



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON D.C. 20460

OFFICE OF THE ADMINISTRATOR
SCIENCE ADVISORY BOARD

EPA-SAB-10- XXX

The Honorable Lisa P. Jackson
Administrator
U.S. Environmental Protection Agency
1200 Pennsylvania Avenue, N.W.
Washington, D.C. 20460

Subject: Office of Research and Development Strategic Research Directions and
Integrated Transdisciplinary Research

Dear Administrator Jackson:

On March 26, 2010, the Science Advisory Board (SAB) provided you with comments on the President's Requested FY 2011 Research Budget (EPA-SAB-10-005). As mentioned in that letter, the SAB has undertaken an advisory activity that has paralleled the annual research budget review since 2007: it has advised the Office of Research and Development (ORD) on strategic research directions. These parallel advisory activities have enabled SAB members to address strategic issues beyond a one-year budget horizon, while still allowing them to counsel EPA on practical realities related to annual budgets. We transmitted our last SAB report on ORD strategic directions on November 26, 2008 (EPA-SAB-09-006). We appreciated your April 21, 2009 response to that report, where you confirmed "ORD's goals are to both solve problems of broad, national significance that cut across multiple EPA program and regional offices...and to provide the more targeted research required to meet the needs of EPA's regulatory programs."

Since receipt of your April 2009 response, members of the chartered SAB have met with ORD representatives twice (on November 9-10, 2009 and April 5-6, 2010) to continue discussion of ORD strategic research directions. At the November meeting, SAB members received briefings on ORD's sixteen research programs. They participated in breakout groups with ORD National Program Directors, who have lead responsibility for research planning, and interacted with ORD scientists in a poster session highlighting recent research projects. At the April 2010 meeting, ORD leadership provided a presentation linking examples of current ORD research activities to your key priorities (improving air quality; assuring the safety of chemicals; cleaning up our communities; protecting America's waters; taking action on climate change; building strong state and tribal partnerships; and expanding the conversation on environmentalism and working for environmental justice). ORD also presented anticipated research accomplishments and their connection to these priority areas. ORD leadership

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1 emphasized that the overarching goal of sustainability is the “true north” and guiding principle
2 for all ORD research activities. Effective ORD research must generate science that helps solve
3 environmental problems and not just identify them. To meet this goal, ORD leaders informed us
4 that ORD would increasingly undertake "integrated transdisciplinary research," defined "as the
5 process to develop sustainable solutions to environmental problems by engaging partners who
6 transcend traditional scientific disciplines throughout each stage of the research process."
7

8 At the April 2010 meeting, ORD leadership asked the SAB to address six charge topics
9 related to ORD research directions and integrated transdisciplinary research:
10

- 11 1. The extent to which ORD's suggested strategic research directions address your priorities
12 by providing the scientific information needed to inform environmental decision-making,
13 especially decisions made by EPA’s Program and Regional Offices
- 14 2. Suggestions for key areas that ORD should leverage by working with other (non-ORD)
15 science programs across EPA and with the science programs of other Federal agencies
- 16 3. Areas for increased emphasis in ORD's research program over the next five years; areas
17 for decreased emphasis over the next five years
- 18 4. Are there strategic research directions that ORD should pursue differently or undertake as
19 it draws upon its unique expertise to conduct integrated, transdisciplinary research (ITR)?
- 20 5. Where can research on socio-economics best contribute to ORD’s ITR efforts?
- 21 6. Where can we apply lessons learned from environmental research to protect human
22 health and from human health research to protect the environment?
23

