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Harvard School of Public Health

July 31, 2009

Mr. Lek Kadeli
Acting Assistant Administrator
Office of Research and Development
U.S. Environmental Protection Agency
Washington, DC

Dear Mr. Kadeli:

On behalf of the Board of Scientific Counselors (BOSC), I am pleased to provide you with a mid-cycle review report of the Office of Research and Development's (ORD) Science and Technology for Sustainability (STS) Research Program at the U.S. Environmental Protection Agency. The STS Research Program underwent a full BOSC program review in April 2007. A seven member review committee, including the Chair and Vice Chair who are members of the BOSC Executive Committee, participated in the current mid-cycle review, which culminated in a 1-day face-to-face review meeting held on March 12, 2009, in Arlington, Virginia.

The purpose of the review was to evaluate progress that the STS Program has made since the 2007 program review and to assess the responsiveness of the Program to advice, comments, and recommendations provided by the BOSC as a product of that review. In that regard, the BOSC is pleased to find that the Program exceeds expectations with respect to progress and responsiveness to the 2007 review.

The review report has been fully vetted and approved by the BOSC Executive Committee and the report is responsive to the ORD charge. We anticipate that the review will assist ORD in evaluating the strength and relevance of the Science and Technology for Sustainability Research Program and will aid in guiding further course adjustments to the Program. We will be happy to provide additional information concerning the format of the review process or answers to any questions concerning the results of the mid-cycle review.

Sincerely,

Gary S. Sayler
Chair, Board of Scientific Counselors

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MID-CYCLE REVIEW OF THE OFFICE OF RESEARCH AND DEVELOPMENT'S SCIENCE AND TECHNOLOGY FOR SUSTAINABILITY RESEARCH PROGRAM AT THE U.S. ENVIRONMENTAL PROTECTION AGENCY

BOSC Science and Technology for Sustainability
Mid-Cycle

FINAL REPORT

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July 2009

A Federal Advisory Committee for the U.S. Environmental Protection Agency's Office of Research and Development

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This report was written by the Science and Technology for Sustainability Mid-Cycle Subcommittee, then vetted, revised, and approved by the Executive Committee of the Board of Scientific Counselors, a public advisory committee chartered under the Federal Advisory Committee Act that provides external advice, information, and recommendations to the U.S. Environmental Protection Agency's (EPA) Office of Research and Development. This report has not been reviewed for approval by EPA, and therefore, the report's contents and recommendations do not necessarily represent the views and policies of EPA or other agencies of the Federal Government. Further, the content of this report does not represent information approved or disseminated by EPA, and, consequently, it is not subject to EPA's Data Quality Guidelines. Mention of trade names or commercial products do not constitute a recommendation for use. Reports of the Board of Scientific Counselors are posted on the Internet at http://www.epa.gov/osp/bosc.

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I. SUMMARY

This report presents the results of the Board of Scientific Counselors (BOSC) Mid-Cycle Review of the U.S. Environmental Protection Agency's (EPA) Office of Research and Development (ORD) Science and Technology for Sustainability (STS) Research Program. The review was structured around six major charge questions (the full charge is provided in Appendix A).

Below are the six charge questions followed by short summary statements of the BOSC's findings relative to each question.

1. *How responsive has the STS Research Program been to the recommendations made in the April 2007 BOSC program review report? The Subcommittee will evaluate progress made regarding "commitments" to the BOSC recommendations as outlined in ORD's response. Specifically, the BOSC will evaluate the accomplishments and effectiveness of the funded research.*

The Program was very responsive to the previous BOSC program review and has implemented a number of actions in response to suggestions from the BOSC. Although the STS Research Program was very responsive, details of some of the plans were still vague and in need of further development. The panel reached a consensus judgment that the STS Research Program was responsive to the comments of the BOSC and has responded in a way that overall "exceeds expectations."

2. *How clear is the rationale for the STS Research Program as described in the documents provided to the Subcommittee? Is it consistent with the advice previously given by the BOSC?*

The new direction of the Program is well laid out in the Multi-Year Plan (MYP), and the initiatives and their rationales were well articulated, both in the materials and briefing provided to the Subcommittee during the conference call and face-to-face meeting. The revised plan that is focused on biofuels is appropriate and addresses many of the issues raised by the BOSC in the full program review.

3. *If needed, what additional performance metrics (e.g., quality and impact of publications, timeliness of completing goals) might be appropriate for the STS Research Program?*

The Subcommittee reviewed the bibliometric information provided and the user survey, which had just been completed the day prior to the face-to-face meeting. The panel thought that the manner in which the publications were presented—from prior to the beginning of the Program and mixed together with publications emanating from grantees with little or no coordination with EPA researchers—made it difficult to assess the outputs. Most of the listed publications were from the old Pollution Prevention Research Program, which technically is not the STS Research Program. The Subcommittee suggested that the data could be broken out separately to be more useful. It is clear, however, that there are some high-quality papers that are highly cited and indicators of quality research that is being conducted by the Program. The user survey information was less clear and not as useful. It was suggested that to demonstrate outcomes and

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impact, the Program develop and implement better methods to track the information that it needs to determine the quality and impact of its research programs. The bibliometric assessment did not provide tangible evidence of the impact of the Program and was not very useful to the Subcommittee. Clearly, some of the research produced in the various STS sub-programs has had a great deal of impact and is being used, but currently there is no coordinated mechanism to collect information on the outcomes and impact of the Program, such as tracking the careers of students and/or postdoctoral fellows who have participated in research projects, listing partnerships with industry and U.S. and international government agencies, and providing details of case study outcomes.

4. *What changes could the Program make to enhance the impact of the research products and complement other existing efforts in the field? How should products be delivered to ensure they are used within and outside the Agency, thereby contributing the greatest value?*

It is suggested that the STS Research Program can take a more organized and aggressive role in transitioning from support of regulatory functions to one that enables the United States to move to true sustainability. This relates to enabling cooperation and coordinated technology development via partnerships among industry, community stakeholder groups, universities, and local and federal government agencies. In this area, the STS Research Program could focus on developing holistic metrics and tools to enable sustainability by focusing on protecting human health and the environment and enhancing economic growth simultaneously.

5. *Given the need to strategically focus the STS Research Program on national environmental priorities, is the initial focus on biofuels appropriate considering the STS Long-Term Goals (LTGs)? If so, is the proposed program appropriately designed to address these important issues?*

The choice of biofuels as a focus for the STS Research Program is appropriate. Although a number of other issues could be selected as the focus for the larger issue of sustainability, few cover as many aspects of the sustainability issue. EPA and ORD in particular are well situated to have a significant impact on U.S. energy policy, particularly the role of biofuels within that policy. Furthermore, because limitations as a result of lack of resources was a theme of the 2007 full BOSC program review, the selection of biofuels as a focus is appropriate as this aligns the STS Research Program with a pressing social and policy issue, but also recognizes the focus of limited resources to support this STS activity. This issue probably is the best focus that could have been selected.

