



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

**OFFICE OF THE ADMINISTRATOR
SCIENCE ADVISORY BOARD**

June 2, 2011

EPA-SAB-11-007

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

Subject: Science Advisory Board Comments on the President's Requested FY
2012 Research Budget

Dear Administrator Jackson:

The Science Advisory Board (SAB) has a long history of reviewing the President's budget request for the Office of Research and Development (ORD). This year, the SAB requested specific budget-related materials from ORD, and an SAB Research Budget Work Group held a public meeting on March 3-4, 2011, to receive briefings from ORD management and interim National Program Directors. The Research Budget Work Group appreciated the quality of the presentations made by ORD and the diligent effort in explaining the main points of the budget in a compressed time frame. The chartered SAB held a public meeting on March 22, 2011, to review and approve this report prior to submitting it to you.

ORD has realigned its research from 13 project areas, defined by specific problems and media type, into four integrated programs (Air, Climate and Energy; Safe and Sustainable Water Resources; Sustainable and Healthy Communities; and Chemical Safety for Sustainability) related to your major priorities plus two cross-cutting areas (Human Health Risk Assessment and Homeland Security Research). This consolidation and realignment of programs reflects an emphasis on integrated transdisciplinary research, multi-pollutant exposures and sustainability. Considerable synergies will be realized in integrating ORD research activities into the new programmatic areas.

The SAB is highly supportive of the realignment of ORD research programs and of aligning the FY 2012 budget with them. The SAB is pleased that the realignment reflects the transdisciplinary and systems-based approach that has been recommended in previous SAB reports (*Office of Research and Development Strategic Research Directions and Integrated*

Transdisciplinary Research, EPA-SAB-10- 010; *EPA's Strategic Research Directions 2008: An Advisory by the EPA Science Advisory Board*, EPA-SAB-09-006). An example is the new area of Sustainable and Healthy Communities that recognizes the linkages between public health, ecosystem services and sustainability.

The SAB appreciates that in a time of budget declines, the requested reductions in ORD's budget are not as deep as the reduction for EPA overall. It is appropriate that the proposed cuts to ORD programs were not across the board but strategic, investing in some research programs while decreasing resources to others. Based on the information ORD has been able to provide the SAB at this time regarding its new alignment of research programs, our comments address the appropriateness of the proposed investments and disinvestments for advancing EPA's strategic research directions and meeting EPA's priorities.

Overall, the SAB is highly supportive of the increased investment in STAR Grants and Fellowships, strategic investments that will benefit future environmental research. The SAB supports the requested budget increases for the Safe and Sustainable Water Resources Research Program and the Chemical Safety for Sustainability Research Program as a minimum level for these programs, which will require additional funding to be fully successful. The SAB believes the cuts made to certain parts of the Homeland Security research program were understandable and justified.

We disagree however, with the planned disinvestments made in human health research because reductions in human health intramural research funding will hamper EPA's ability to conduct major epidemiological studies and understand cumulative exposures and risks. We strongly disagree with the requested level of investment in climate change research; ecosystem services science; and social, behavioral, and decision sciences. Funding for research on climate change adaptation should increase because this research will have broad impacts for environmental protection. The 10 percent cut in the President's budget for ecosystem research weakens a program that supports multiple EPA regulatory programs. Lack of funding for social, behavioral, and decision science research will frustrate efforts to attain environmental and economic sustainability. We are concerned that the requested level of funding in these areas will jeopardize EPA's ability to meet your environmental priorities.

Because ORD's restructured research programs are so new and ambitious, the FY 2012 budget does not contain a great amount of detail describing research activities and the breakout of funding. As a result, the SAB cannot fully comment at this time on the adequacy of the requested budget for advancing the individual research visions in each of the new programmatic areas. At ORD's request, the SAB plans to hold a joint public advisory meeting (June 29-30, 2011) with ORD's Board of Scientific Counselors to review the draft frameworks that ORD has committed to develop for each new research program. At that time the SAB will have additional advice that may be useful to the Agency in future budget planning.

The SAB is pleased to have again reviewed the EPA research budget and looks forward to continued work with you to strengthen the Agency's vital research base that supports your priorities. We look forward to receiving your response to this review and continuing our interactions with EPA to develop future advice on the Agency's science program.

Sincerely,

/signed/

Dr. Deborah L. Swackhamer
Chair
Science Advisory Board

/signed/

Dr. Jerald Schnoor
Chair
SAB Research Budget Work Group

NOTICE

This report has been written as part of the activities of the EPA Science Advisory Board (SAB), a public advisory group providing extramural scientific information and advice to the Administrator and other officials of the Environmental Protection Agency. The SAB is structured to provide balanced, expert assessment of scientific matters related to problems facing the Agency. This report has not been reviewed for approval by the Agency, and, hence, the contents of this report do not necessarily represent the views and policies of the Environmental Protection Agency, nor of other agencies in the Executive Branch of the Federal government. Mention of trade names of commercial products does not constitute a recommendation for use. Reports of the SAB are posted on the EPA website at <http://www.epa.gov/sab>.

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Science Advisory Board Comments on the President's Requested FY 2011 Research Budget.

