants have generally been awarded for the highest priority needs of each program office. However, some lower-priority research topics, such as reducing acid rain, are not being funded by STAR grants or other EPA research because of resource constraints.

STAR Grant Funding Falls Within EPA's Strategic Goals

Since 1995, when the STAR program began, and through March 2000, ORD has awarded about $415 million in exploratory and focused grants. Once all of the awards are made for fiscal year 1999, total exploratory and focused grant awards will amount to about $430 million. EPA has awarded these grants in keeping with eight program-related strategic goals that could benefit from STAR grant research. Table 1 shows how the $415 million in grant awards corresponds to EPA's strategic goals. The table does not include fellowship grant awards, which amounted to about $39 million for fiscal years 1995 through 1999.

Table 1: STAR Grants by EPA Strategic Goals, Fiscal Years 1995–99

Dollars in millions

EPA's strategic goal	Award amounts
Clean air	**$87.0**
Clean and safe water	**16.5**
Safe food	**2.5**
Preventing pollution and reducing risk in communities, homes, workplaces and ecosystems	**3.0**
Better waste management, restoration of contaminated waste sites, and emergency response	**9.7**
Reduction of global and cross-border environmental risks	**15.6**
Expansion of Americans' right to know about their environment	**3.6**
Sound science, improved understanding of environmental risk, and greater innovation to address environmental problems	**277.1**
Total	**$415.0**

Note: Individual grant amounts are associated with one strategic goal. STAR grants are not applicable to 2 of EPA's 10 strategic goals, "a credible deterrent to pollution and greater compliance with the law" and "effective management."

Source: GAO's analysis of EPA's data.

STAR grants applicable to the sound science and clean air goals represented about 67 and 21 percent of the funds awarded, respectively. Since sound science is a multipurpose goal, grants funded under it frequently apply to another goal as well.

STAR Grants Align With ORD and Program Office Priorities

In addition to EPA's strategic goals, ORD has established six broad priority research topics: safe drinking water, high-priority air pollutants, emerging issues, improving ecological risk assessment, improving human health risk assessment, and pollution prevention and new technology. These are generally consistent with EPA's strategic goals. Three of ORD's priority topics—improving the assessment of risks to human health, emerging issues, and improving ecological risk assessment—have been the focus of the majority of STAR grants awarded. Appendix III shows how the research areas of the awarded grants are aligned with the six research topics.

ORD takes the needs of program and regional offices into consideration when writing the requests for grant applications and awarding STAR grants. ORD's research coordination teams include program office and regional representatives who identify EPA's research needs and determine

the research that will be conducted internally or externally. According to the science advisers in the offices of Air and Radiation and Solid Waste and Emergency Response who have served on the teams, ORD considers program offices' research priorities and ensures that the offices' top research needs are covered by the STAR grants. For example, because EPA considers particulate matter in the air to be a costly potential health risk, the Office of Air and Radiation has particulate matter research as a top priority, and ORD has awarded STAR grants for research on particulate matter under its topic of high-priority air pollutants. A program official in the Office of Air and Radiation, who is responsible for developing the standards, is incorporating STAR grant results into the new standards.

Funding for STAR grants has generally been consistent with the highest research priorities of the program offices. Some lower-priority research needs are not benefiting from STAR grants, however, because of resource constraints. According to program officials, the likelihood that the grants will address a research need depends on where that need ranks in the program offices' and ORD's priorities. For example, officials concerned with acid rain issues, which is a lower priority for the Office of Air and Radiation, told us that to date no STAR grants have included research that can be used to meet their needs. Similarly, no STAR grants have targeted research on stratospheric ozone or asthma mitigation. Officials responsible for these areas believe they could benefit from STAR research, but their research needs have a relatively low priority within the Office of Air and Radiation. Although ORD recently decided to fund a combustion research project that the Office of Solid Waste and Emergency Response will use, an official from that office told us that the STAR program generally has focused on few of its research needs because waste issues are currently a low priority for ORD.

According to program officials, the approximately $100 million in annual funding for STAR grants is not sufficient to cover all of the program offices' research needs that are not otherwise met by other sources, such as ORD's laboratories. To compensate, the officials stated, they seek out research being conducted by other organizations, some in other countries, on similar topics that may meet their research needs. Recently, the Science Advisory Board's Research Strategies Advisory Committee completed its annual review of the agency's budget request for fiscal year 2001 science and technology funds. The committee agreed that EPA is not adequately funding research on certain environmental issues, such as hazardous waste cleanup. ORD officials concur that budget constraints limit grant awards and that consequently some research cannot be funded through the

program. They told us that they consider research being done by scientists at EPA and other agencies, such as the National Science Foundation, when awarding STAR grants to ensure that program offices' research needs get the best coverage possible.

Usefulness of the Focused Grants to EPA's Program Offices Varies, Largely Because of Competing Program Objectives and the Nature of Grants

Although STAR grants are generally aligned with EPA's strategic priorities and those of ORD and the program offices, program officials believed that the usefulness of the completed focused grants to their programs varied. They stated that they were using 6 of the grants, did not expect to use 4 of them, and were uncertain about the extent to which the remaining 15 grants might be useful in the future. According to the officials, the grants varied in their usefulness to the programs largely because the STAR program's goals—advancing environmental science generally and meeting program needs specifically—may be in conflict.