6. *Are there any other areas of national significance in the near term that the Program should address?*

The BOSC did not think that there were alternative focus areas that should be considered; rather, the STS Research Program can have the strongest impact by being positioned as a nexus to bring sustainability issues to all policy debates. As suggested in the response to Charge Question 4, the STS Research Program now is positioned to take on a central role in transitioning the United States to move to true sustainability. This relates to enabling cooperation and coordinated technology development via partnerships among industry, community stakeholder groups,

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universities, and local and federal government agencies. In this area, the STS Research Program could focus on developing holistic metrics and tools to enable sustainability by focusing on protecting human health and the environment and enhancing economic growth simultaneously. If another area is contemplated, the BOSC suggests that the entire area of sustainability of water resources be considered.

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II. INTRODUCTION

EPA's ORD enlists its BOSC to conduct independent expert reviews of ORD's environmental research programs every 4 to 5 years. Mid-cycle reviews, scheduled midway through the review cycle, are a critical step in the process. Narrower in focus than the in-depth technical evaluation that constitutes a full program review, the objectives of a mid-cycle review are to gauge the Program's progress and offer advice and feedback with respect to future directions and performance and accountability.

At a public meeting in April 2007, a BOSC subcommittee completed a full program review of the STS Research Program, culminating in a BOSC report submitted to ORD in April 2008. Since that time, the Program has made significant progress toward the overall reorganization of the Program elements and implementation of its LTGs; the Program has implemented changes in response to BOSC suggestions in a reorganized research program in the midst of changing Agency resources and priorities. To evaluate progress in advancing the Program in line with BOSC comments, ORD requested that the BOSC conduct a mid-cycle review to assess the STS Research Program's activities and plans in light of changes in Agency strategic plans and national needs.

The BOSC STS Mid-Cycle Subcommittee consisted of six members (Appendix B). The Chair and Vice Chair also were members of the BOSC subcommittee that conducted the 2007 full program review. The other five members were experts in various aspects of the reorganized STS Research Program and a subset of the BOSC subcommittee that conducted the 2005 program review. Following one organizational conference call on February 12, 2009, to discuss the charge provided by ORD and review materials provided to the STS Research Program Mid-Cycle Subcommittee, a public meeting was held on March 12, 2009, in Arlington, Virginia. The purpose of the review was to provide general feedback on ORD's efforts to date and advice and feedback on issues related to the future directions of the STS Research Program and its measures of success. This was accomplished through a set of specific charge questions used to guide the Subcommittee through its review of the materials prepared for this process. The full charge to the Subcommittee is presented in Appendix A.

The Subcommittee was informed that it should assign an overall rating for the responsiveness of the Program to the BOSC full program review and its progress toward implementing changes in response to the review. The rating should be in the form of the adjectives used for this process (see Appendix A, Section 4.0 for definitions)—Exceptional, Exceeds Expectations, Meets Expectations, and Not Satisfactory. This uniform rating system is intended to promote consistency among BOSC program and mid-cycle reviews and generate a clear understanding of the BOSC's assessment of ORD's progress. The adjectives are used as part of a narrative summary of the review so that the context of the rating and the rationale for selecting a particular rating will be transparent. For the mid-cycle review, the rating is based on the quality, speed, and success of the Program's actions in addressing previous BOSC recommendations.

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III. CHARGE QUESTION # 1

How responsive has the STS Research Program been to the recommendations made in the April 2007 BOSC program review report? The Subcommittee will evaluate progress made regarding "commitments" to the BOSC recommendations as outlined in ORD's response. Specifically, the BOSC will evaluate the accomplishments and effectiveness of the funded research.

The STS Research Program has been very responsive to the April 2007 BOSC program review. The Subcommittee was very impressed with the responsiveness and progress on the MYP. When the full program review was conducted in 2007, the BOSC Subcommittee found that the STS Research Program was in a transition period and had not yet implemented the MYP. Some aspects of the Program were new and were not reviewed. In this case, the BOSC gave opinions on the proposed direction. In the 2007 full program review, the BOSC had made a number of recommendations. The Program consolidated those comments into several major areas and provided each comment or suggestion in its detailed response. This included an explanation of the reasons for some activities and the current status of the various Program elements. The table that provided specific comments and responses and how they had been addressed was straightforward and made it easy to review the changes in the Program. The Program then revised its MYP and reorganized itself in response to the BOSC comments. All of the BOSC comments have been addressed in that report and through the reorganized program.

There have been substantial changes in the direction of the STS Research Program, and 2 years is actually a short time in which to execute such a change in mission. Based on the pre-meeting materials provided to the Subcommittee and the presentations/discussions during the face-to-face meeting, it is very obvious that the Program took the BOSC review comments very seriously and worked hard to address them all.

The response to the suggestion to document areas in which the research has been important in technical reports, patents, and other types of activities also was appreciated. Because the Program is so young, few of the program elements were specifically related to sustainability. There is a clear history, however, of contribution that produces the expectation that this level of activity should continue in the future.

One of the comments from the initial review was to take a broader overview of sustainability and document and later interact with other programs. Several states now are suggesting that sustainability will be a management goal and have started to consider implementation. The suggestion was to look particularly outside of the United States, where there is considerable activity in Canada, Australia, and Western Europe. Although the STS Research Program participates internationally, this issue has not yet been addressed in a significant manner.

Detail to support the effectiveness claims of the Program will become even more important as the end of the MYP period occurs. In several ways, this is an "engineering" as well as a research

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program. The BOSC suggests that it would be especially important to list those papers and activities since the beginning of the current MYP. It would be straightforward to complete a separate bibliometric analysis for the papers or reports published since 2007.

The panel reached a consensus judgment that the ORD STS Research Program was responsive to the comments of the BOSC and has responded in a way that "exceeds expectations" overall. The STS Research Program responded to all points in the BOSC report, but the response lacked specifics in some of the items. For example, within the People, Prosperity, and the Planet (P3) and extramural research programs, it is not clear how the STS Research Program will induce or promote the use of metrics during formulation of proposals. Has the Program re-allocated staff or funds to reflect/support the new priorities as outlined (specifically) in LTG 1?

It would have been useful to have been given a list of key metrics proposed as "foundation metrics," such as water quality, water use, water discharge, carbon dioxide emissions, energy use, solid waste generation, solid waste to landfills, ecological impairment, and so forth. In going forward, there is a need to keep the metric list simple, straightforward, and easily measurable. Using biofuels as an example to begin to define sustainability and build a set of metrics is a sound idea that can be built on. Also, combining LTG 1 (metric) and LTG 2 (models) is needed for the biofuels and other evaluations.

The STS Research Program was well organized for the mid-cycle review and provided the Subcommittee with the appropriate amount of background materials and oral briefing.

A table is presented in Appendix C that provides comments from the STS Mid-Cycle Subcommittee on the responses of ORD to comments from the 2007 BOSC program review.

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IV. CHARGE QUESTION # 2

How clear is the rationale for the STS Research Program as described in the documents provided to the Subcommittee? Is it consistent with the advice previously given by the BOSC?

The rationale for the LTGs was clearly set forth in the background documents provided and in the oral description of the design of and vision for the future Program. The responses to the comments made during the full program review also clearly indicated the new direction for the Program. Finally, the oral presentation made by Dr. Alan Hecht, Director for Sustainable Development, also was thoughtfully laid out and clearly presented.

