

February 11, 2009

## **BOSC Mid Term Review**

### **Discussion Paper on**

## **Progress and Future Direction for the Science and Technology for Sustainability (STS) Program**

### **BOSC Mid term Review**

Information provided herein will address the following goals and review how the Office of Research and Development (ORD)'s sustainability research program has impacted EPA.

- Evaluate progress made by ORD for the STS program since their initial reviews in April 2007
- Evaluate and obtain advice on key future directions that have been developed by ORD and other potential areas that could be considered

### **Issues Identified During BOSC 2007 Review**

- 1) Better define, communicate, and coordinate metrics research and its outputs and better explain their relationship with other components of the STS
- 2) A broader focus may be required to leverage and inform what others are doing in Green Chemistry and Green Engineering
- 3) Use sustainability criteria to evaluate proposals (SBIR and P3)
- 4) Better program integration is needed as the P2NT transitions to the STS
- 5) ORD STS Program should be more strategic and focus on limited number of areas where it can make unique contributions and impacts
- 6) ORD needs to collaborate more extensively with outside partners to avoid duplication and enhance research impact
- 7) Develop annual goals that are better defined and quantifiable so that impact can be determined

### **ORD Sustainability Leadership in EPA**

ORD showed remarkable foresight and leadership in developing a *Sustainable Research Strategy (2007)* ([www.epa.gov/sustainability](http://www.epa.gov/sustainability)) emphasizing a systems approach to deal with environmental issues. The Strategy has influenced and affected the direction of a

number of EPA Programs: OPEI's Sector Reports on Energy and Manufacturing include sustainability measures (<http://www.epa.gov/sectors/index.html>); OPPTS Pollution Prevention Program is reassessing its long term goals and is seriously considering the goals of the ORD Sustainability Strategy; An interoffice Vision 2020 working group is revising OSWER's RCRA 2020 report with major focus on shifting from waste to materials management; and the Office of Water has developed a strategy for Sustainable Water Infrastructure ([http://www.epa.gov/waterinfrastructure/.](http://www.epa.gov/waterinfrastructure/))

In EPA and across government, ORD is recognized for its leadership on sustainability. The Sustainability program coordinates with other agencies on a number of activities, conducts training for EPA Program and Regional offices; and maintains and continually upgrades an EPA sustainability website that provides one stop access to all EPA sustainability and ORD research programs. This website ([www.epa.gov/sustainability](http://www.epa.gov/sustainability)) was significantly revised and updated on February 11, 2009 and new sections on energy and biofuels were added. While working closely with all regions, Region 10 has taken the lead in promoting these training workshops and in developing a regional sustainability website (<http://yosemite.epa.gov/r10/oi.nsf/sustainability/sustainability>).

By virtue of the above, the ORD sustainability program has become the recognized EPA point of contact for business and international partnerships. The Sustainability program routinely receives and distributes within EPA dozen of invitations to speak at national and international sustainability meetings and conferences. The Sustainability program also coordinates (with OIA and OEI) the interface between EPA and the EU 7<sup>th</sup> Research Framework. Such consultation and coordination has impacted the priorities of EU solicitations in climate change, and computation toxicology.

Domestic and international focus on sustainability and sustainability research has grown since publication of the ORD Research Strategy. A review of external factors affecting business and government policies strongly suggests that sustainability is likely to be the next level of environmental protection (Hecht, 2007: attached.)

### **STS Coordination with Other ORD Multi-Year Plans (MYPs)**

ORD has MYPs that provide science to support key Agency policy and regulatory objectives of the major EPA media-based programs (e.g., air, water, land) and provide science to address broader cross-cutting needs. The STS, Ecosystem and Global Change programs have broad policy implications across all media. The degree to which the sustainability research interfaces and impacts these existing national programs depends on the degree to which sustainability is specified as a priority within the overall objectives of the program. New EPA mandates related to biofuels have recently been enacted. As a result, new efforts have been initiated to understand the environmental implications and ultimate sustainability of these fuels. In other cases, such as safe drinking water or clean water or land remediation, the goal of achieving sustainable outcomes is less regulatory driven and more policy directed. The development and use of

sustainability metrics possible leading to ISO standard is also being discussed internationally for nanotechnology. A key objective of these metrics is to assess the degree to which the environment remains on a sustainable trajectory in the face of global change. The STS program is working closely with the following research programs to ensure they consider sustainability concepts:

- Clean Air
- Drinking Water
- Human Health
- Pesticide and Toxics
- Water Quality
- Land
- Nanotechnology
- Ecosystem
- Global Change

Recognizing the above, ORD management has promoted effective interaction among all NPDs and the sustainability program is aiming to leverage existing resources and impact program office priorities. One example of effective inter-program coordination is in the area of biofuels research. ORD's sustainability program has played a major role in coordinating EPA biofuel activities (see section below.) Consequently the Ecosystem Research Program launched a significant research effort to assess the impact of biofuel production in the Midwest (Future Midwest Study) and the Global Change Program provided additional resources from a new appropriation to the Sustainability Program to launch additional research projects.