1. Background

The Science Advisory Board (SAB) has a long history of reviewing the President's budget request for the Office of Research and Development (ORD). The SAB reviewed the President's FY2012 request for each of ORD's six research areas (Air, Climate and Energy; Safe and Sustainable Water Resources; Sustainable and Healthy Communities; Chemical Safety for Sustainability; Human Health Risk Assessment; and Homeland Security), plus a seventh research area, Economics and Decision Science, directed by the National Center for Environmental Economics (NCEE) in EPA's Office of Policy. The SAB addressed five common questions to each program area:

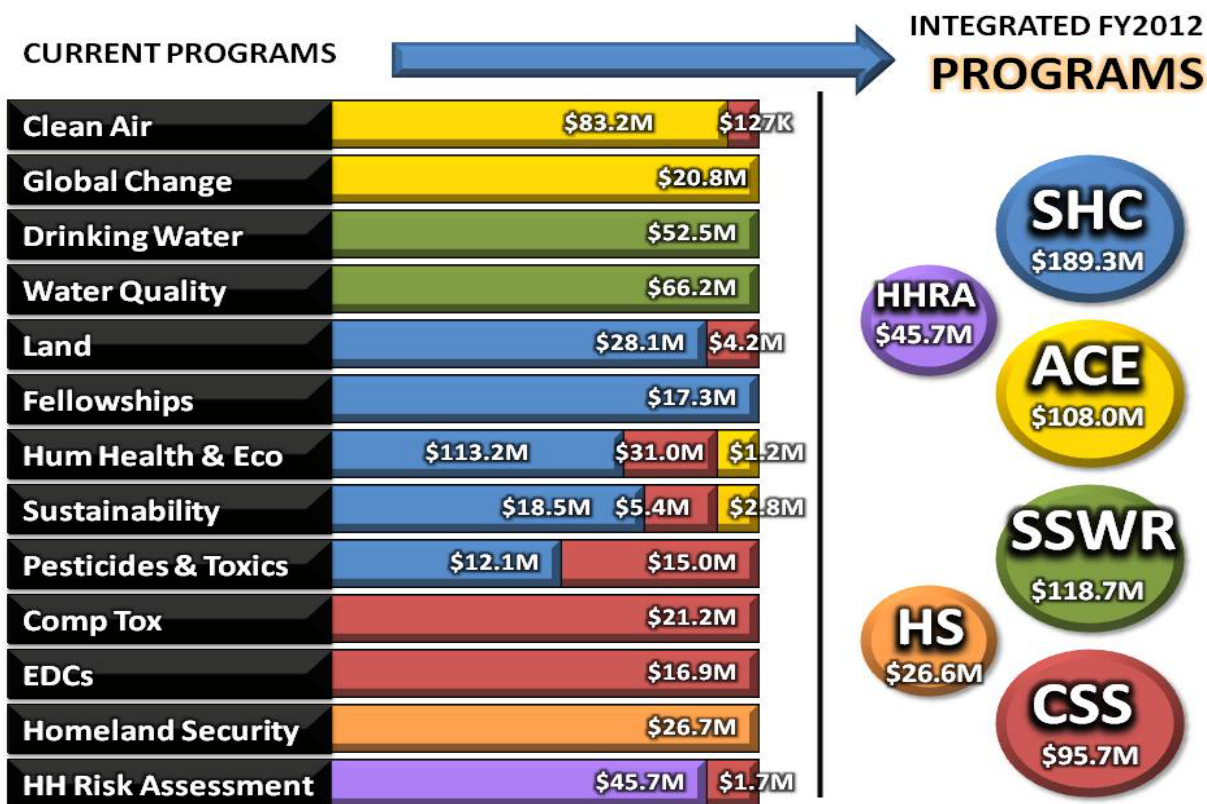
1. How well will the requested budget permit EPA to advance its strategic research directions and meet EPA priorities?
2. Are the changes since the FY 2010 enacted budget and EPA's research budget trends appropriate, taking into consideration overall resources, FTEs, and intramural and extramural resources?
3. Are there well defined objectives/work products for next year's budget? Can these be accomplished with the given resources?
4. Are there pivotal, "game-changing" investments that can advance the science?
5. Are there investments that will serve multiple program or multiple priority needs?

In addition to the detailed Budget Narratives and presentations provided by ORD and NCEE, which described the major programs that were enhanced, preserved or cut in the FY 2012 budget request, the work group drew on three information items extracted for them by ORD from EPA's *FY 2012 Budget in Brief*:

- Transformational Solutions Through Science Innovation (fact sheet)
- EPA Office of Research and Development FY 2010 to FY 2012 in NEW Program/Project Structure
- EPA Office of Research and Development FY 2010 to FY 2012 in FORMER Program/Project Structure.

This information provides an overview of the changes associated with the President's Budget request and is included as Attachment A to this report. The overview information details the cross-walk and realignment of budget categories in the FY 2012 President's Budget with earlier budgets. In this context, it is important to note that many of the "decreases" and "increases" in budgets for individual ORD program areas represent reallocations from "old program" structures to new FY 2012 research program structures. The graphic below, provided by ORD to the SAB Research Budget Work Group Meeting on March 3, 2012, provides an overview of these complex budget reallocations.

Transfer of funds to ORD Integrated FY 2012 Programs



Key to ORD Program Acronyms

ACE	Air, Climate and Energy Research Program
CSS	Chemical Safety for Sustainability Research Program
HHRA	Human Health Risk Assessment
HSR	Homeland Security Research Program
SHC	Sustainable and Healthy Communities Research Program
SSWR	Safe and Sustainable Water Resources Research Program

2. Key Findings and Observations

The President's Fiscal Year (FY) 2012 budget request recommends a 13 percent decrease in EPA's budget, a 2.6 percent cut to Science and Technology programs within the Agency and a 2.1 percent cut to EPA's Office of Research and Development (ORD). Funding for ORD declined more than 20 percent (in GDP indexed dollars) from the high in 2004 to the low in 2008, and had only begun to recover slightly in 2009 and 2010. The proposed reductions in FY 2012 reverse this very appropriate trend toward recovery in levels of investment in science and technology. The proposed reductions limit the research needed to support EPA's efforts to protect human health and the environment.