The rationale for using biofuels as the focus of the Program was not particularly clear in the MYP, but the white paper provided an excellent rationale for this initiative. The clearest rationale was given in the oral briefing by Dr. Hecht, both during the conference call and at the face-to-face meeting. The BOSC concludes that, after reviewing all of the written materials and hearing the oral description and the following clarifying discussion, the rationale for the use of biofuels as a mechanism to create a common vision for sustainability within the Federal Government (and EPA specifically) seems well focused and appropriate.

There needs to be a clearer vision of how critical problems that are outside of EPA control in significant respects, such as biofuels sustainability, can best be addressed by the STS Research Program. There is a need to position the STS Research Program as a leader within the Agency and as a focal point in which concepts for sustainability and metrics of progress toward sustainability are developed that can be used throughout the government and industry. The STS Research Program also can be a leader in assuring that these important sustainability perspectives are included in national debates. This requires outreach to a range of communities and collaborative partnerships with the private sector, academia, and other government agencies.

Dr. Hecht presented a diagram at the face-to-face meeting meant to illustrate the position of the LTGs' position within the STS MYP. The diagram shows information or logic flow between and among LTGs, and the LTGs are shown in parallel. This is counter to the manner in which they are described and should operate; the LTGs should be integrated and feed one into another. This figure should be re-thought. The step described in the left-hand box in this diagram is, "Develop an understanding of systems by conducting assessments of current and future scenarios." This is a critical step that should not be separate from or precede the LTGs. Considering future scenarios is particularly important as the Program charts a course toward a more sustainable future.

The rationale for the design of the extramural research programs is not nearly as clear as for the biofuels research program. It would be useful to tailor the external programs to better support the overall STS vision as described in the LTGs.

When considering sustainability with the biofuels issue as the focus of the Program, the BOSC suggests that the scale of sustainability be considered. The biofuels program in collaboration with the Ecological Research Program embraces much of the upper Midwest. The San Luis

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Basin project is designed at a much smaller scale but is more typical of the kinds of sustainability programs that have been developing in western states. The Portland project is at the small end of the scale and is very focused and applicable to applied public planning activities. Will scale be a feature of the current program, or will it be included in the next MYP? The question of scale also may be critical in selecting metrics/indicators of sustainability for national or local governments and managing technologies and landscapes.

The STS Research Program is encouraged to continue investigating tools for managing landscapes in cooperation with the Ecological Research Program. In deciding what to use as a metric, there also should be consideration as to what kind of analysis tools will be used. Will a life-cycle assessment (LCA) approach be the analysis tool, and what kinds of metrics would be applicable? Will taking a probabilistic approach as in environmental risk assessment be a possibility so that distributions of metrics can be used? Until the analysis tools are better defined, it will be difficult to finalize the metrics.

The STS Research Program has made major contributions to LCA. Where possible, the BOSC suggests that these activities be continued and indicators of sustainability continue to be developed for the LCA process. The reasoning is that LCA has the general format of any analytical decision-making process, and the STS research group has extensive expertise in this field. With some adjustments, a modification of the LCA approach may be applied to questions regarding sustainability in a variety of situations and scales, including biofuels. The BOSC did not see plans to leverage the Program's LCA expertise in furthering its goals. The BOSC can visualize how parts of the LCA approach could be applied easily to the Portland case study; the approach also probably could apply to the San Luis Basin application and certainly to the entire area of biofuels.

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V. CHARGE QUESTION # 3

If needed, what additional performance metrics (e.g., quality and impact of publications, timeliness of completing goals) might be appropriate for the STS Research Program?

Because the STS Mid-Cycle Subcommittee did not receive actual data and detailed information to support ORD STS responses, it was difficult to "evaluate the accomplishments and effectiveness of the funded research." In this regard, it is difficult to ascertain whether the Program will be able to arrive at an adequate and representative set of metrics.

The BOSC recommends avoiding performance metrics such as number of publications and similar "soft" metrics. The performance metrics must be outcomes-based and support that true sustainability is being achieved with clear linkage to the STS Research Program. For example: (1) the number of industry engagements, because this is "where the rubber meets the road"; (2) collaboration within ORD to encourage these programs and their budgets to focus on sustainability, especially as the biofuels program is a good test case as it relates to air, human health/ecosystems, water quality, land use, and pesticides/toxics; and (3) updating and verifying developed models.

The BOSC encourages the STS Research Program to think about other means of demonstrating transfer of information and the overall impact of the Program. It is anticipated that the biofuels, San Luis Basin, and Portland projects will result in publications with joint authorships that demonstrate the collaborative impact of the research. Participation in national and international workshops, allied professional association conferences, research programs, and meetings also would be an indicator of impact. It also may be possible to jointly fund projects outside of the Federal Government (states, cities, counties, etc.) and internationally. Although tracking of this information would be time-consuming, it would be an important measure of the overall impact of the Program.

The greatest impact of the STS Research Program will be to serve as the coordinating forum for sustainability issues across the Agency and Federal Government. For this reason, one suggested metric of success is quantifying and recording the number of times the STS Research Program is consulted by other programs; emphasis should be placed on team participation and multi-authored publications.

It would be useful to develop a metric that reflects technology transfer from the STS Research Program. Specifically, it would be useful to track whether metrics promoted by the Program are being used both within EPA and extramurally. This possibly could be assessed by examining proposals to the P3 and Small Business Innovation Research programs to determine whether the proposed metrics are being used more frequently in the proposals.

Additional metrics of performance that reflect necessary activities may include: (1) joint papers/documents with other agencies, (2) case studies of outcomes and their impacts,

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(3) number of industrial partnerships; (4) number of keynote addresses; (5) number of people addressed; and (6) number of presentations.

There is a long history of documenting outcomes and impacts in the extension systems developed by land grant universities. The extension organizations have prepared very good guidance manuals that should be of use to ORD and the STS Research Program (e.g., *How to Conduct Evaluation of Extension Programs*, a 1999 manual by Murari Suvedi, Kirk Heinze, and Diane Ruonavaara that can be found at http://www.canr.msu.edu/evaluate/SourcesFiles/Training%20Manual.htm. Other useful resources can be found at https://www.msu.edu/~suvedi/Resources/Evaluation%20Resources.htm

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VI. CHARGE QUESTION # 4

What changes could the Program make to enhance the impact of the research products and complement other existing efforts in the field? How should products be delivered to ensure they are used within and outside the Agency, thereby contributing the greatest value?

The BOSC suggests that extramural funded research be maintained and internal programs be better aligned with the STS Research Program.

It is suggested that the Program, or some other designated and recognized sustainability-focused group within EPA, should formally be established as the focal point and overall coordinator for a major sustainability program. Without this, the effectiveness of the STS Research Program is limited, and as such the models and tools developed will have limited application. Presently, the Program "throws them over the fence," hoping that someone picks them up and uses them. This in essence marginalizes the Program when it should be elevated and recognized as the entity to drive sustainability within all governmental agencies and coordinate all related activities, including those by universities, industry, and stakeholder groups. Presently no such entity exists, resulting in a collection of unfocused groups duplicating their efforts or performing contradictory activities. The STS Research Program has the personnel with the experience and expertise to fulfill this need.