24 The intent of these charge questions was to focus SAB attention on whether ORD is "doing the
25 right science." ORD leadership noted that a separate EPA federal advisory committee, ORD's
26 Board of Scientific Councilors, provides ORD with detailed advice as to whether it is "doing the
27 science right." Based on discussions with ORD at the November and April meetings and the
28 background materials provided to us, we have reached three general conclusions. First, we
29 conclude that the current research highlighted by ORD, as well as the strategic directions ORD
30 suggested in April, clearly support your key priorities in general. Second, we strongly endorse
31 ORD's efforts to plan future research in light of: a) its relevance to Agency decisions linked to
32 one (or preferably several) of your key priorities, b) the potential of the research to deepen
33 systems thinking about root causes of environmental problems; and c) and the likelihood of
34 potential research to stimulate innovative environmental problem solving. Finally, we support a
35 systems approach and transdisciplinary research for ORD, because they will strengthen the
36 quality and relevance of research supporting EPA's mission now and well into the future.
37

38 However, we cannot fully address ORD's six charges because we lack the detailed
39 information needed to respond to those charges. Although ORD identified many positive
40 linkages between its research programs and your key priorities, the materials provided do not
41 characterize ORD's entire research portfolio. Therefore, we cannot address the *extent* to which
42 current research activities support key priorities, or identify areas for *increased emphasis* or
43 *decreased emphasis* in ORD's research program over the next five years, at this time. In
44 addition, two of ORD's charges focused on integrated transdisciplinary research, but ORD did
45 not provide the SAB with background information on its plans for implementation. We know
46 that integrated transdisciplinary research is a work in progress. The SAB needs a clearer

1 understanding of how ORD plans to develop and use the approach before we can provide
2 appropriate advice on strategic directions related to it.

3
4 ORD convincingly demonstrated linkages between ORD research contributions and EPA
5 accomplishments under the key priorities. Some research program areas, such as sustainability,
6 human health risk assessment, ecosystem services, and human health, contributed to all seven
7 priorities. Some contributed to fewer, but all research programs showed linkages to key
8 priorities in some way.

9
10 We recommend that EPA make these linkages when planning future research programs.
11 The ecosystem services program, for example, has no single program office champion, but it
12 generates science that is useful for decisions affecting clean air and water, cleaning up
13 communities, chemical safety, environmental justice, climate change adaptation and mitigation,
14 and decisions by state and tribal partners.

15
16 One of your key priorities, building strong state and tribal partnerships, deserves special
17 mention. While some EPA offices maintain regular contact with states and regions (e.g., EPA's
18 Office of Water meets twice a year with state toxicologists involved in drinking water standard
19 setting), there is no systematic communication between ORD and states regarding research
20 needs. A more systematic process is needed for states to identify, organize, prioritize and
21 communicate their immediate and anticipated requirements for science support into the ORD
22 research planning and implementation process. States have unique perspectives on
23 environmental research needs and can help inform research strategies and agendas, but many do
24 not have their own resources to conduct research. ORD could be more proactive in sponsoring
25 regular meetings and webinars and in encouraging ORD scientists (and managers) to participate
26 in Interpersonnel Agreements (IPAs) at the state level and similarly encouraging IPAs from
27 states to ORD. We recommend that ORD work actively with states, regional scientists, and local
28 academics to develop interagency research projects, such as community-based research.

29
30 The importance of a systems approach and integrated transdisciplinary research

31
32 We believe two changes are essential to support your key priorities. It will be essential
33 for EPA as a whole, and not just ORD alone, to adopt a systems approach to research planning.
34 It will also be essential to plan and conduct research in new, integrated and cross-discipline ways
35 to support this systems approach. The heart of a systems approach is an emphasis on
36 understanding an environmental problem or environmental management strategy in relation to
37 the environment as a whole, and not in isolation. A systems approach also incorporates
38 “feedback loops”, where what is learned from the research is fed back to and modifies the
39 research questions being asked, as well as the management strategies taken. A systems approach
40 will help EPA gain a fuller understanding of why an environmental problem occurs or how an
41 environmental management strategy might work. There are few examples of using systems
42 approaches in current ORD research programs, but one that stands out is the Sustainability
43 Program’s and Biofuels Interagency Work Group’s approach to understanding the environmental
44 impacts and benefits of biofuels. They are considering multi-media impacts and benefits to both
45 humans and ecosystems related to feedstock production, transportation to processing plants,
46 biofuels production and distribution, and the end-uses of the biofuels – the entire biofuels

1 “system” as well as an all-encompassing range of impacts and benefits. This allows for a
2 comprehensive assessment of biofuels and the development of more effective management and
3 mitigation strategies.