Overall, the SAB recognizes the difficult budget environment with which the nation is dealing in 2012, and although we consider these planned cuts to EPA's budget to be extremely unfortunate, we understand that they may be necessary to reduce overall government spending. Given the dire need for more cost-effective research on human health and the environment, the SAB agrees that it is critical to promote innovative, job-creating research. Thus, the SAB understands the relative priority given to ORD in this budget, but also recognizes that Agency cuts do not come from fat, but rather from the marrow of its activity and mission. The United States cannot ignore threats to air quality and ecosystems and threats from climate change as these threats will significantly reduce the health of the American people and the vitality of the American economy and ecosystems. It is also important to bear in mind that research has consistently strengthened the economy, in part by creating new kinds of jobs. Ceres, an organization that articulates the views of major American corporations on their social responsibilities, recently estimated that the National Ambient Air Quality Standards alone will result in the creation of 1.5 million jobs over the next five years. The country needs clean energy and clean air as well as jobs, and the former can augment the latter.

Over the last year the EPA has realigned its research organization from 13 project areas, defined by specific problems and media type, into four integrated programs and two cross-cutting areas (Human Health Risk Assessment and Homeland Security Research). Motivation for this consolidation and realignment of programs reflects an emphasis on integrated transdisciplinary research, multi-pollutant exposures and sustainability. The integrated research programs represent a new way of thinking about environmental research. Considerable synergies will be realized in combining research into the four programmatic areas: Air, Climate and Energy; Safe and Sustainable Water Resources (water quality plus drinking water); Sustainable and Healthy Communities; and Chemical Safety for Sustainability. The SAB strongly commends ORD for a dramatic response to SAB past recommendations concerning its realignment of research areas and dedication to transdisciplinary research for protecting human health and the environment.

ORD's realignment is wise and ambitious, moving EPA research in a new and bold direction. ORD is moving from a *risk management paradigm*, which has guided and influenced research over the past two decades, towards a *sustainability paradigm*, and that move is welcome. It is consistent with a public health approach of preventing disease rather than a medical approach to treating disease after it occurs and recognizes that environment and health are an interconnected

system. Restructuring EPA's research programs, however, is a significant challenge, and the Agency must consider how to translate research results from this new approach into science-informed environmental policy and decisions. The Board looks forward to providing continued advice to ORD as it develops strategic plans for each of its newly restructured research programs.

The SAB is highly supportive of two requested increases for FY 2012. The President's budget requests an increase in extramural research grants under the Science to Achieve Results (STAR) program of 40 percent from \$61.4M in the FY2010 enacted budget to \$86.1M. It is most appropriate to seek out and stimulate cutting-edge research from external research institutions at a time when EPA itself is restructuring its research programs and exploring new research paradigms. The President's FY 2012 budget request also includes a 56 percent increase over the FY 2010 enacted budget for EPA's overall research Fellowship program to \$17.3M. This overall fellowship program includes a Presidential Science Technology Engineering and Math (STEM) initiative, an important investment to stimulate research and training for scientists that supports the emphasis on sustainability. Within the overall fellowship investment, there is a 45 percent increase over the FY 2010 enacted budget for the STAR Fellowship program to \$14.1M. It is most appropriate to invest in training the next generation of environmental scientists when ORD's research programs are taking a new direction.

Among the requested investments in the President's budget for FY 2012, the SAB strongly supports a major reallocation of funds for Chemical Safety for Sustainability (CSS) research, a 22.9 percent increase over the FY 2010 enacted budget to \$95.7M in the FY 2012 President's budget request, and for Safe and Sustainable Water Resources (SSWR) research, a 6.9 percent increase over the FY 2010 enacted budget to \$118.8M in the FY 2012 President's budget request.

The requested increase in the CSS budget appears justified given the ambitious goals of this newly aligned multidisciplinary program. Realignment allows EPA to streamline its work and be more effective in achieving public health and environmental protection. The SAB supports the investments in endocrine-disrupting chemicals research, a 48 percent increase over the FY 2010 enacted budget to \$16.9M in the FY 2012 President's budget request, the new green chemistry and design for the environment initiative (+\$5.4 M) and next-generation computational toxicology tools (+\$2 M).

Given the planned shift toward multipollutant cumulative risk assessment and the backlog of ten thousand chemicals that need to be assessed, there is a strong need to invest in modernizing the human risk assessment approach to move beyond the one-pollutant-at-a-time framework. The Agency needs to develop a clear plan for how the outputs of the CSS program (e.g., Tox 21, NexGen) will be used by the ORD Human Health Risk Assessment program. With a flat budget for HHRA, it is unclear how innovation and modernization of the risk assessment program will be achieved.

In the SSWR program, the SAB recommends an increased focus on viewing water and wastewater holistically as an integral part of the overall water cycle, and additional resources for this area of research are needed. Wastewater is a resource providing water, nutrients, and energy for harvest and reuse, and it can be used to make communities more socially, economically, and

environmentally sustainable. Such an approach is in concert with EPA's changing role from purely a regulatory agency to one that promotes sustainable and healthy communities.

In the President's FY2012 budget request there are significant reductions in ORD research in the areas of homeland security, human health, ecosystems, and air/climate/energy research. These programs provide needed knowledge and data as well as guidance and expertise to EPA offices charged with the mission of maintaining homeland security, improving air quality, mitigating climate change and cleaning up our environment while promoting sustainable and livable communities.

Homeland Security Research (HSR) is slated for a 24 percent budget reduction from the FY 2010 enacted budget to \$26.7M in the FY 2012 President's budget request. The HSR program has developed emergency response products for water and wastewater treatment plants and buildings under threat of a chemical, biological or radiological attack. The SAB understands that these programs are considered "mature," and the products that have been developed are widely considered to be of very high quality. The SAB believes that the reductions made as a result of the maturation of certain program elements are justified, but that funds should be provided to the Agency to disseminate the knowledge and software developed through these mature programs to states and communities. These products could help to make the nation's water infrastructure more sustainable in the event of either terrorist attack or natural disasters.