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VII. CHARGE QUESTION # 5

Given the need to strategically focus the STS Research Program on national environmental priorities, is the initial focus on biofuels appropriate considering the STS LTGs? If so, is the proposed program appropriately designed to address these important issues?

During the 2007 full program review, the BOSC suggested that to make a significant impact on the field of sustainability the STS Research Program needed to focus its resources and develop some demonstration projects that could be used as a focal point to develop general concepts and metrics. The choice of the sustainable biofuels system as a "test bed" to focus the tools, methods, and metrics developed by the Program is excellent. The focus on biofuels fulfills the Program elements outlined in both LTG 1 and LTG 2. This choice will not only allow the development of concepts and metrics but position the STS Research Program to make a significant contribution to a critical national need. It is important to consider the consequences of future biofuels scenarios. This argues for the further development of methods such as "consequential" LCA. The STS Research Program should be proactive and examine likely future biofuel scenarios and not take the more reactive role of analyzing scenarios that already exist. A sustainable biofuels system must be planned so that irreversible investments in technology do not lock in undesirable configurations. This requires the use of models and forward-looking analyses.

In the view of the BOSC, biofuels research is an excellent choice to examine how sustainable the biofuels approach is; it can be used as an example to develop concepts, tools, and metrics. Also, EPA can transform itself into being a technology enabler for enhancing the biofuels program rather than being viewed as a regulatory Agency that is setting up regulatory hurdles. The BOSC recommends that the Program determine the issues and then develop technology programs to overcome the hurdles in a sustainable manner. The choice of biofuels will strategically position the STS Research Program to maximize continued fiscal support.

Although the BOSC agrees that the focus on biofuels is appropriate, there are some possible concerns that need to be recognized and managed. For instance, several questions need to be considered: Can the STS Research Program keep up with changing technology and maintain influence given the U.S. Department of Energy's huge presence? Regulations are written about pollution rather than sustainability. Can the Program maintain relevance if EPA does not follow the Program's lead? Can the STS Research Program deal with hybrid biosynthetic processes as well as purely biological processes in its analyses? How will the borders of biofuels, as they relate to the sustainability research question, be defined?

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VIII. CHARGE QUESTION # 6

Are there any other areas of national significance in the near term that the Program should address?

In general, it is suggested that EPA take a more organized and ambitious role—in addition to its regulatory responsibilities—in a technical assistance mission that enables the United States to move to true sustainability. This relates to enabling cooperation and coordinated technology development via partnerships among industry, community stakeholder groups, universities, professional associations, advocacy organizations, and government agencies at the local, state, and federal levels. EPA efforts to date to provide applied research and case study information for advancing sustainable planning and development practices have been well received and respected in the public planning realm. The STS Research Program is positioned to take on this leadership role and in doing so can become one of the most influential programs within ORD. Specifically, the STS Research Program could concentrate on developing metrics and tools with a "holistic focus" to enable sustainability by focusing on protecting human health and the environment and enhancing economic growth simultaneously.

As a federal agency leader in advancing the practice of sustainability, EPA also will need to broaden its capacities and/or form partnerships to advance the whole of sustainability. Specifically, the EPA environmental, scientific focus excludes the social equity component of the accepted three-component definition of sustainability: environment, economy, and equity. In this regard (and consistent with National Environmental Policy Act definitions), a sustainable future also will necessitate qualitative assessments and quantitative measures for human health and well-being. The BOSC noted that few other federal agencies have addressed sustainability topics as actively and as long as EPA; hence, the Agency should actively advance the whole-system concept of sustainability even while it expands the Agency's normal mission area in support of other federal agencies taking up their respective sustainability responsibilities. The federal practice can be seen increasing in agencies as diverse as the U.S. General Services Administration and the U.S. Departments of Transportation (Federal Highway Administration), Defense, Commerce, Interior, Agriculture, and Housing and Urban Development.

Currently, many regulatory programs—developed more than 20 years ago and having served a useful purpose—are now such that they can impede the sustainability agenda. One such example is in the case of industrial by-products classified as a Resource Conservation Recovery Act hazardous waste; this designation prevents by-products from being land-filled, but it also makes it difficult for the material to be beneficially reused even when it can be done in a protective and sustainable manner (i.e., low cost and/or low energy). The present regulatory structure does not allow this to be done easily.

Although biofuels research probably is the best choice for the "pilot" holistic program, some other issues of national concern include:

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- Energy and climate changes.
- Water sources, distribution, and quality.
- Land-use policies and urban sprawl.
- Existing buildings—what can be done to render them more sustainable?
- Infrastructure—how can it be rendered truly "sustainable" in all senses?
- Transportation and sustainability scenarios.

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IX. SUMMARY ASSESSMENT

The BOSC assigned an overall assessment score of "Exceeds Expectations." This rating was considered to be appropriate as the STS Research Program addressed all of the BOSC recommendations and has done so in a manner such that it is clear that the Program is on a path to establishing itself as one of the main bodies within EPA (not just ORD) focused on sustainability. The STS Research Program can be a "change agent" and is trying to fill in the huge white space that currently exists within EPA related to sustainability. If the Program was more recognized within the Agency as being this entity, the rating would have been "Exceptional," as the Program would have the clout to actually move the agenda forward; however, because the STS Research Program currently is marginalized by EPA and has not received recognition as the lead organization for sustainability within the Agency, its effectiveness in moving the agenda forward is questionable. This lack of recognition is in spite of a strong and focused research and development program that will generate useful information and tools. There is a need for a better method to deliver information on sustainability with a true partnership among all stakeholders, including industry. The expertise and the will to fill this critical need within EPA are there, and the current leadership and plan are in place to make this transition.

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X. APPENDICES

Appendix A: BOSC Science and Technology for Sustainability Mid-Cycle Subcommittee Charge

1.0 Objectives.

The objectives of this mid-cycle review are to:

1. Evaluate the progress made by the Office of Research and Development (ORD) Science and Technology for Sustainability (STS) Research Program toward addressing the recommendations that resulted from the initial program review (April 25–26, 2007), and

2. Evaluate and obtain advice on key future directions for the research program that have been developed and other potential areas that could be considered.

2.0 Background Information.

Independent expert review is used extensively in industry, federal agencies, congressional committees, and academia. The National Academy of Sciences has recommended this approach for evaluating federal research programs.[1]

For the Agency's environmental research programs, periodic independent reviews are conducted at intervals of 4 or 5 years to characterize research progress, identify when clients are applying research to strengthen environmental decisions, and evaluate client feedback about the research. Mid-cycle evaluations are an important part of this program review process. Scheduled midway through the review cycle, these independent assessments give ORD an opportunity to gauge the Program's progress relative to the commitments it made following its last review.

For the upcoming mid-cycle review, the STS Research Program is preparing a progress report that will provide the context for discussions during the meeting. The report will identify progress the program has made toward its Long-Term Goals and changes implemented by the program in response to BOSC's major recommendations from the 2007 review.

The STS Research Program has undergone significant changes since the initial BOSC review. The changes are based on: (1) the BOSC 2007 recommendations, (2) feedback from the 2006 Office of Management and Budget Program Assessment Rating Tool review, (3) significant emerging issues in the sustainability arena, and (4) budget and organizational changes in EPA.