Usefulness of the Completed Focused Grants to EPA's Program Offices Varies

For the 25 completed grants we examined, 6 were being used by EPA program officials because they met a research need. For example, one STAR grant created an animal model emulating the development of autism in humans. The goal of the research was to assess how a woman's exposure to certain chemicals during pregnancy could affect the fetus. According to officials in ORD and the Office of Prevention, Pesticides, and Toxic Substances, the STAR research was the first proving a relationship between chemicals and the development of autism. The officials are using the results as they develop guidelines for assessing risks to children's health.

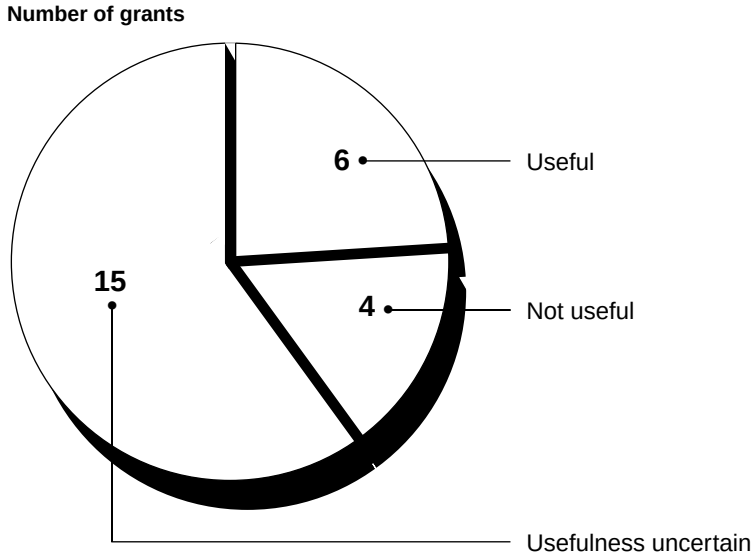
In contrast, program officials did not expect to use the research results from four grants at all. For example, a grant researching the development of methods to prevent wastes by auto suppliers did not provide useful results, according to officials in the Office of Prevention, Pesticides, and Toxic Substances. The officials stated that they had begun similar research 2 to 3 years before the grant was issued and that they had researched the issue more extensively than the grantees did. They stated, however, that the grantees benefited by increasing their technical expertise in conducting this type of research.

Program officials believed that the extent to which the remaining 15 completed focused grants might prove useful in the future varied. For

example, six grants, totaling over $750,000, that researched methods for estimating the benefit of environmental policies were not currently useful but were expected to be useful to the agency in the long term. Program officials told us that the research topic—estimating values for lives, ecosystems, and other entities affected by environmental policies—is an important one for the agency. These officials generally agreed that the grants contributed to an improved understanding of the overall issue of environmental valuation and would probably provide some basis for future work on the issue. One of the program officials also stated that it was probably prudent to fund these grants in order to advance knowledge and understanding of this issue, even though the grants are not providing research results that can be used immediately. On the other hand, the future usefulness of a grant investigating wet cleaning processes—instead of the standard dry cleaning process—is less certain, according to officials in the Office of Prevention, Pesticides, and Toxic Substances. The officials stated that the research was well done and illustrated the environmental benefits of wet cleaning over dry cleaning. However, they believe that the garment cleaning industry is unlikely to adopt the new technology because cleaning companies have already made costly changes in the infrastructure of their plants to comply with EPA regulations. The officials plan to keep the grant results as a reference on the garment cleaning industry in the event that future regulatory changes make alternative cleaning approaches more viable.

Figure 2 shows how program officials perceived the usefulness of the 25 completed focused grants.

Figure 2: Usefulness of 25 Completed Focused Grants to EPA Program Officials



Note: These focused grants were completed as of December 1999.

The STAR Program's Competing Goals and Reliance on Grants Limit the Usefulness of the Research to EPA Program Officials

The STAR program's objectives may be contradictory in that the program is expected to focus on achieving long-term gains in environmental science as well as being responsive to the more immediate needs of the program offices. According to some program officials, they understood that the foremost goal of the STAR program was to advance environmental science rather than to meet the programs' needs. As a result, STAR grants may be limited in the extent to which they are useful to the program offices.

Furthermore, the STAR program's reliance on grants to accomplish environmental research limits its ability to directly respond to the research needs of EPA's program offices. The principal purpose of any grant is to assist grantees in furthering a public purpose rather than to obtain services directly for the government's benefit. According to several EPA program officials, program offices' needs do not always match up with grant recipients' research objectives; therefore, some of the STAR grant topics are not directly applicable. In addition, one program official told us that STAR researchers are sometimes reluctant to answer questions posed by program officials because the terms of the grant do not require them to be responsive to the needs of EPA's program offices.