Within the new Sustainable and Healthy Communities (SHC) research program, the President's FY 2012 budget request calls for reductions in funding for human health research, a 16 percent reduction from the FY 2010 enacted budget to \$45.4M in the FY 2012 President's budget request, and ecosystem research, a 15 percent reduction from the FY 2010 enacted budget to \$60.9M in the FY 2012 President's budget request. Reductions in human health intramural research funding will hamper EPA's ability to conduct major epidemiological studies and understand cumulative exposures and risks. Future budgets need to provide for more high-quality epidemiological studies to better understand exposures and their impacts, especially for susceptible and vulnerable populations and hazard dose-responses functions needed to protect public health using the best possible science. The SAB does not support the reduced funding request for FY 2012 in this area.

The SAB is especially concerned about a 10 percent reduction in funding for ecosystems services research compared to 2.1 percent overall for ORD research. The proposed reduction provides inadequate funding for research that supports multiple EPA regulatory programs and that the SAB has characterized as transdisciplinary with the "potential to be transformative for environmental decision making" (SAB Report, *Consultation on EPA's Implementation of the Ecosystem Services Research Program*, EPA-SAB-09-019). Ecosystem services research is critical for understanding the ways in which policy and management choices affect the type, quality and magnitude of the goods and services that ecosystems provide to sustain human well-being. Furthermore, these cuts jeopardize EPA's sustainability research program efforts.

Funds for ORD research on Air, Climate and Energy (ACE) would decline 3 percent from the FY 2010 enacted budget to \$108.M in the FY 2012 President's budget request. Relative to other budget cuts, this is modest, and it indicates that certain aspects of biofuels and mercury-in-air

research are being completed. But there are cuts in resources for priority activities in the Clean Air Research Program for source-receptor and dose-effect research that investigate human exposure to air pollutants and resulting health effects in the nation's major cities (-\$ 0.150M) and in priority research on the effects of climate change on estuaries (-\$0.625M). Funds for modeling research to support the development of State Implementation Strategies will be reduced (-\$ 0.762M) and, as a result, State Implementation Strategies will be delayed. Additionally, the ACE program lacks focused investment in climate mitigation and adaptation, research needed to meet EPA's priority of "taking action on climate change."

After reviewing the President's FY 2012 budget request in light of *EPA's Fiscal Year 2011-2010 EPA Strategic Plan*, the SAB finds ORD's plan to structure its four major research programs around the Administrator's four major goals meritorious. Based on the explicitly identified research visions and objectives identified for all of the newly structured programs, the SAB sees a major research gap in the area of social, behavioral and decision sciences. The SAB recommends that ORD develop an additional research strategy centered on addressing this gap. EPA should conduct research addressing ways of obtaining environmental goals other than through command-and-control regulations. Research in social, behavioral and decision sciences is required to understand and effectively apply human behavior, market approaches and innovative incentives to conserve resources and emit less pollution.

The SAB advises ORD to assume leadership to include the social, behavioral and decision sciences more broadly as an explicit research enterprise. This need not be a new program, but can be accomplished effectively by treating it as a cross-cutting strategy. This recommendation seems especially pertinent during ORD's realignment of programs because each of the four research programs acknowledges issues in the decision, behavioral and social sciences, ranging from decision analysis and decision structuring to risk communication to behavior change and beyond. None of these realigned programs, however, seem to have devoted any resources to it. Research in these areas is inexpensive relative to the costs involved in much of the physical and biological sciences. Relatively modest investments in this cross-cutting domain could have large future benefits.

3. Specific Comments on ORD's Restructured Research Programs

3.1. Air, Climate, and Energy

ORD identified the problem statement that shaped the goals of this research program as follows:

Protecting health and the environment from the impacts of climate change and air quality are central 21st century challenges. These challenges are complicated by the interplay between air quality, the changing climate, and emerging energy options.

The vision of the Air, Climate and Energy (ACE) research program is to “provide cutting-edge scientific information and tools to support EPA’s strategic goals to protect and improve air quality and take action on climate change.”

How well will the requested budget permit EPA to advance its strategic research directions and meet EPA priorities?

Because of the changing structure of EPA’s research programs, ORD was not able to provide sufficient detail for the SAB to say with certainty whether the requested budget will permit EPA to advance its program-level strategic research directions and meet EPA priorities. ORD research on Air, Climate and Energy (ACE) is slated to decrease by \$3.4 million dollars from \$111.4 million in 2010 (enacted budget) to \$108 million in the President’s 2012 proposed budget – a decline of about 3 percent. Relative to other budget cuts, this is modest, and it indicates that certain aspects of biofuels (-\$2.2 M) and mercury-in-air research (-\$2.4 M) are being completed and are no longer in the budget. But there are cuts in resources for priority activities in the Clean Air Research Program for source-receptor and dose-effect research that investigate human exposure to air pollutants and resulting health effects in the nation’s major cities (-\$150 K) and also cuts in research on the effects of climate change on estuaries (-\$625 K). Funds for modeling research to support State Implementation Strategies will be reduced (-\$ 762 K) and will delay their development.

The requested budget for global change research will decrease by \$17,000 to \$20.8M in a critical area where increased investments are needed. There are no clear investments in climate change adaptation, a very important area that will affect environmental protection broadly. Climate change affects different regions differently. Some arid regions and those depending on snowmelt from mountains may become drier; humid regions may become wetter with added problems of flooding. ORD could investigate various adaptation strategies with program offices and regions to help communities adapt to climate change by “hardening” their infrastructure, practicing water reuse, and implementing soil conservation practices on the landscape. Even research on “geoengineering” is needed in the event that mitigation and adaptation efforts are not sufficient.