1 Evaluating Federal Research under the Government Performance and Results Act (National Research Council, 1999).

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As a result, ORD has initiated work on a few key emerging areas of science (e.g., biofuels and green building issues).
Several documents will be provided to the Subcommittee to use in addressing the charge questions. ORD will provide two tables that summarize the changes to the overall program. Additional documents include, but are not limited to, the latest versions of the STS Multi-Year Plan and the *EPA Biofuels Strategy*.

This review is not intended to be the in-depth technical evaluation of a full program review. Presentation time at the face-to-face meeting will be minimized in favor of discussion.

3.0 Charge Questions for ORD's Science and Technology Sustainability Research Program.

ORD is interested in receiving feedback concerning the following questions:

1. *How responsive has the STS Research Program been to the recommendations made in the April 2007 BOSC program review report? The Subcommittee will evaluate progress made regarding "commitments" to the BOSC recommendations as outlined in ORD's response. Specifically, the BOSC will evaluate the accomplishments and effectiveness of the funded research.*

2. *How clear is the rationale for the STS Research Program as described in the documents provided to the Subcommittee? Is it consistent with the advice previously given by the BOSC?*

3. *If needed, what additional performance metrics (e.g., quality and impact of publications, timeliness of completing goals) might be appropriate for the STS Research Program?*

4. *What changes could the program make to enhance the impact of the research products and complement other existing efforts in the field? How should products be delivered to ensure they are used within and outside the Agency, thereby contributing the greatest value?*

5. *Given the need to strategically focus the STS Research Program on national environmental priorities, is the initial focus on Biofuels appropriate considering the STS LTGs? If so, is the proposed program appropriately designed to address these important issues?*

6. *Are there any other areas of national significance in the near term that the Program should address?*

4.0 Summary Assessment

In developing a short report that responds to the above charge questions, the BOSC Mid-Cycle Subcommittee should provide a summary assessment, including a single qualitative rating, which reflects the extent to which the program is making progress in response to the BOSC review of

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2007. The rating should be in the form of one of the adjectives defined below, which are intended to promote consistency among BOSC program reviews. The adjective should be used as part of a narrative summary of the review, so that the context of the rating and the rationale for selecting a particular rating will be transparent. For mid-cycle reviews, the rating should be based on the quality, speed, and success of the program's actions in addressing previous BOSC recommendations. The adjectives to describe progress are:

- *Exceptional* indicates that the program is meeting all and exceeding some of its goals, both in the quality of the science being produced and the speed at which research result tools and methods are being produced. An exceptional rating also indicates that the program is addressing the right questions to achieve its goals. The review should be specific as to which aspects of the program's performance have been exceptional.

- *Exceeds Expectations* indicates that the program is meeting all of its goals. It addresses the appropriate scientific questions to meet its goals, and the science is competent or better. It exceeds expectations for either the high quality of the science or for the speed at which work products are being produced and milestones met.

- *Meets Expectations* indicates that the program is meeting most of its goals. Programs meet expectations in terms of addressing the appropriate scientific questions to meet their goals, and work products are being produced and milestones are being reached in a timely manner. The quality of the science being done is competent or better.

- *Not Satisfactory* indicates that the program is failing to meet a substantial fraction of its goals, or if meeting them, that the achievement of milestones is significantly delayed, or that the questions being addressed are inappropriate or insufficient to meet the intended purpose. Questionable science is also a reason for rating a program as unsatisfactory for a particular long-term goal. The review should be specific as to which aspects of a program's performance have been inadequate.

5.0 Subcommittee Approach for Mid-Cycle Review

- Hold one combined administrative and technical (public) teleconference prior to the face-to-face meeting.

  - Allows Subcommittee to become familiar with Federal Advisory Committee Act (FACA) meeting requirements.

  - Allows the Subcommittee Chair to make review and writing assignments.

  - Allows the ORD to present background and other relevant materials to the Subcommittee.

  - Allows the Subcommittee to ask clarifying questions.

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- ✧ EPA shall distribute background materials and documents requested by the Subcommittee in advance of the teleconference calls.

- Hold a 1-day face-to-face meeting for the mid-cycle review.
  - ✧ The meeting will include brief ORD presentations on program progress.
  - ✧ Members of the Science and Technology for Sustainability Mid-Cycle Subcommittee will ask questions and discuss the progress with ORD representatives.
  - ✧ Subcommittee members will draft portions of the short report.
- Hold one teleconference call within 1 month following the face-to-face meeting to finalize the draft short report.

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Appendix B: BOSC Science and Technology for Sustainability Mid-Cycle Subcommittee

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Appendix C: Subcommittee Comments on Responses of ORD to the 2007 BOSC Program Review

This appendix presents a table of BOSC recommendations and ORD responses/actions for the 2007 BOSC program review of the STS Research Program. The BOSC Mid-Cycle Subcommittee Comments are in ***bold italics.***

Issue #	Recommendations	Response/Actions	Time Line
1a	A clear definition of sustainability and a framework for its application are required to fund appropriate extramural research programs and to determine the efficacy of specific metric or decision tools. ***Recommendation being addressed.*** ***Like the fact that the STS Program is taking the initiative to fill in the white space by involving other EPA and non-EPA groups to address what is really meant by being sustainable; not so much the definition of the word, but to define what issues need to be addressed and programs implemented to achieve sustainability.***	While the STS Program adopts the general definition of sustainability given in E.O. 13423, more specific goals and metrics must be defined for each media or cross-media element, as in the case of sustainable production of biofuels. ORD will coordinate a series of workshops to facilitate discussions that will further identify sustainability outcomes and metrics in key areas, such as, for example, sustainable urban development, green building design, and sustainable agriculture. These workshops will be designed to engage key Agency officials in Program Offices and Regions to obtain their perspectives.	Sept 09
1b	Definitions are needed for some terms to improve clarity of Program elements and responsibilities. ***See 1a above.***	See response above.	Sept 09
1c	Develop an outline for how metrics for sustainability will be developed. This should include criteria for assessing the utility and predictability of metrics. ***Recommendation being addressed.*** ***Like the approach of selecting a few test cases to determine appropriate metrics as in the biofuels program. Not much discussion of MYP in information given before or during face-to-face meeting.***	In the revised MYP, the general approach for the development of sustainability metrics will be described, including criteria to assess their utility.	Feb 09
		ORD is working with other federal agencies to define a set of criteria and indicators for sustainable biofuel production. This work will be a model for application and development of metrics in other areas.	Nov 08