Research for STAR grants may also not be completed in a time frame that is useful to the program offices. STAR grants range from 1 to 5 years. Grantees can request a 1-year extension, which ORD officials must automatically approve in accordance with OMB's Circular A-110, according to ORD officials, and ORD may authorize additional extensions. Thus, even though it may be several years before STAR grants produce results, the grantees are still in compliance with the terms of their grants. Program officials also differed in whether grant timing fit their needs. For example, an official in the Office of Air and Radiation told us that projecting research needs that far in advance was possible, while another in the Office of Solid Waste and Emergency Response stated that many of his office's research needs involve cleanup work at Superfund sites and require results in a shorter amount of time than the grants can usefully provide.

ORD Could Enhance Its Management of the STAR Program to Help Ensure That It Meets Its Objectives

ORD could enhance its management of the STAR program to help ensure that the results of the grants are readily useful to the EPA program offices and that the program meets its objectives. Areas needing further improvements include (1) tracking grants to ensure that they are completed on time and have produced the research intended; (2) improving communications with EPA's program offices when designing and reviewing grants for relevancy and disseminating grant results; and (3) establishing criteria to measure program effectiveness. Reports by two independent scientific organizations agree that while the program is generally well structured for achieving its goals, communications between ORD and EPA's program offices should be improved.

ORD Could Further Improve Its Tracking of Grant Results

ORD has not been adequately tracking grants and has not ensured that exploratory and focused grants were completed on time. As of December 1999, 144 of the nearly 200 grantees for exploratory and focused grants had missed their deadlines, including extensions, for submitting final reports. ORD officials recently noted that they plan to do a better job of tracking grants. In that regard, in June 1999, ORD hired a contractor to track and identify interim and final reports. ORD has identified a number of additional final reports since December 1999. According to a STAR program manager, however, ORD cannot ensure that research will produce results in the agreed time or with the intended results. Similarly, ORD has not adequately tracked the fellowship grants to determine whether they have been effective. It had not analyzed whether any of the approximately 200 fellowships completed as of December 1999 had resulted in college graduates taking jobs in environmental occupational fields. Recognizing

the need to determine whether fellowship recipients are continuing in the environmental sciences, ORD began in early 2000 to track the recipients of completed fellowships. In that effort, ORD has obtained follow-up information for about 60 of the 200 completed fellowships.

ORD Could Better Communicate With Program Offices About STAR Grants

ORD could also improve its communication with the program offices during the grant process, according to several EPA program officials. For example, ORD has not consistently obtained information from cognizant program office officials when designing requests for grant applications or reviewing grant proposals for relevancy during the grant selection process. While a number of program officials have participated in these processes, others told us that they have not been invited to do so. One official, who had not been involved in the pre-award process, believes that, had she been involved, she might have influenced ORD to select a grant that could have met her and others' research needs. She acknowledged that ORD has recently recognized that more participation from the program offices prior to awarding the grants could increase their usefulness. The draft report by the National Research Council agreed that some program officials had expressed concern that, in practice, they have little influence on ORD's research priorities.

Furthermore, ORD had not adequately communicated grant results to program officials. For 13 of the 25 grants we examined, program officials learned about completed research as a result of ORD outreach and notification. For the remaining grants, officials learned about 1 grant's final results through a professional conference and were not aware of the completed research for the remaining 11 grants until we contacted them for this review. In addition, most of the program officials were not aware of interim research results for the grants we reviewed. One program official explained that, if he had been aware of the interim research results on air pollution in large buildings for one STAR grant, he could have notified the researchers of problems with their methodology and corrections could have been made. Instead, the usefulness of the completed research is questionable, and unless the methodology issue can be resolved, the official will be unable to use the results.

ORD has taken steps to communicate the results of STAR program research, including posting STAR research report summaries on its Web site, providing program offices with lists of grants that might contain useful research, and sponsoring workshops on grant topics. While the program officials acknowledged that ORD makes STAR information available, the

format of this information makes it difficult for program officials to identify research relevant to their needs. For example, program officials stated that interim and summaries of final research reports are organized on ORD's Web site by grant topic, a format that makes identifying specific relevant research difficult because they have to sift through numerous lengthy reports. For the ORD workshops on grant topics, not all grant topics are covered. For example, the indoor air research topics were not covered in any workshop, according to a program official. ORD managers acknowledge ongoing difficulties in conveying research results to the program offices and say they have been increasing their efforts to do so.

According to both the National Research Council's draft report and the March 2000 report by the joint subcommittee of EPA's Science Advisory Board and ORD's Board of Scientific Counselors, now that the STAR program is starting to produce results, EPA should place greater emphasis on communicating those results to potential users in the agency. By strengthening communication between STAR program managers and the program offices, ORD could better ensure that STAR results are being rapidly and effectively transferred to the officials who can use them. The joint subcommittee report also recognizes that ORD has initiated several efforts to improve communication, such as developing reports on the status of research topics.

ORD Has Not Focused on Developing Measures to Help Ensure the Program Meets Its Goals

Because the STAR program is relatively new, ORD's primary focus has been on establishing a framework and processes for the program, not on setting criteria for measuring its overall effectiveness. For example, ORD has not set goals for measuring whether the grants are meeting the research needs of EPA's program offices. Such measures would allow STAR managers to determine if the program as a whole is achieving its expected results of involving the best scientists in EPA research, providing useful research for the program offices, and training a cadre of environmental scientists for the future. According to ORD officials, most of their efforts to date have focused on establishing a high-quality research program. They now believe it is time to place a greater emphasis on evaluating the program's benefits. Consequently, ORD asked the joint subcommittee of EPA's Science Advisory Board and ORD's Board of Scientific Counselors for assistance in developing measures for determining if the STAR program is meeting its overall goals.