Overall, Ceres (2011) estimates that the National Ambient Air Quality Standards alone will result in the creation of 1.5 million jobs over the next five years. The country needs clean energy and jobs. Finally, clean air is one of EPA’s success stories. Ambient pollution levels have steadily decreased since the establishment of EPA and the enactment of the Clean Air Act. In

March 2011, EPA issued *The Benefits and Costs of the Clean Air Act from 1990 to 2020*. According to this study, the direct benefits from the 1990 Clean Air Act Amendments are estimated to be almost \$2 trillion for the year 2020, exceeding costs by a factor of more than 30 to one.

Are the changes since the FY 2010 enacted budget and EPA's research budget trends appropriate, taking into consideration overall resources, FTEs, and intramural and extramural resources?

Certainly ACE should be a priority for the agency. Although air quality has improved over the decades as a result of EPA research, monitoring and enforcement, fine particulate matter and ozone are responsible for a large fraction of the human health effects in the United States each year caused by pollution, and OMB estimates that the benefits of air pollution regulations far exceed their costs. In addition, climate change and energy choices are among the most important issues looming before the country. It should be a top priority for EPA to research the most cost-effective, job-creating policies possible to ensure our safe energy future. Support for climate change mitigation is roughly without change in the President's 2012 budget compared to the 2010 enacted budget, but it should be a high priority for more funding on both mitigation *and* adaptation. ORD has contributed substantially to the U.S. Global Change Research Program, especially in the area of modeling climate change effects on air and water quality. With new regional climate scenarios about to emerge from the North American Regional Climate Change Assessment Program and the Coordinated Regional Climate Downscaling Experiment, EPA could provide cutting edge research on possible futures expected under climate change 2010-2050. Considerable research exists on climate mitigation strategies (Intergovernmental Panel on Climate Change Working Group III, 2007), but very little has been done on estimating adaptation capacities on a regional scale and integrating them with mitigation capacities.

Are there well-defined objectives/work products for next year's budget? Can these be accomplished with the given resources?

Yes, there are well-defined objectives and expected accomplishments for the FY 2012 budget year, but ORD did not fully communicate to the SAB the stage of each of those investments. Furthermore, there are certain objectives that seem to be missing. For example, the ACE program's "Theme 2" was identified as "*Develop integrated approaches to assess how social and economic factors affect vulnerability to air pollution and climate change,*" but ORD did not present plans for social and economic research to address this item. Research is needed in how to encourage *behavior* that sustains and improves the environment, such as driving habits, recycling and reducing carbon footprints, which are small investments with big returns.

Are there pivotal, "game-changing" investments that can advance the science?

There are initiatives to develop and implement a new air-monitoring network using the latest breakthroughs in technology that promise to be much more cost effective and enlightening for mixtures of air pollutants. The Near Road research program promises important new information on road side exposures, an important human health and environmental justice issue. In addition, the SAB recommends that the Agency implement another game-changing investment in

behavioral social sciences. By a small investment in behavioral science, ORD could conduct research to identify how to accomplish regulatory goals much less expensively with alternate incentives other than enforcement actions. There should be an entire new research effort in alternate means to attain improvements in air quality and greenhouse gas emissions without the traditional command-and-control options and enforcement paradigm. This would revolutionize environmental protection and may prove popular with citizens, business, and Congress alike.

Are there investments that will serve multiple program or multiple priority needs?

ACE provides tremendous synergies among the ORD climate, and energy research programs. There are many cross-cutting issues between ACE and the other research areas as well: atmospheric nitrogen deposition to watersheds, social and behavioral science on changing climate and water resources, and the energy-water nexus just to name a few. The United States cannot have clean energy resources in the future without water availability, and it cannot create clean water by desalination or water reuse if the country does not have abundant energy supplies.

One of the model projects for which the SAB applauds ORD is the cookstove project. Through a public-private partnership with the Peace Corps and the Department of State through the Global Alliance for Clean Cookstoves, EPA has leveraged private funds to expand the use of safe cook stoves in developing countries and parts of the United States, especially in Native American territory, where traditional cookstoves generate black soot. ORD's investment in this area focuses on an important driver of global climate change. Black soot also is a threat to women's and children's health in developing countries and Native American reservations. By utilizing EPA's unique expertise in characterizing emission generation, quantifying exposures and assessing human health effects, ACE will continue to address the health, environmental, economic, and gender risks associated with the use of solid fuels in traditional cookstoves.

3.2. Safe and Sustainable Water Resources

ORD identified the problem statement that shaped the goals of this research program as follows:

Increasing demands for sources of clean water combined with changing land use practices, growth, aging infrastructure, and climate change and variability, pose significant threats to our Nation's water resources. Failure to manage our Nation's waters in an integrated, sustainable manner will limit economic prosperity and jeopardize both human and aquatic ecosystem health.

The vision of the Safe and Sustainable Water Resources program is to “*use an integrated, systems approach to research for the identification and development of the scientific, technological and behavioral innovations needed to ensure clean and adequate and equitable supplies of water that support human well-being and resilient aquatic ecosystems.*”

How well will the requested budget permit EPA to advance its strategic research directions and meet EPA priorities?

In its Fiscal Year 2011-2015 *Strategic Plan* the EPA identifies six near-term priority goals, including: “Clean water is essential for our quality of life and the health of our communities. EPA will take actions over the next two years to improve water quality.”

The SAB agrees with the reallocation of funds and the overall increase in the FY 2012 budget for Safe and Sustainable Water Resources (SSWR), a 6.9 percent increase over the FY 2010 enacted budget to \$118.8M in the FY 2012 President’s budget request. While this increase is only a modest request, it attests to the Administration’s commitment to support SSWR during difficult economic times.

These budget increases for drinking water and water quality research are consistent with prevailing scientific and technological opinions that continued improvements in public health, the availability of reliable supplies of energy, a cleaner environment, adaption to climate change and economic stability cannot be achieved without the availability of adequate supplies of safe potable water and clean water for industrial and commercial development. This budgetary support continues SSWR’s obligation to deliver the scientific information and technological innovation necessary for the nation to produce adequate supplies of clean water. The SSWR program combines two well established groups, drinking water research and water quality research, both with a strong history of providing sound scientific and technical advice to the Agency.