Looking ahead, the degree to which sustainability becomes a key EPA objective depends on the degree to which ORD—in partnership with the program offices—can provide the information and tools that allow for sustainability principles to be incorporated into future policies and regulations.

### **Focusing on National Issues**

Both the BOSC and the Science Advisory Board (SAB) urged ORD to apply the tools and methodologies being developed in the STS research program to issues of national significance. The first key issue of significance the program decided to address is the expanded use of biofuels to address both energy security and environmental needs. The following events put ORD and the STS program in a leadership role on biofuels:

- Worked with OAR, Region 7, and the EPA Agricultural Counselor to develop an overall EPA Biofuel Strategy. The Strategy was reviewed by external advisory committees and recast as an EPA Coordinating Framework (CF.) The CF is being finalized into an EPA transition paper.

- Coordinated all EPA input into the interagency Congressionally-mandated Biomass R&D Board, ORD (and EPA) were instrumental in making sustainable biofuel production the overarching goal of the National Biofuel Action Plan (October 2008.)
- ORD in cooperation with USDA and DOE led development of science-based criteria and indicators for measuring sustainable biofuel production. This interagency work has identified 31 indicators organized into 4 groups of 14 proposed environmental, economic, social, and energy diversification and security criteria.<sup>1</sup> A paper outlining research limitations and needs for use of indicators has been published Hecht et al 2009 (attached.)
- ORD and EPA program offices and Region 7 have prepared transition paper requesting that a leadership team be organized to conduct the environmental assessment of the increased use of biofuels, as required by Section 204 of the Energy Independence and Security Act of 2007 (EISA 2007). The first assessment is due by December 2010.
- STS prepared an inventory of all ORD (lab, center and NPD) ongoing biofuel research and is now prepared if requested by ORD to organize and led efforts to develop an overall ORD research strategy.

### **STS and ORD Transformation**

The BOSC should be aware of an important context for their review of the future of the STS program. To best fulfill its mission ORD must fully employ its unique integrated multidisciplinary capability to solve increasingly complex environmental issues. Two important concepts are under discussion: First what is integrated multidisciplinary research (IMD). Second what are issues of national significance?

These concepts are important to the STS and were broadly recognized in the ORD Sustainability Research Strategy:

“The increasing stresses require new approaches to environmental protection that go beyond end-of-pipe control strategies concerned principally with pollutant emissions. Based on our understanding that environmental problems are rarely contained within a single resource or geographic area, we must develop and implement integrated and systems-based approaches to meet society’s needs today and ensure a more sustainable future.”

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<sup>1</sup> Criteria being defined as categories of factors, capacities, or processes that are used to evaluate the environmental, economic, or social elements of a sustainable biofuel system; Indicators being measurable outcomes of a criterion, a means for measuring or describing various aspects of the criterion.

In further development of these concepts of IMD and focusing on national issues, BOSC might consider the role the STS and sustainability plays in promoting cradle to grave analysis (Systems Approach), explicit consideration of all risks (Risk Analysis) and trade off s between costs /benefits.

### **Revisions to STS and Future Directions**

The STS Research Program is designed to ultimately position ORD to provide technical support to regional and national sustainability policies and initiatives. Toward this end, the STS Research Program has established 3 long-term goals (LTGS):

LTG 1: acknowledges the important role that metrics and indicators must play as the sustainability work evolves. It starts with a formal research effort to critically examine those metrics currently in use. It also calls for the establishment of collaborative projects to develop and test new metrics with the goal of maintaining a sustainable trajectory in the face of global change.

LTG 2: seeks to influence decision makers through the development of decision support tools that promote environmental stewardship and sustainable management practices. Based in large measure on the adoption of the life cycle perspective and sustainability metrics, this work encompasses both core research (in furthering methods and techniques) and applied research (with tools for specific clients).

LTG 3: emphasizes the role that technologies have in creating sustainable outcomes. Through the P3 competition and the ETV program efforts will be placed on finding solutions to client driven problems while promoting sustainable design and implementation practices.

Responding to BOSC recommendation, the following changes have been made:

- **Redirection of Resources.** Funding for the intramural Green Chemistry Program has been shifted to nanotechnology related activities. This redirection reflects the guidance that the STS Research Program received during its 2007 BOSC Review. The BOSC suggested that the Green Chemistry Program be assessed internally to determine whether some of its functions are already being met by the private sector or academia.
- **Collaborative Network for Sustainability.** While funding for this extramural grant program has been eliminated, ongoing work will be completed and disseminated. Disseminating research results through web broadcast was started last year and will continue. A report on the program will be released.
- **Sustainable Tools and Metrics for Biofuels.** Responding to SAB and BOSC recommendation to identify a specific national issue for applying sustainable tools and metrics, the STS Research Program has identified sustainable biofuel production as that issue. Working with other federal agencies under the Biomass

R&D Board a set of biofuel criteria and indicators has been proposed for policy level review. At the same time collaborative work has been launched external stakeholder groups.