The March 2000 joint subcommittee report focused on evaluating whether the STAR program is structured appropriately to achieve its goals. Overall,

the report found that the program is structured and managed to generate high-quality science, conducted by well-qualified scientists, on topics that are relevant to the environmental problems identified in EPA's strategic plan. The report concluded that the STAR program is generally well planned, organized, and managed for achieving its goals. However, it recommended that ORD seek expert assistance in developing a monitoring and evaluation system for the program.

Conclusions

Initial results indicate that the STAR program is yielding some research that is useful to EPA's program offices and that it is well-structured and managed to generate high-quality science. However, for the STAR program to better meet one of its major goals—that of supporting the research needs of EPA's program offices—ORD must improve its tracking of grants to ensure that the research is being completed as agreed and that it is communicating the research results throughout EPA. Reports by two independent scientific groups agree that the STAR program's research results should be better communicated. EPA recognizes this concern and has taken several actions to improve communications, but more could be done.

ORD has focused the majority of its efforts to date on the near-term objectives of establishing the STAR program and on awarding the grants. However, ORD has not established criteria to help ensure that the program is meeting its major objectives. Now that the program has begun to produce results, it is appropriate for EPA to focus greater attention on managing on-going research, disseminating research results, and evaluating program results to date.

Recommendations

To enhance the effectiveness of the STAR program, we recommend that the Administrator of EPA direct the Assistant Administrator of ORD to take the following actions:

- Track and monitor the grants to ensure that interim and final research results are delivered on time and are made available as soon as possible for use by the program offices.
- Take the additional steps needed to better disseminate and communicate STAR research results to the appropriate program officials. This would require continuing and expanding the efforts

already under way to consult with program offices in determining the most effective communication methods.

- Develop program criteria to evaluate the effectiveness of each type of grant—exploratory grants, focused grants, and fellowships. In addition, the criteria should assist EPA in drawing an overall conclusion on whether these grants satisfy the program's overall objectives.

Agency Comments

We provided a draft of this report to EPA for its review and comment. EPA's comments and our detailed responses are in appendix IV. EPA agreed with the report's conclusions that the grants generally align with EPA's, ORD's, and the program offices' broadly defined priorities and the funding for STAR grants falls within priority research areas. However, EPA suggested changes in five other areas. First, EPA stated that our report negatively characterized the data on the usefulness of STAR grants to the program offices, noting that no benchmarks exist for an appropriate level of usefulness. We disagree. Rather, our report simply portrays the views of EPA program officials, one of the intended beneficiaries of the program, on the grants' usefulness. We agree that no benchmarks exist for the usefulness of grants, although benchmarks would be helpful to evaluate the program. Second, EPA stated that there is no contradiction in using grants to support the program offices and to further advance environmental research. We recognize that the STAR program can contribute to both of these goals. However, as the draft report stated, program officials noted that these goals may conflict and that the primary purpose of grants is to assist grantees in furthering a public purpose rather than in obtaining services directly for the government's benefit. Third, EPA stated that the report misrepresented the relative amount of STAR grant funding to overall ORD funding. We changed the report to more accurately reflect the proportion of ORD's funding accounted for by the STAR grant program. Fourth, EPA stated that it did not agree with our conclusions as to the number of grants that had been completed and made available to program offices. Specifically, EPA stated that, by counting only those final reports posted to its Web site, we did not include a substantial number of additional completed grant reports that were in its files. Therefore, EPA disagreed with our conclusion and recommendation that tracking of STAR grants should be improved. While EPA states that additional research reports were in its files, at the time of our review, a STAR program official confirmed that all final reports were posted to the Web site. If they were not posted, they were not readily available to the program offices. Therefore, we believe our conclusions and recommendation are warranted. Finally, EPA stated that it has been taking steps to implement two of the

report's recommendations to better disseminate and communicate STAR research results and to evaluate the program. We acknowledged these efforts in the report.

We are sending copies of this report to appropriate congressional committees; interested Members of Congress; the Honorable Carol M. Browner, Administrator, Environmental Protection Agency; and other interested parties. We will also make copies available to others on request.

Please call me at (202) 512-6111 if you have any questions about this report. Key contributors to this report were John Wanska, Karla Springer, John C. Johnson, and Roger Bothun.

Sincerely yours,

Peter F. Guerrero
Director, Environmental
Protection Issues

Scope and Methodology

To obtain information on the Environmental Protection Agency's (EPA) Science To Achieve Results (STAR) grant program, we interviewed officials in, and collected and analyzed information from, the Office of Research and Development's (ORD) National Center for Environmental Research and the Grants Administration Division; the Office of Air and Radiation; the Office of Solid Waste and Emergency Response; and the Science Advisory Board's Research Strategies Advisory Committee. We also reviewed two recent reports by independent scientific groups. The March 2000 report by a joint subcommittee of EPA's Science Advisory Board and ORD's Board of Scientific Counselors objectives were to examine whether (1) the STAR program is structured appropriately to achieve its stated purpose, (2) the program is integrated effectively with the agency's strategic plans and programs, and (3) efforts to communicate with the external scientific and regulatory communities regarding STAR research opportunities and outputs were adequate. The draft report by the National Research Council assessed the overall structure and management of EPA's research program and evaluated scientific peer review procedures used by the agency.