The SAB supports the \$6.0M increase to develop innovative new tools and information research in the development of green water infrastructure, especially in the face of nationally restricted financial resources. However, the SAB has concerns about whether the planned funding is sufficient to meet the full vision of the SSWR program. In 2012, SSWR appears to generally focus on urban systems and specifically on the management of storm-water. If this assessment is correct, the SAB considers this approach to be too narrow, and encourages the EPA to expand the scope of this work to include, for example, the study of large watersheds.

Given the tight integration of larger watersheds with urban water resources, larger watersheds need to be explicitly studied. Only in this manner can specific program goals be obtained, which focus on innovative solutions to reducing and managing groups of chemicals and pathogens and nitrogen and phosphorus pollution.

The new paradigm in wastewater management is to view wastewater not as a waste, but rather as a resource that can provide water, nutrients, and energy to meet social, economic and environmental needs. This paradigm fits within ORD’s focus of sustainability and a systems approach, and it links management of wastewater with issues of food production, land use, water quality and energy production. It also provides opportunities to advance science in understanding the direct and indirect energy use in public infrastructure as well as understanding risk associated with the use of non-potable water. There is also a strong social/behavioral component to this type of research. The SAB recommends that ORD demonstrate a leadership role in this effort to help water and wastewater utilities make critical advances in these areas.

The SAB is very supportive of the \$4.2M increase in funding to assess the potential public health and environmental risks associated with hydraulic fracturing. The combination of retrospective analyses and new case studies is reasonable but may not be sufficient to gain the critical knowledge of the large-scale impacts of these processes from an ecological and human health perspective. The SAB encourages the SSWR program to ensure that new case studies are conducted to expand the knowledge gained from this initial program. Proposed funding levels for FY 2012 are likely insufficient for the out-years.

The SAB understands the \$2M reduction in the Beaches Program as it draws to a conclusion. However, these studies are still critical and the SAB advises the program to provide a phased reduction approach that maintains the high quality of research and management guidelines that has already emanated from this program. Similarly, the SAB is concerned that proposed funding reductions for "development of best management practices" and informing decisions associated with control of pathogens in drinking water systems will limit the extent to which EPA can respond to the priorities defined by EPA's Distribution System Research and Information Collection Partnership. These reductions will affect the nation's ability to respond water infrastructure problems that may cause endemic waterborne disease.

With respect to the SSWR program, the SAB believes that the EPA's requested level of funding, which includes a 6.9 percent increase, will generally enable it to advance its strategic research directions and meet its near-term priorities.

Are the changes since the FY 2010 enacted budget and EPA's research budget trends appropriate, taking into consideration overall resources, FTEs and intramural and extramural resources?

Realignment of drinking water and water quality research programs into an integrated research program addressing water resources and water infrastructure will exploit synergies, increase efficiency and foster transformative research focusing on entire watersheds for both ecological and human health. It is clear that by implementing this alignment and integration that the Agency is responding to recent recommendations and suggestions of the SAB and other external advisory groups. The SAB commends the Agency for this initiative. The realignment integrates drinking water and water quality, two mature ORD water programs. These program components have a history of delivering sound scientific and technological advice to inform EPA regulatory decisions and advisories, and the SAB expects that, with adequate budgetary support, the realigned SSWR program will continue to maintain its high level of performance. Synergies from this realignment will help to leverage the SSWR's resources and extend its already impressive capabilities.

As the nation engages the daunting environmental challenges of the twenty-first century, the critical nexus that exists between the water-energy, water-food, water-health, water-climate and water-environment interfaces cannot be overemphasized. The SAB recommends that the SSWR program continue to receive the budgetary support that it deserves. These interfaces demand abundant supplies of water to preserve and maintain the nation's health and economic viability. The EPA depends on a vibrant and productive SSWR program to meet its mandate to protect the

nation's health and environment, which depend on the production of safe drinking water and the maintenance of appropriate water quality nationally.

Are there well-defined objectives/work products for next year's budget? Can these be accomplished with the given resources?

Yes, clearly defined research goals are stated for the FY 2012 budget, and the SAB believes that the SSWR will make progress towards meeting ORD's objectives.

FY 2012 objectives and work products for the SSWR include the delivery of scientific and technical data from ongoing projects such as: studying the impacts associated with hydraulic fracturing on watersheds; criteria development and implementation guidance for recreational waters; carbon sequestration monitoring and model development; national wetlands condition assessment; developing new approaches for evaluating and managing groups of chemicals and pathogens; and developing new innovative approaches for reducing and managing nitrogen and phosphorus pollution in food producing watersheds such as the Chesapeake Bay ecosystem.

The SAB believes that the budget requests made by the SSWR program will allow ORD to accomplish its near-term priorities and objectives through the activities noted.

Are there pivotal, "game-changing" investments that can advance the science?

The investment in "green infrastructure" is potentially "game-changing." One prime example is the restoration of the Chesapeake Bay watershed. EPA's preliminary evaluation of the application of green and gray infrastructure within the watershed found that a proper mix of these infrastructures provides a least-cost solution for meeting nutrient and sediment reduction targets and achieving greenhouse gas mitigation, floodwater storage and recreational use.

While the evaluations are in their infancy, the use of these infrastructures appears to have merit and the SAB encourages the Agency to continue these evaluations, and to explore opportunities to broaden the scope of their application.

Are there investments that will serve multiple program or multiple priority needs?