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Issue #	Recommendations	Response/Actions	Time Line
1d	Coordinate metric development with other LTGs. ***See 1c above.***	ORD will add language to the MYP to ensure that appropriate linkages are made between the metrics LTG and the balance of the program. The revisions will factor in the role of metrics and other driving forces.	Feb 09
1e	Determine a strategy of how metrics will be used***.*** ***See 1a above.***	ORD will coordinate a series of workshops to facilitate a discussion to further develop definitions of sustainability concepts, including metrics. These workshops will be designed to engage key Agency officials in Program Offices and Regions to obtain their perspectives. During these discussions, ORD will address how metrics will be used to support the sustainability concepts identified and determine their applicability to key Agency programs. Biofuel work is a good case study. Here, the intent of using metrics is to define a "dashboard" of key environmental, social, and economic measures for all agencies to monitor. Where trends are going in the wrong direction, collaborative federal action would be initiated.	Sept 09
1f	The metrics developed under the Pollution Prevention and New Technologies (P2NT) Research Program have not pervaded other programs. ***Agreed as STS Program is trying to take the initiative for coordinating sustainability within EPA and is acting as a change agent with limited budget and no real mandate to do so.***	Although pollution prevention is an important consideration in other Agency programs, the P2NT Research Program was not specifically designed for or focused on metrics development for other programs.	N/A
1g	Going forward, an extramural program based on the Technology for a Sustainable Environment (TSE) Program could be crafted to emphasize metrics and how technologies move toward improving the measures. ***See answer to 1a above.***	The STS Program is pursuing partnerships with the National Science Foundation (NSF) and other extramural research agencies on topics such as Green Building. In addition, current projects funded under the extramural Collaborative Science and Technology Network for Sustainability (CNS) program are using decision-making tools to move toward identified sustainability outcomes on a regional scale. Many of the projects have a strong focus on metrics, and some also	Oct 08

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Issue #	Recommendations	Response/Actions	Time Line
		are incorporating technologies. Beginning in October 2008, ORD will initiate a monthly webinar accessible to all of EPA on these projects. In addition, ORD will sponsor a workshop in the spring of 2010 to bring together internal and external investigators to identify lessons learned from the CNS program and identify any specific outputs from the ongoing projects that could be used to enhance research efforts related to metrics and decision support.	
1h	Testing protocols (in real-world applications) should be established to determine if the metrics are measuring the intended functions, if they are consistent in their evaluation, if they are sufficiently independent, and if they can be effectively used to determine if specific actions are driving society to become more sustainable. ***Agree with response.***	We agree metrics should be evaluated to ensure that they are moving society to a more sustainable future. There is some work underway to develop and test a set of system metrics that represent the most fundamental properties and processes that must be preserved to ensure the sustainability of a particular geographical system or region (e.g., the San Luis Valley community). However, since these studies are data-intensive and often resource-intensive, the extent to which EPA alone can fund and manage such activities is limited. Therefore, at the present time, our efforts are limited to geographic-specific studies such as the one above and a new effort in the area of biofuels. The revised MYP will reflect our current plans in these areas.	Feb 09
1i	The predictability of the models should be evaluated and sensitivity analyses conducted. ***See above.***	See response above.	Feb 09
1j	Sustainability targets need to be identified so that appropriate metrics can be designed and tested. ***Agree with response.*** ***It is very clear that the STS Program realizes that the right metrics are critical and it is on the right approach—need to walk before you can run.***	ORD will coordinate a series of workshops to facilitate a discussion on further developing definitions of sustainability concepts, including metrics and how to make them operational. These workshops will be designed to engage key Agency officials in Program Offices and Regions to obtain their perspectives. During these discussions, ORD will address metrics and their applicability to key Agency programs.	Sept 09

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Issue #	Recommendations	Response/Actions	Time Line
1k	Critical experiments should be designed that allow testing of hypotheses within the realm of defined metrics. ***Agree with response; however, use of biofuels as a test case should be main test case focus.***	We agree that the intent of metrics is to ensure that they are moving society to a more sustainable future. There is some work underway to develop and test a set of system metrics that represent the most fundamental properties and processes that must be preserved to ensure the sustainability of a particular geographical system or region (e.g., San Luis Valley community). However, since these studies are often resource intensive and are data intensive, the extent to which EPA alone can fund and manage such activities is limited. Therefore, at the present time, our efforts are limited to geographic-specific studies such as the one above and a new effort in the area of biofuels. The revised MYP will reflect our current plans in these areas.	Feb 09
1l	Evaluation of the metrics should be done systematically and quantitatively. ***Agree with response.***	Our new work on biofuels is setting a model of how we might proceed to address critical national issues. ORD will use the biofuels example as a model of how to work across EPA and the rest of government to establish and implement metrics that are systematic and quantitative.	Nov 08
1m	A team that was better integrated throughout EPA could draw on additional resources that could enhance their effectiveness. ***This response will not address the real issue: that EPA needs to get serious about sustainability and lead this initiative.***	ORD will expand the existing metrics team to include other parts of the Agency. For example, an internal EPA team focused on sustainable biofuel production has been organized and is already discussing issues related to metrics.	Jun 09
2a	The relevance and impact of the Green Technology Program (GTP) is less apparent, and this program needs to be assessed internally to determine if it is serving a function that is not being met already by the private sector and academia. ***Agree with response.***	ORD will deemphasize in-house Green Technology research (LTG 3) and modify the MYP to reflect increased emphasis on metrics (LTG 1) and decision support tools (LTG 2). The MYP also will be modified to indicate that extramural GTP efforts will be focused on partnerships with other funding agencies to help identify important priorities.	Feb 09

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Issue #	Recommendations	Response/Actions	Time Line
2b	All of the program elements and the Green Technology Program in particular are in need of refinement to better address sustainability issues and to demonstrate and articulate the role that they play in contributing to sustainable outcomes. **Agree with response.**	See response above.	Feb 09
2c	Consideration should be given to redirecting the Green Technology Program or replacing it with an extramural grants program. ***Agree with response.***	See response above.	Feb 09
2d	*Green Technology:* Carefully examine the rationale for the selection of target areas/technologies to better address market failures and tie outcome measures to sustainable measures and metrics. ***Agree with response.***	See response above.	Feb 09
2e	Results derived from the Green Technology Program have not been effectively communicated to larger industrial enterprises. ***Do not agree with response as one Subcommittee member does not think this Program has been widely publicized because this is his function in Industry and he is not that aware of it. Focused engagement of the private sector should be a part of the plan.***	The research results from the Program's many projects have been the subject of numerous presentations at national professional meetings attended by representatives of nearly all major chemical producers. In the 10-year period from 1996 to 2006, the Green Chemistry program published 384 peer reviewed papers, 34% of which are listed among the top 10% of all cited papers in their field. Recently, a member of the Program's staff was elected as the Second Vice-Chair of the American Institute of Chemical Engineers' Environmental Division, thus providing an additional opportunity to highlight ORD sponsored Green Chemistry research.	N/A
3a	The P3 Program should improve the solicitation/judging criteria to require a clear statement by students as to the effects articulated via sustainability metrics or decision tools. A clear tie-in with	The MYP will be revised to indicate that the P3 program already requires student teams to quantitatively and/or qualitatively articulate the benefits of their project in the social, environmental, and economic dimensions, both at the proposal stage and	N/A