To determine whether the grants awarded met EPA's strategic goals and ORD's priorities, we interviewed ORD officials to obtain an understanding of how grants are categorized by subject area and how these subjects were aligned with EPA's strategic goals and priorities. We also obtained information on the grant award process and reviewed documentation on the process. The documents reviewed included EPA's and ORD's strategic plans and various listings of the grants awarded. The listings identified the year of the award, the research topic, and the dollars awarded. Using this information, we compared the grants awarded to EPA's goals and ORD's research priorities to determine how the grants were aligned with specific goals and priorities.

To assess the extent to which the completed focused grants have provided research that is being used by EPA's program offices, we obtained information on those grants completed as of December 6, 1999, from the National Center for Environmental Research's Web site. At the suggestion of STAR program managers, we considered a grant to be completed if its final report was posted on the Web site and the December 6, 1999, date provided STAR program staff time to ensure that all available final research reports had been posted on the site. We excluded completed exploratory grants, since those grants were less likely, according to STAR managers, than focused grants to yield results that the programs could use in the near-term. We also obtained from a STAR manager a list of staff in the program offices and regions who were most likely to benefit from the results of the

completed grants. We contacted those officials, and selected others who we learned were also potential users of the results, to discuss their views on the research from the completed grants. Officials we interviewed were from ORD; the offices of Prevention, Pesticides, and Toxic Substances, Water, Air and Radiation, Solid Waste and Emergency Response, International Activities, and Policy and Reinvention; and regions IX and X.

In addition, we used data from EPA's automated Grants Information Control System to compile lists of grants that should have been completed as of December 6, 1999. Exploratory and focused grant recipients are required by their grants to provide a final report to ORD within 90 days of the expiration of the grant's project period. Therefore, to determine which exploratory and focused grants should have been completed and had final reports submitted to STAR managers, we considered only those with project periods ending at least 90 days prior to December 6, 1999. As a condition of the grant, fellowship recipients must submit their theses or other publications to ORD after the end of the grant period, as soon as those papers are available. Because that deadline is less definitive, to determine which fellowships should have been completed, we used December 31, 1999, as the cutoff date and asked STAR managers about any actions they were taking to ensure that the fellowships were effective. We did not independently verify the accuracy of the grants data. However, we discussed the issue of data accuracy with an official in the Grants Administration Division, who told us that the data fields we used were likely to be accurate because they are relatively easy for the grant project managers to keep updated.

We conducted our work between September 1999 and August 2000 in accordance with generally accepted government auditing standards.

EPA Funding for Environmental Research

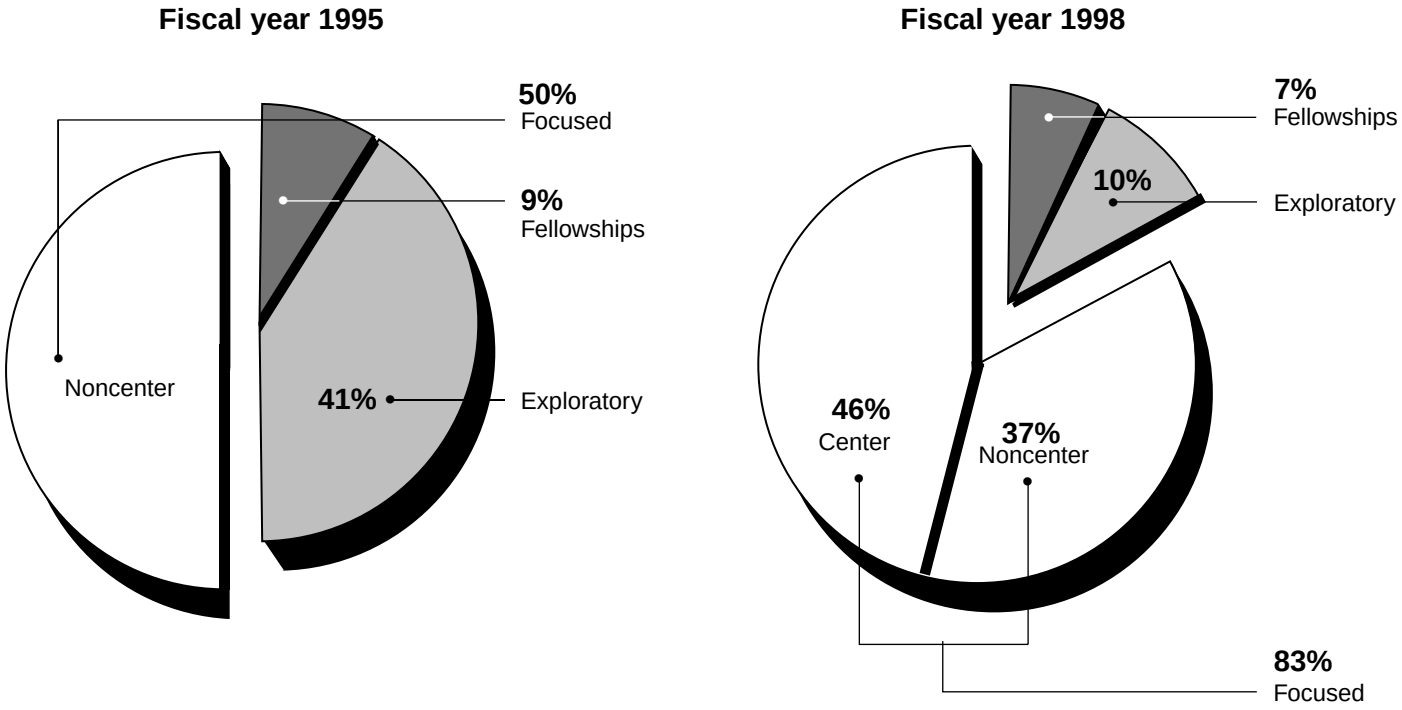
For fiscal year 1999, EPA obligated about $458 million for ORD, whose primary purpose is to provide research for the agency. About $218 million of this amount was for internal research ORD conducted, about $91 million was for the external STAR program, and about $149 million was for other external research, such as contracts. In addition to the ORD funding, EPA's program offices fund research projects. In fiscal year 1999, about $118 million was available for these projects, but the agency does not know how much of that was spent on research-related efforts. ORD is currently trying to identify all the research that EPA is conducting; however, ORD does not plan to identify the amount of funding for research conducted outside of ORD because of difficulties in defining and accounting for research. Estimates of the total federal funding for environmental research range from about $2 billion to $3.2 billion for fiscal year 2000.[1]