4
5 A systems approach that incorporated human health concerns into global change analysis
6 could be used to break down artificial barriers between human health and ecological assessment.
7 Systems approaches, if applied to air research or to ORD's "one hydrosphere" vision, could help
8 EPA better understand the root causes of environmental problems that may be related to energy
9 usage, transportation, and local planning and zoning.

10
11 Integrated research across disciplines, environmental media, and organizational units is
12 an essential tool in implementing the systems approach to research that will support your key
13 priorities. Again, there are examples of transdisciplinary research within ORD, such as the
14 Ecosystems Services program that has combined economics with ecology. We strongly
15 recommend that transdisciplinary research be implemented throughout ORD as the rule rather
16 than the exception. Development of such a systems-oriented, integrated transdisciplinary
17 research program that is responsive, innovative, and credible will require: 1) careful planning
18 and implementation; 2) strategic examination of ORD's workforce needs; 3) budget allocations
19 to align with research priorities; 4) effective integration of social science expertise into ORD's
20 work; and 5) commitment to conduct and evaluate transdisciplinary research pilots and apply
21 lessons learned to ORD's overall research program.

22 23 Implementing integrated transdisciplinary research: opportunities and challenges

24
25 ORD framed its discussion of strategic research directions by providing examples of
26 current ORD activity. ORD also provided a suggested research vision and strategic directions
27 and examples of anticipated accomplishments for each of your seven key priorities. We support
28 this approach, which links multiple ORD programs to environmental goals and tangible decision
29 contexts. ORD representatives noted that the suggested research vision and strategic directions
30 resulted from discussions between ORD National Program Directors, who provide leadership for
31 ORD research programs, and program office counterparts. It will be valuable for ORD to
32 confirm these suggested research visions with EPA managers in program offices and regions and
33 use the resulting visions for research to guide future planning and to communicate with the
34 public about ORD's research activities.

35
36 We recommend that ORD consider and implement as soon as possible strategies to 1)
37 encourage systems approaches to research and, 2) provide leadership for and support integrated
38 transdisciplinary research teams. Planning and conducting a systems-based and integrated
39 transdisciplinary research program requires mechanisms to encourage scientists to think outside
40 their traditional disciplines or research programs, to seek connections and questions that cross
41 research programs and media, and to look for "systems effects" related to a research question.
42 ORD National Program Directors noted the utility of linkages across ORD research programs
43 and linkages to your priorities in preparation for the SAB meeting. In the process, many
44 discovered new areas for possible collaboration, coordination, and data sharing. ORD
45 representatives also acknowledged that there is no clear process or mechanism to establish
46 leadership in interdisciplinary work beyond the National Program Director community.

1 Collaboration and coordination on research projects too often occurs serendipitously rather than
2 deliberately.

3
4 ORD's presentations demonstrated the value of transdisciplinary research and
5 collaboration across research program areas. ORD's management structure, however, currently
6 provides the ORD Executive Committee and ORD Laboratory Directors with primary control of
7 resources, while research planning is the responsibility of National Program Directors.
8 Integrated transdisciplinary research requires alignment of research resources with Agency
9 priority needs and is more likely to succeed with true matrix management that recognizes those
10 priorities and addresses resource allocation decisions. EPA's management of resources will need
11 to evolve to support transdisciplinary teams and their work. Priority areas such as environmental
12 justice, ecosystem services, sustainability, and climate change, which have no single program
13 office advocate and which are strong candidates for integrated transdisciplinary research, will
14 especially need a change in management and funding support to sustain viable research
15 programs.