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Issue #	Recommendations	Response/Actions	Time Line
	the goals of LTG 1 and LTG 2 could be developed. ***Also need to engage the private sector.***	at the final report stage. Results from ORD's STS research program will be used to enhance the sustainability criteria used in future P3 solicitations.	
3b	The Small Business Innovation Research (SBIR) Program should increase its use of sustainability metrics in selection criteria and increase the linkage of program outcomes to sustainability metrics. ***Agree with response.***	The MYP also will be modified to indicate that this is an excellent opportunity to focus on sustainability in the SBIR program. Like other extramural programs, SBIR is in the stage of identifying solicitation topics. SBIR already releases "success story" reports that quantify environmental benefits. SBIR is structured to address technology priorities across the Agency, many of which have been sustainability-related in recent years. In addition, the law that authorizes SBIR requires that potential for commercialization be a strong criterion for funding. Results from ORD's STS research program will be used to enhance the sustainability criteria used in future SBIR solicitations.	N/A
3c	The [P3] Program could benefit from a more systematic evaluation of the program outcomes, such as tracking of careers of recipients to obtain information that can be used to measure impact as outcome. Thus, a detailed analysis of the impacts on the P3 Program on the student participants is desirable. ***Agree with response.***	Although the P3 Program is a relatively young program (it was started in 2003), the National Center for Environmental Research is working with ORD/Office of Resources Management Administration to assess the effectiveness of the program relative to its role in: (1) stimulating sustainability in academic institutions; (2) providing students with an opportunity to work on real-world problems and thereby learn the value of teamwork and diversity; and (3) develop technologies, tools, and processes that promote sustainability.	2010
4a	The Subcommittee recommends integrating an implementation plan as part of the STS MYP. ***Agree with response; however, as stated previously, the MYP information was not apparent in the materials, and the deadline is cited as Feb 09. This was a bit confusing.***	As part of the revision of the STS MYP, ORD will include additional appropriate language to better describe the planned research. However, the MYP is not intended to include specific implementation details about the research activities that ORD plans to perform over the next 5 years. ORD Laboratories and Centers typically develop these implementation details consistently with the MYP goals.	Feb 09
4b	The two Annual Performance Goals (APGs) do not seem to flow	ORD will make adjustments to the existing APG language and structure to ensure that	Feb 09

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Issue #	Recommendations	Response/Actions	Time Line
	well into a logical research plan with quantifiable goals and objectives. ***Agree with response but would have liked to have seen examples of what is being referred to in the response. See response to 4a.***	goals are more quantifiable and to better define the anticipated outcomes.	
4c	There needs to be significant interaction between this LTG [1] and, in particular, LTG 2, which are intimately tied together. It should be assured that there is integration and continuity among the elements during the plan for transition. ***Very general response—see response to 4a.***	ORD will incorporate changes into the MYP that will better explain how ORD and its partners will integrate the various research components described in the STS MYP.	Feb 09
4d	LTG 1 metrics should be used to inform LTG 3 activities. ***Very general response—see response to 4a.***	Language will be added to the MYP to address this recommendation.	Feb 09
4e	Geographic and landscape orientation should be incorporated for local implementation. ***Very general response—see response to 4a.***	ORD also recognizes that sustainability will occur at various geographic scales. Some efforts within STS and in other programs already have activities that address geographic-specific sustain-ability issues. The MYP will be modified to more clearly reference these efforts.	Feb 09
4f	Economics and other social dimensions should be incorporated as part of feedback loops of process- or output-evaluated decision-making. ***Agree with response.***	Others in the Agency are doing components of this work. ORD will remain abreast of these activities and attempt, where feasible, to incorporate results into our decision tools.	N/A
4g	The life cycle assessment (LCA) programs, metrics, and procedures developed under the P2NT Research Program are relevant and important to the goals of EPA, stakeholders, and the international community. The STS Research	Agree.	N/A

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Issue #	Recommendations	Response/Actions	Time Line
	Program is positioned to move these initiatives forward and is encouraged to build on this strength. ***This is not really a recommendation but a statement, so agree with response.***		
4h	Ecological aspects should be incorporated into the decision analysis tools. Additional expertise might be needed to cover ecological systems, so it would be wise to strengthen collaborations with the ORD Ecology Research Program. ***Agree with response.***	Aspects of this recommendation already are being incorporated into ORD's Eco research program. Efforts to coordinate the two programs will continue.	N/A
5a	Some program elements are small components and lack a critical mass of personnel. Currently, much of the work being conducted by the STS Research Program is eclipsed by the magnitude and pace of advancements of industrial and academic communities. Thus, in developing the plan, the Program must make strategic decisions on where it can make an impact on the overall field. ***Agree with response. Furthermore, EPA needs to get serious about sustainability. A coordinating group with an appropriate budget is needed, as well as recognition and support to achieve true sustainability engaging other government groups, universities, and industry.***	The MYP will be modified to reflect integration or elimination of smaller components. ORD has advanced academic sustainability concepts by funding the TSE and CNS programs. Based on these recommendations and those of the Science Advisory Board, ORD already has made some strategic adjustments, to ensure high impact, including focusing on the key emerging issue of the sustainability of various biofuel production options, and these will be reflected in the revised MYP.	Feb 09
5b	The potential impact of the STS Program is limited by lack of a critical mass and resources. In developing the STS Research Program, ORD must make better	The revised STS will more clearly delineate the strategic program choices made and the criteria for selection. The ORD sustainability lead will conduct new outreach activities across EPA	Feb 09

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Issue #	Recommendations	Response/Actions	Time Line
	use of capabilities across ORD. ***See 5a response.***	programs and regions to help inform the strategic choices.	
5c	… is important to keep abreast of and continue to lead the development of LCA methodologies. ***Agree with response.***	ORD is already at the forefront of LCA methodology development.	N/A
5d	Development of streamlined methods is needed as part of the expansion of LCA tools (e.g., make them user-friendly) as well as integration of material flow analysis (e.g., industrial ecology concepts). ***Agree with response, but the Feb 09 time frame has passed.***	The MYP will be modified to ensure that it reflects streamlined LCA approaches. Several supported CNS projects employ material flow analysis (MFA) methodologies. ORD also is cosponsoring with NSF a special issue of the *Journal of Industrial Ecology* on applications of MFA.	Feb 09
5e	System-based methods are indispensable for moving toward sustainability. These are integrated in the STS MYP, but need to be integrated into tools. ***Agree with response, but Feb 09 time frame has passed.***	ORD already is taking a systems-based approach as it develops its integrated tools. For example, several efforts are underway to produce tools that will holistically examine the environmental impacts of biofuels. However, we will make this more explicit in the revised MYP.	Feb 09
5f	Carefully examine the rationale for the selection of target areas/technologies to better address market failures and tie outcome measures to sustainable measures and metrics. ***Agree with response.***	This is a very ambitious goal. Some STS elements attempt to provide technologies that promote sustainable choices, particularly the environmental implications of the production, utilization, and disposal of biofuels.	Feb 09
5g	The Environmental Technology Verification (ETV) Program should encourage an increased role in supporting emerging markets in trades/mitigation/offsets, such as mercury/greenhouse gases, etc. ***Agree with response.***	Several of the existing ETV centers have or currently are verifying technologies in emerging market areas. For example, in the area of climate change, ETV has verified several combined heat and power units designed to reduce carbon dioxide and other pollutants.	N/A