The relative funding levels for the three types of STAR grants—exploratory, focused, and fellowships—has changed from fiscal year 1995 to fiscal year 1998. In fiscal year 1995, the year the STAR program began, EPA awarded approximately $58 million, with focused grants accounting for the largest share of funding, about $29 million, or 50 percent, of the total. In fiscal year 1998, ORD awarded approximately $148 million in STAR grants, and focused grants constituted 83 percent of the total amount as shown in figure 3.[2]

[1] In April 2000, the American Association for the Advancement of Science estimated about $2 billion in total federal environmental research for fiscal year 1999; in 1999, the National Science Foundation estimated about $3.2 billion.

[2] Fiscal year 1998 was the last year for which all of the STAR grants were awarded. ORD is still in the process of awarding grants for requests for proposals from fiscal year 1999 and has not yet awarded any grants for the fiscal year 2000 applications.

Figure 3: Percentage of STAR Funding, by Type of Grant, Fiscal Years 1995 and 1998



Source: GAO's analysis of EPA's data.

Over half of the focused grants awarded for fiscal year 1998 were for research centers at universities, a practice that ORD has recently begun to emphasize. There were no center grants for fiscal year 1995. According to a STAR program manager, many of the research issues that the agency faces currently, and expects to face in the future, require multidisciplinary work, and grants to centers are more suited to this type of research. Fellowship grants accounted for about $10 million in fiscal year 1998 and supported approximately 300 fellowships. ORD expects to continue funding fellowships at this level. Awards for exploratory grants have decreased significantly. According a to STAR program manager, exploratory grants are proving to be the least useful of the STAR grants. While the manager believed some of the broad research done with exploratory grants is beneficial to the agency, ORD has gradually diminished the exploratory share in favor of more focused grants.

STAR Program Requests for Grant Applications by ORD's Priority Topics, Fiscal Years 1995 Through 2000

STAR Requests for Application by subject matter	ORD's priority topics					
	Safe drinking water	High-priority air pollutants	Emerging issues	Research to improve ecological risk assessment	Research to improve human health risk assessment	Pollution prevention and new technology
Air						
Indoor air quality		X			X	
Health effects of particulate matter		X	X		X	X
Air pollution chemistry and physics		X	X	X	X	
Air toxics		X	X		X	
Mercury fate and transport	X	X	X	X		
Water						
Drinking water	X		X		X	
Risk-based decisions for contaminated sediments			X	X	X	
Water and watersheds	X		X			
Health effects of arsenic	X				X	
Ecology						
Ecological assessment and indicators			X	X		
Global climate change			X	X		
Regional scale assessment and analysis			X	X		
Ecology and oceanography of harmful algal blooms			X	X	X	
Ecosystem restoration				X		
Health						
Exposure of children to pesticides			X		X	
Endocrine disrupters			X	X	X	
Children's environmental health and disease prevention research centers			X		X	
Human health risk assessment			X	X	X	
Role of inter-individual variability in human susceptibility				X	X	X
Children's vulnerability to toxic substances in environment	X	X	X		X	X
Exposure to waste combustion products		X	X		X	X
Chemical mixtures in environmental health	X	X	X		X	X
Other						
Analytical and monitoring methods	X	X		X	X	X

(Continued From Previous Page)

	ORD's priority topics					
STAR Requests for Application by subject matter	**Safe drinking water**	**High-priority air pollutants**	**Emerging issues**	**Research to improve ecological risk assessment**	**Research to improve human health risk assessment**	**Pollution prevention and new technology**
Environmental fate and treatment of toxics and hazardous wastes	X			X	X	
Environmental statistics	X	X		X	X	
High-performance computing		X	X	X	X	
Technology for a sustainable environment			X	X		X
Decision-making and valuation for environmental policy					X	X
General solicitation – exploratory research	X	X	X	X	X	X
Socioeconomic projects related to pollution prevention					X	X
Program on bio-remediation				X	X	X
Futures: detecting the early signals			X			
Total	**10**	**12**	**22**	**18**	**24**	**11**

Source: EPA's classification of grants awarded by research priorities.