In its Fiscal Year 2011- 2015 Strategic Plan, the EPA identifies its strategic goal #2 as "Protecting America's Waters" with two objectives: 1) to protect human health and 2) to protect and restore watersheds and aquatic ecosystems. Goal 2 is also defined as: *"Protect and restore our waters to ensure that drinking water is safe, and that aquatic ecosystems sustain fish, plants and wildlife, and economic, recreational, and subsistence activities."*

The strategic measures associated with the two objectives for Goal 2 are quite extensive, and for objective 1, include waters safe to drink, fish and shellfish safe to eat and water safe for swimming. For objective 2, the strategic measures are even more extensive and comprehensive. Strategic measures for objective 2 call on EPA to improve water quality on a watershed basis; improve coastal and ocean waters; increase wetlands; improve the health of the Great Lakes; improve the health of the Chesapeake Bay Ecosystem; restore and protect the Gulf of Mexico;

restore and protect the Long Island Sound; restore and protect the Puget Sound Basin; and sustain and restore the United States-Mexico Border Environmental Health. All of these strategic measures require either the availability of abundant quantities of water safe to drink or water of specified quality appropriate for some intended commercial or industrial application(s), e.g., fish and shell fish production, a fundamental charge of the SSWR program. It is commendable that these EPA's strategic goals and measures encompass the repair and protection of such a wide array of large scale natural systems, such as wetlands, oceans and coastal waters, the Great Lakes and the sensitive Chesapeake Bay and Puget Sound ecosystems.

The work of the SSWR serves multiple priority needs by also protecting the nation's food production capabilities, e.g., improving the health of the Chesapeake Bay Ecosystem, one of the nation's unique and most efficient natural human seafood production resources. Also, as mentioned below in Section 3.6, the CANARY early detection system for drinking water contamination, developed collaboratively with ORD's Homeland Security research program, not only protects drinking water but also protects Homeland Security.

3.3. Sustainable and Healthy Communities

ORD identified the problem statement that shaped the goals of this research program as follows:

Communities face social, economic, and environmental trade-offs in a resource-constrained world. These trade-offs are often not well characterized in terms of the implications and interactions between human health, ecosystem services, economic vitality, and social equity. Conventional decision-making often does not adequately characterize these complex interactions. Communities therefore need holistic, integrated, and functional science and practical technical tools and support to find solutions that are sustainable: that is, they are equitable, efficient, and effective.

ORD described the "expected broad outcomes" for the Sustainable and Health Communities (SHC) as follows: "Local, regional and national decision-makers will have tools to more equitably weigh and integrate social (including human health), economic, and environmental factors in order to promote human health and welfare and to ensure that nature's benefits are available to generations to come." The FY 2012 budget requested research funds to support an integrated systems approach to: 1) pilot the development and use of information and tools for decision makers and stakeholders in urban communities; 2) conduct research on human health protection; 3) conduct research to address barriers to community sustainability; and 4) conduct research to develop performance measures for sustainable and health communities.

How well will the requested budget permit EPA to advance its strategic research directions and meet EPA priorities?

The President's FY 2012 budget request calls for reductions in funding within the SHC program, a 10 percent reduction from the FY 2010 enacted budget to \$189.3M in the FY 2012 President's budget request. The President's FY 2012 research budget would create this new program by combining five programs (Fellowships, Human Health and Ecosystems, Sustainability, Land Protection and Restoration and Pesticides and Toxics), which existed in the FY 2010 enacted

budget, into one transdisciplinary program. This restructuring appears appropriate based on the following ORD budget narrative descriptions for this program:

The SHCRP will focus primarily on environmental sustainability at the community scale. The SHC program aims to conduct research and development that will help communities assess their current health and environmental condition and identify strategies that increase ecosystem services while decreasing community health risks. Healthy communities will translate to healthy economies.

This new program is ambitious. It has the potential to offer communities an integrated understanding of environmental issues and solutions that can not only protect citizens from hazardous materials and activities but also offer them ways to understand, protect and use the "nature on which they depend" to help achieve a "sustainable and healthy community." This approach aims to offer communities research that informs an integrated understanding of the science that is essential to move toward sustainability and good health. Such integrated understanding would encompass both protection from pollution and hazards and identifying opportunities to make better use of the ecosystems and renewable resources on which every community depends.

The success of this novel and ambitious approach, however, depends on adequate research funding. The SAB believes that the funding request for FY 2012 is not adequate to support the program. The overall requested budget shows a reduction at a time when the new program requires investments to ensure its success.

Reductions in ecosystem research, a 15 percent reduction from the FY 2010 enacted budget to \$60.9M in the FY 2012 President's budget request, will impair ORD's research on ecosystem services. These reductions will slow progress that SAB believes has the potential to characterize a fuller suite of ecological benefits from environmental protection actions for decision makers and the public [*Consultation on EPA's Implementation of the Ecosystem Services Research Program* (EPA-SAB-09-019), *SAB Advisory on the EPA Ecological Research Program Multi-Year Plan* (EPA-SAB-08-011)]. The reductions in funding in the FY 2012 President's budget request for ecosystems research follows a dramatic long-term downward trend since 2004 when the EPA ORD ecosystems budget was nearly double (\$108M) the President's request for FY 2012. EPA should be cognizant of the potential impact of these reductions in research funding on the future direction of the SHC program.

Reductions in funding for human health research, a 16 percent reduction from the FY 2010 enacted budget to \$45.4M in the FY 2012 President's budget request, include a -\$3M loss of the Congressionally-directed FY 2010 appropriation for children's environmental health research and other reductions that will severely hamper EPA's intramural capability to conduct major epidemiology studies. Such studies are needed to better understand exposures, especially for susceptible and vulnerable populations, and hazard dose-responses functions to support development of regulations to protect public health using the best possible science.