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Issue #	Recommendations	Response/Actions	Time Line
5h	An analysis should be conducted to determine if there are emerging markets in this trade/offset area that have a barrier surrounding verification issues. ***Agree with response.***	ORD's National Risk Management Research Laboratory already has engaged in market analysis research to identify where verification will be most useful.	Feb 09
5i	…industrial sectors [need] to have tools for streamlining LCAs that allow for rapid evaluation of environmental burdens. ***Agree with response, but has this been done to meet Feb 09 date?***	The MYP will be modified to ensure that it reflects streamlining LCA approaches.	Feb 09
5j	The Program should incorporate additional decision-making tools, such as probabilistic risk assessment, Bayesian networks, causal pathways, and Multi-Criteria Decision Analysis (Igor Linkov and others) in the research program. ***Agree with response, but has this been done to meet Feb 09 date?***	The MYP will be revised to explain the range of decision-making tools being applied.	Feb 09
6a	Because the STS Research Program is sparsely populated and not coordinated with outside efforts, a strategic plan that includes an awareness of what is being done outside of the Agency, including that of organizations outside of the United States, and how ORD can make a significant impact on the science should be developed. ***See response to 5a above. Need an initiative to make this happen in EPA as this request is way beyond R&D and the STS Program is doing its best to fill in the white space.***	Language will be added to the MYP to explain how areas in the STS are coordinated with international research and other outside efforts. ORD cannot commit to developing a separate strategic plan to describe these relationships. Since the sustainability concept transcends the STS, integration must occur with other ORD MYPs. ORD will lead a dialogue among its National Program Directors and others to determine how sustainability concepts can be integrated into the design and execution of all of its research programs. However, in order for sustainability concepts to become a priority, senior Agency officials such as members of the Science Policy Council will need to participate and support this effort.	Feb 09
6b	LTG 2 could be improved through targeted extramural collaborations	A number of tools have been developed or enhanced through the CNS program. An	N/A

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Issue #	Recommendations	Response/Actions	Time Line
	on the development of new tools or cooperation on the advancement of existing tools or tools being developed in the private sector. ***Agree with response and think the STS Program is doing the best it can at present.***	example is the Energy & Materials Flow & Cost Tracker (known as EMFACT), a free materials management tool designed for small business manufacturers. ORD has worked extensively with outside organizations to advance the implementation of new tools. For example, to help implement the Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts (known as TRACI), ORD has worked with numerous organizations and programs, including the NSF International/American National Standards institute and the Leadership in Energy and Environmental Design (known as LEED) green building rating system of the U.S. Green Building Council.	
6c	Efforts should be made to reach a wider set of stakeholders, such as nongovernmental organizations, state agencies, etc. ***This is a critical recommendation; heard that such outside engagement is being pursued.***	The revised MYP will identify specific efforts ORD will conduct to better characterize activities underway, nationally and internationally, in the areas of metrics and decision support tools to ensure that our research is adding incremental value.	Feb 09
6d	One example of a program with many successful elements is the ETV Program …. The Subcommittee would like to recognize two program elements that it considered to be of excellence. These include: (1) the public outreach component, which brings early public use; and (2) the clear team spirit of the Program members. To find a balance of speed and a team sense of "over-accomplishment" is rare. ORD can be rightly proud of this program element and the impact that it has had. The Subcommittee recommends this program element for an ORD citation if this has not been done already. ***Good response.***	The ETV program was nominated by ORD for and won an Agency Bronze Medal in 2004 for its work to verify homeland security technologies from 2002 through 2004. ORD agrees with the BOSC and will consider submitting a package recognizing these and other components of the ETV program.	N/A

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Issue #	Recommendations	Response/Actions	Time Line
6e	*SBIR*: Increase meeting of stakeholder needs. If the Program can better address the internal Agency needs from the STS MYP, it will provide a valuable service and be recognized more favorably. The goal of moving to a 100% cost share basis needs to be carefully evaluated. Although this will better leverage funds, it might miss important opportunities. This might be a future goal, but it needs to be determined if this would result in missed opportunities for small businesses. This could occur if they: (1) could not afford the assessment; and (2) are not being funded for this purpose through the SBIR Program. Additional SBIR opportunities in the broader set of sustainability concerns, such as land and water uses, need to be explored. One example might be the design of storm water handling systems in new developments. Certainly there are other opportunities as well. ***It would be good to see more engagement with bigger industries rather than small businesses, because larger organizations have resources as well.***	The SBIR Program encourages but does not require cost-sharing as part of the commercialization focus of the program. An SBIR Phase II Program review completed this year showed that 73% of SBIR projects secure additional investment beyond their SBIR awards. SBIR is structured to address technology priorities across EPA through the Environmental Technology Council and other mechanisms. Storm water management technology has been among the sustainability-related topics addressed by SBIR in recent years.	N/A
7a	The APGs should be provided in more quantifiable forms, generally in the form of SMART (specific, measurable, achievable, relevant, and timely) goals. The goals are written very generically, without sufficient measurable targets against which one can evaluate performance. Annual Performance Measure 1, 2008 is well-defined, but 2009 is nebulous and could be refined. ***Good response, but not clear that this has been done by the***	ORD will make adjustments to the existing APG language and structure to ensure that goals are more quantifiable and better define the outcomes anticipated.	Feb 09

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Issue #	Recommendations	Response/Actions	Time Line
	cited deadline.		
7b	The actual outputs and outcomes could be more clearly defined and communicated to targeted sectors. ***See above.***	See response above.	Feb 09
7c	The two Annual Performance Goals (APGs) do not seem to flow well into a logical research plan, with quantifiable goals and objectives. ***See above.***	See response above.	Feb 09
7d	*ETV*: The current outcomes analysis does not measure the effect of the ETV Program, because it does not attempt to identify outcomes in the absence of the ETV Program. Outcome measures stated in terms of numbers of verifications are probably better, even if considered less relevant. These metrics are better linked to the question of number of decision-makers/impacts. The metrics were deemed to be well-defined, but not well-quantified. ***Agree with response.***	Over the years, ETV has produced many protocols that are widely used across many industries to evaluate technologies and their environmental implications. ETV offers independent and unbiased data that decision-makers feel comfortable using for implementation of regulations and/or voluntary programs. The ETV program tracks its verifications and protocols and can provide the BOSC annual figures. On February 2, 2009, the ETV Program will be hosting a kick-off meeting for the "Advanced ETV European Effort to Support International Environmental Technology Verifications." The meeting will be held in Stuttgart, Germany. Also, held in conjunction with this meeting will be the 4th Annual International ETV Working Group Meeting, bringing together representatives from verification programs in the United States, Canada, and the European Union.	Feb 09

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Appendix D: List of Acronyms

APG	Annual Performance Goal
BOSC	Board of Scientific Counselors
CNS	Collaborative Science and Technology Network for Sustainability
EMFACT	Energy & Materials Flow & Cost Tracker
EPA	United States Environmental Protection Agency
ETV	Environmental Technology Verification Program
FACA	Federal Advisory Committee Act
GTP	Green Technology Program
LCA	Life Cycle Assessment
LEED	Leadership in Environmental and Energy Design
LTG	Long-Term Goal
MFA	Material Flow Analysis
MYP	Multi-Year Plan
NSF	National Science Foundation
ORD	Office of Research and Development
P2NT	Pollution Prevention and New Technology Research
P3	People, Prosperity, and the Planet
SBIR	Small Business Innovation Research
SMART	Specific, Measurable, Achievable, Relevant, and Timely Goals
STS	Science and Technology for Sustainability
TRACI	Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts
TSE	Technology for Sustainable Environment

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