Comments From the Environmental Protection Agency

Note: GAO's comments supplementing those in the report text appear at the end of this appendix.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

AUG 15 2000

OFFICE OF
RESEARCH AND DEVELOPMENT

Mr. Peter F. Guerrero
Director, Environmental Protection Issues
Resources, Community, and Economic Development Division
U.S. General Accounting Office
Washington, DC 20548

Dear Mr. Guerrero:

Thank you for the opportunity to comment on the General Accounting Office (GAO) draft report entitled, *Environmental Research: EPA's STAR Program Focuses on Agency Priorities But Management Enhancements Are Possible* (GAO/RCED-00-170). We are especially pleased that the GAO found that the Science to Achieve Results (STAR) Program: (1) "...has generally aligned with EPA's, ORD's and the program offices' broadly defined priorities;" and (2) "...all of the funding for STAR grants awarded falls within one or more of ORD's six priority research topics, and grants have generally been awarded for the highest priority needs of each program office."

In addition, we were pleased to note that the draft report accepts the generally positive conclusions of a recent evaluation of the STAR Program by the Environmental Protection Agency's (EPA) independent Science Advisory Board (SAB) and Board of Scientific Councelors (BOSC), as well as a just completed report by the National Academy of Sciences (NAS).

However, there are several issues that we want to bring to your attention. We offer suggested changes that will improve the integrity of the report. In addition, we have enclosed detailed comments on specific portions of the text.

See comment 1.

1. There is no benchmarking for some of the quantitative conclusions. For example, EPA staff, interviewed by GAO, stated 12 of 25 (or 48%) of the relevant grants to be of immediate benefit to the Agency, or likely to be of benefit in the future. For nine other grants (for a total of 21 of 25, or 84%), the EPA staff stated that these grants may be useful in the future, but the respondents interviewed were not absolutely sure about how the results of these grants might be used. GAO characterized this information negatively.

   Conversely, we find this result to be an indication of success, particularly at such an early stage in the STAR Program's development. We believe this result might even be used to

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evaluate programs in other agencies and institutions. Unfortunately, since there was no standard against which to measure this achievement, the results are presented negatively in the report. This implies that all grants should have been shown to be immediately useful. This is not the general expectation of a grants program.

In addition, since the GAO evaluators did not go beyond program offices and regions in their interviews and analysis, they missed other intended beneficiaries of STAR research. For example, one grant regarding pollution prevention in the automobile manufacturing sector was cited as not useful to a program office. However, this grant was targeted to a different audience - the automobile manufacturers themselves. We believe an analysis of the utility of STAR grants should look beyond the simple question of utility within the Agency.

See comment 2.

2. The report states that there may be an internal contradiction within a grants program that is working to support the Agency's mission and simultaneously working to advance the basis of our understanding of complex environmental issues. We believe the following shows that we have addressed this issue and that there is no inherent contradiction:

First, with the advice of the NAS, we have crafted the entire Office of Research and Development (ORD) research program (STAR Program included) to focus on "core" research as well as "problem-driven" research. This means that some of our research is aimed at solving the more immediate problems that the EPA faces (e.g., problem-driven). The rest of our research program is aimed at providing a scientific foundation to help the Agency deal with issues that cut across a number of problems that, we believe, will be important.

Second, over the past two years, ORD has developed a research planning process that includes the program offices and regions as full partners. This is an open process and it has received praise from the Agency and from the SAB.

Third, within the STAR Program, we have created cross-Agency teams to help write the Requests For Applications (RFAs) that we publish, and to help with the relevancy reviews of those proposals that have passed rigorous, external peer review. This past year, for example, more than 100 people from the program offices and regions participated in the STAR writing and relevancy review processes.

Fourth, since it would be illegal to direct the conduct of individual grants, we have chosen to direct the topics for which we are asking for applications. Thus, roughly 90 percent of the STAR grants are dedicated to very focused and targeted RFAs. This is quite different from the way other agencies, such as the National Science Foundation or National Institutes of Health, administer their grants programs. However, it is most appropriate for a mission agency, such as EPA.

3

See comment 3.

3. The draft GAO report states, "...fiscal year 1999, ORD awarded about $96 million in STAR grants for externally conducted research. This represented about 30 percent of ORD's overall budget of about $313 million for research." This is not an accurate portrayal of the budget for ORD's STAR grants. For FY 1999, ORD's budget for STAR grants and fellowships was approximately $96 million. This represented about 17 percent of ORD's overall appropriated budget of $552.9 million.