## **Discussion of Issues and Future Direction**

### *Expanding ORD Biofuel Research*

One key objective of the EPA Coordinating Framework for Biofuels is to support research and assessment activities that will be essential for implementing traditional statutes and new EISA mandates. As such the CF proposes that EPA develop a prioritized research strategy aimed at enhancing in-house and extramural research to support continued improvement for LCA methodology; enhance scientific research to support ongoing RFS-2 regulatory development efforts; and initiate new efforts to characterize fate and transport of biofuel blends, and identify the need for modified or new remediation technologies, methods, and models.

EPA research is needed to assess impacts of current and new practices and technologies to produce EISA mandated volumes of corn and cellulosic ethanol and other alternative fuels on water quantity, air quality, GHG emissions, and ecological services, such as water quality, soil quality, and biodiversity. While EPA programs and regions have identified current research needs across the biofuel supply chain, additional work is needed to prioritize these research needs.

How ORD organizes itself and defines its role in an overall EPA research strategy is yet to be determined.

### *Defining a Strategy for Technology*

EPA's role in the area of development and evaluation of technologies includes activities ranging from providing funding for new innovative ideas through the Small Business Innovative Research (SBIR) program to verifying the performance of technologies using standard protocols. To date, these programs have only tangentially addressed the issue of how to ensure the development and adoption of technologies that will be sustainable over the long-term. EPA needs to have a role in the technology area in order to ensure the next generation of regulations and guidance are based on and encourage the use of the most sustainable approaches. However, EPA technology research is undergoing a major reassessment. At the current time, Except for the P3 Student Design Competition, the STS program does not have sufficient resources to invest in research on specific sustainable technologies. While there is annual funding for the SBIR program, it is not specific to the STS because funds are drawn from across the ORD budget and proposals requested to support technology needs identified by all the programs. Therefore, while the resources may be officially placed under the STS program, the program should not be considered part of the STS program due to its broad objectives. The role of the ETV

program in STS is under reevaluation. While the program will continue to fund the development of new innovative technologies through P3 programs and as funds are available from external sources and will also continue to verify innovative technologies through the ETV program, a clearer strategy on how to advance EPA and ORD in promoting sustainable technology development is needed. Any perspectives of the BOSC on this issue will be welcomed and can directly impact the redesign of the area. Understanding the environmental implications of technologies, providing tools to assist users evaluate the ultimate sustainability of a technology are areas under consideration, and partnerships with other federal agencies to support cutting edge academic engineering and physical science research in rapidly growing (or changing) sectors (including energy, green building, and nanotechnology) are areas under consideration.

### *Creating EPA Sustainability Metrics*

The STS program has established several Annual Performance measures (APGS) aimed at developing sustainability metrics in key areas and is leading a research effort on regional sustainability metrics (San Luis Basin Research Project.) What is missing is an EPA wide effort for science-based measures of sustainability comparable to the EPA Report on the Environment (RoE). The STS program has begun to inventory all proposed sustainability metrics and will propose to the ORD Executive Council that ORD lead EPA in developing such a national report on sustainability by 2012.

### *Managing Materials*

Significant EPA program office efforts are underway to shift EPA focus from managing waste to managing materials. The impetus for this shift in strategy reflects growing worldwide pressures to reduce energy and commodity costs, avoid regulatory issues, and adapt green technologies and green processing methods. Ongoing analyses have identified several high priority economic sectors where materials management is critical from an environmental, energy, water, and economics perspective. STS can play a critical role in supporting these efforts through development of a methodology for sustainable supply chain design, decision support tools, more effective processing and production methods and technology development especially related to use of nano-material in key sectors. A recent OSTP report on manufacturing supports this overall effort.

### *Energy Efficiency and Green Building Research*

Supportive of the managing materials thrust, the STS program is engaged with an Office of Science and Technology Policy effort to develop an interagency research agenda for High Performance Green Buildings. For this effort, EPA is in the lead for the water and materials sections. The materials research needs include targeted Life Cycle Assessment, enhanced Life Cycle Inventory data collection, development of enhanced materials management analytical methodologies, and research and development of building

materials and products with minimal environmental and public health impacts over their extended life cycle.

### **Research to be highlighted in the March 12 Mid Term Review**

#### LTG 1

- San Luis Basin
- Biofuel Research and Criteria and Indicators

#### LTG 2

- Waste Reduction (WAR) algorithm,
- LCA methodology

#### LTG 3

- P3
- ETV/ESTE