16
17 The primary drivers for ORD's future research should be the overall goal of
18 sustainability, the Agency's key priorities, and the potential for encouraging innovation. Where
19 possible, ORD should play to its historical strengths, but ORD legacy programs should not
20 determine ORD's future research. Two areas where ORD's historical expertise relates directly to
21 your priorities and link to sustainability and innovation are the domains of assuring the safety of
22 chemicals and environmental justice. We encourage ORD to continue investments in green
23 chemistry and green engineering, and developing new ways to assess and model chemical
24 toxicity, including determining cumulative risks, toxicity of chemical mixtures, and toxicity of
25 vulnerable life stages. These new approaches will foster innovation to strengthen American
26 international trade competitiveness and may even open new opportunities for green jobs and
27 businesses in environmental justice communities. Similarly, environmental justice is a natural
28 platform for bringing together a wide array of disciplines in a model where integrated research
29 can play a role in eliminating problems that lead to environmental justice issues. ORD should
30 look for opportunities to work with communities to address such issues, where ORD can link its
31 historical expertise in chemical assessment and engineering to the social sciences. The SAB
32 would be pleased to work with the Agency to identify additional implementation opportunities.

33 34 Role of social and behavioral sciences

35
36 ORD's research direction largely misses strategic opportunities related to social and
37 behavioral sciences. It also misses the opportunity to improve ORD research programs by
38 incorporating social and behavioral sciences. It is important to note that your priorities call for
39 preventing and reducing adverse environmental impacts (e.g. *improving* air quality, *protecting*
40 *America's water*, *taking action* on climate change), not just studying how and why our life-
41 sustaining environmental resources are being degraded. If the intent is to have impact, then
42 research on social and behavioral science topics offer the most promising avenues to advance
43 your priorities. EPA needs to reorient its research agenda to recognize that many environmental
44 threats stem from the actions, decisions, and behaviors of individual Americans. The automobile
45 and its emissions is a classic example. ORD's list of current activities includes studying the
46 effect of vegetation on pollution reduction and studying emissions of biofuel blends. Although

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1 these represent important areas of research, they reflect ORD's legacy programs, oriented toward
2 regulatory support. They are likely to have little impact in terms of understanding and
3 influencing the social and decision-making dimensions of automobile purchases, commuting,
4 and vehicle miles traveled. Similar arguments can be made for strengthening research related to
5 unique social and behavioral patterns in environmental justice communities, understanding how
6 water is used and valued, and studying how energy is consumed and the impact of consumption
7 patterns on climate change. Social and behavioral sciences can provide knowledge that assists
8 EPA communicate science in ways that help people better understand their choices and give
9 them options for changing behavior.

10
11 Although ORD has reached out to social and economic scientists in some areas (e.g.,
12 through the use of consultants in its ecosystem services research program and through a recent
13 extramural solicitation for social science research related to improving homeland security risk
14 communication), ORD lacks intramural expertise to involve social scientists where they are
15 needed. Social, behavioral, and economic scientists have consistently been involved only in
16 ORD's global change program. They should be involved in all integrated transdisciplinary
17 research efforts, from initial problem formulation through final project evaluation. In addition,
18 research on benefits, costs, public values and perceptions, and behavior should be viewed as
19 appropriate subjects for environmental research and not as factors outside the paradigm for
20 science and research that ORD presented to SAB members at the April 5-6, 2010 meeting.

21
22 Conclusion

23
24 The comments provided in this letter are interim comments on ORD strategic research
25 directions and integrated transdisciplinary research. We are seeking continued and more focused
26 dialogue with ORD as part of the Board's efforts to advise on science and research supporting
27 EPA's decisions. The SAB looks forward to any comments you have at this time on our initial
28 reflections on these important topics.

29
30 Sincerely,

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33
34 Deborah L. Swackhamer, Chair
35 Science Advisory Board
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