See comment 4.

4. The draft GAO report makes a strong statement that of 200 grants, due to have final reports to the STAR Program by December 6, 1999, only 56 final reports were in hand. The draft report concludes that tracking and oversight of grantees is deficient. We are not certain how these numbers were derived by GAO. We believe that the GAO did not adequately pursue this issue, and as a result, reported numbers in error. The draft GAO report states that all grants with final reports due by December 6, 1999 were considered.

We conducted a thorough internal analysis of the information contained in the Agency's official grants system. Based on the project end dates, we determined that there were 131 STAR grants with reports due on or before December 6, 1999. We instructed the relevant Project Officers to examine their files and determine whether a final report was issued and whether it was received before or after December 6, 1999. We then determined that 109 final reports were received by December 6, 1999. In addition, there are still 12 final reports that have not been received. We are actively working to obtain them from the Principal Investigators.

In other words, GAO found that only 28% of the reports due were completed on time; whereas, we found that 83% were completed on time.

We believe that this error is likely due to the fact that GAO evaluators only looked at those final reports that had already been posted on our web site. In fact, as shown above, many more reports had been received, but were not yet posted on the web.

Thus, we believe that the conclusion and recommendation concerning the need to improve our tracking process for grants is based on incorrect information, and should be revised accordingly.

See comment 5.

5. There are several recommendations in the draft GAO report that echo previous recommendations of the SAB/BOSC, and NAS. We have already started to implement those recommendations, as follows:

We agree that we need to evaluate the effectiveness of the STAR Program, once a sufficient number of grants has been completed. About one year ago, we began discussions with the NAS to: (1) establish a panel of scientists external to EPA, to develop the appropriate metrics for such an evaluation; and (2) evaluate a number of the areas (RFAs) for which we have awarded grants.

4

We agree that we need to improve the communication of results from the STAR Program to the EPA program offices and regions. Toward that end, we have already instituted the following:

- A keyword searchable web site for all grants and fellowships, that includes annual report summaries and final reports.

- Annual workshops between STAR grantees and EPA staff. In 1999, a dozen such topic-specific workshops were held.

- We have started the development of state-of-science reports, that summarize and integrate the results of our research to make our research results more accessible Agency-wide and to others. Two such reports are currently being prepared, and several more will be developed this year.

- We prepare STAR Reports at regular intervals throughout the year. These reports deal with a specific area of research that STAR is supporting, and summarize the results and the research underway. These reports are written for a non-scientific audience, to ensure that decision-makers and others understand what STAR grantees are doing and producing.

In summary, ORD has a number of additional initiatives underway to improve communications with the program offices and regions.

We appreciate the opportunity to respond to this draft report. Should you have any questions or need additional information, I can be reached at 202-564-6620.

Sincerely,

Norine E. Noonan

Norine E. Noonan, Ph.D.
Assistant Administrator

Enclosure

GAO's Comments.

1. We do not agree that our report negatively characterizes the number of grants useful to program officials. Our report states the number of completed focused grants that are useful, not useful, or of uncertain usefulness based on our discussions with EPA program officials. We recognize that there is no benchmark for the number of grants that should be useful to program officials, although one would be helpful to determine the effectiveness of the STAR program. Furthermore, while we agree that STAR research may be useful to parties outside of EPA, we did not go beyond interviewing EPA program and regional officials about the usefulness of STAR focused grants because it is a stated goal of these grants to address the research needs of these officials.

2. We disagree that there may not be a contradiction in using a grants program to simultaneously support the agency's mission and to advance the understanding of complex environmental issues. We recognize that EPA has made efforts to direct STAR grants into research areas that are relevant to the program offices, and our review has shown that, consequently, some research results have proven useful in meeting program needs. However, the principal purpose of any grant is to assist grantees in furthering a public purpose rather than obtaining services directly for the government's benefit. Furthermore, program officials stated that the needs of the program offices have not always matched the grant recipients' research objectives and that the grant research has often been designed to contribute to broad scientific issues. Therefore, as the program officials we interviewed pointed out, the goals of the program may conflict.

3. We agree that the amounts comparing STAR program obligations with total ORD research obligations for fiscal year 1999 should be revised. We revised the report to reflect that ORD obligated $91 million for the STAR program out of a total of $458 million it obligated for all research. Thus, the STAR program accounts for about 20 percent of all research obligated by ORD. We do not agree that the STAR program's obligated amounts should be compared to ORD's overall budget because that amount may include funding for activities other than research.

4. We disagree with EPA's assertion that our conclusion and recommendation regarding the need to improve the tracking process is incorrect and should be revised accordingly. While EPA states that additional research reports were available in the files at the time of our review, these were not posted to the Web site and were therefore not readily available to the program offices. We worked with STAR program

managers to develop the methodology for counting completed grants as those with final reports posted to the Web site, as discussed in appendix I. Furthermore, we provided the officials with additional time to identify all completed reports in their files and to post them to the Web site. As a result, we believe that no changes are needed to our report.

5. Our report acknowledges the efforts EPA has begun to develop criteria for evaluating the STAR program's effectiveness and to better disseminate and communicate research results.

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