In addition, the requested budget does not explicitly show investment in two additional key areas. There is no explicit investment in or plans for social, behavioral and decision science

research that will help communities understand and address key elements of the SHC vision, i.e., “the implications and interactions between human health, ecosystem services, economic vitality, and social equity.” Also, the requested budget does not explicitly show investment in research linking ecosystem services and ecological health. To achieve EPA’s and ORD’s sustainability goals, ORD’s research budget should include explicit investments in research on the interconnections between human health and ecosystem services, a perfect example of where a systems approach could be applied. A budget that allows ORD to advance its strategic research directions should show investment in ways sustainable and healthy communities depend on ecosystem services and ways reductions in environmental degradation can reduce human sensitivity to exposure to environmental toxicants.

Are the changes since the FY 2010 enacted budget and EPA’s research budget trends appropriate, taking into consideration overall resources, FTEs, and intramural and extramural resources?

As noted above, the SAB supports the overall new structure and approach of the SHC research program. The Board believes, however, that the reduced funding for ecosystem and human health research is inappropriate and that the lack of funding for social, behavioral, and decision sciences within this program will reduce its effectiveness. In addition, the SAB considers the reductions in the research budget for waste clean-up to be substantial. The Hazardous Substances Superfund research would experience a 16.7 percent reduction from the FY 2010 enacted budget to \$17.8 in the FY 2012 President’s budget request. These cuts will impact future programs in OSWER, adversely affect the health and well-being of communities and impede EPA’s efforts to promote environmental justice.

The SAB, however, does support the FY 2012 budget request increase of \$2M in a long-term review of EPA’s overall laboratory network. With increasing coordination, ORD, program and regional laboratories could integrate activities generally and across disciplines to save funds and use laboratory resources in a more effective, efficient fashion.

Are there well-defined objectives/work products for next year’s budget? Can these be accomplished with the given resources?

ORD provided the SAB with an initial description of the general objectives for the SHC research program, but because of the novelty of the research program, EPA is still in the process of developing a detailed plan outlining research products, timelines and deliverables. The objectives are reasonable in general, but many specifics remain to be articulated. The objectives require alignment with the research products, FTEs and budget. ORD has committed to provide a draft plan for SAB review in June 2011 describing a proposed timeline and a strategy for multi-year investments.

This realigned SHC program is an exciting and courageous effort to shift towards a community-based approach to risk assessment and management, with all its multi-stressor/multimedia, cumulative risk complexities. It is the right direction and the Agency is correct to pursue it. However, unlike other realigned programs (ACE, CSS and SSWR), which have been able to quickly and clearly define expected outcomes based on earlier accomplishments within the more

traditional programs from which they were formed, the SHC program has not presented as clear a picture of what will be accomplished with the \$189M allocated in the President's requested FY 2012 budget. This is understandable because the SHC program is not so much a collection of previous programs as a new way of conceptualizing the interrelated human health and environmental protection goals and the science and policy approaches for accomplishing them. The SAB advises ORD to carefully plan how it will communicate SHC goals and activities and evaluate this new program as it develops.

Since the new research will use an integrated approach that considers problems from a systems perspective, research will cut across several of ORD's former research areas that are now included in SHC research program. ORD has an opportunity to explain ways in which an integrated approach can realize synergies and program integration and minimize the adverse impacts to research from the significant reductions in the FY 2012 budget request. The SAB recommends that ORD provide a better mapping between outcomes and FTEs and budget to demonstrate how the requested budget for the SHC research program will permit EPA to advance its strategic research directions and meet EPA priorities.

Are there pivotal, "game-changing" investments that can advance the science?

Unfortunately, because of lack of funding for social, behavioral, and decision science research and research focusing on the integration of human health and ecosystem services, ORD is not reaping the maximum benefit from this important new research area. ORD has, however, still identified important "game-changing" investments in the SHC research area presented to the SAB. These investments include:

- Identification of barriers to community sustainability,
- Tools designed to inform local decision makers and stakeholders so that they can move their communities toward greater sustainability, and
- General modeling approaches and pilot projects that may advance environmental justice and equitable solutions.

The SAB looks forward to learning more about these investments from ORD.

In addition, SAB members identified four additional game changing investments that should be included in the 2012 priorities and supported with research. These topics will be explored with ORD as part of the SAB's continued focus on ORD strategic research directions. First, ORD should support research on life-stage susceptibility throughout the human life cycle. Second, cumulative risk assessments should be part of projects that consider interactions among human health; ecosystems; and economic, social, and nonchemical stressors. Third, as projects investigate interactions among human health and chemical stressors, ORD should invest in the epigenetic effects that can potentially result in transgenerational changes.

Finally, there is a need for ORD to invest in program evaluation to consider the effectiveness of the SHC research program. Because the SHC is such a novel and ambitious program, it can serve as the "test bed" for integrated transdisciplinary research that takes a systems approach and develops innovative solutions for environmental problems. It will be important to invest in

evaluation to test the concept and measure its impact. SHC is an appropriate test-bed, since EPA's work in ecosystem services, now integrated within SHC, has laid the groundwork for the realignment to emphasize sustainability. The community-based approach offers a unique opportunity to determine what specific "mixes" of threats (including cumulative risks across stressors and media) in particular social contexts are faced by actual communities. This would provide an empirical basis for orienting the multi-stressor research in the other programs.

Are there investments that serve multiple programs?

Yes, there are investments that may potentially serve multiple programs. There will be natural synergies with the SSWR program, the efforts of ACE to address air pollution and global change and EPA's environmental justice program. Through the SHC research program, EPA will have opportunities to develop non-invasive methods for controlling mold and asthma and for promoting green infrastructure.

3.4. Chemical Safety for Sustainability

ORD identified the problem statement that shaped the goals of this research program as follows:

Although chemicals are essential to modern life, we lack innovative, systematic, effective, and efficient approaches and tools to inform decisions that reduce negative environmental and societal impacts of chemicals.

The vision of the Chemical Safety for Sustainability (CSS) program is "EPA science will lead the sustainable development, use, and assessment of chemicals by developing and applying integrated chemical evaluation strategies and decision support tools for integrated evaluation strategies."

This new research program consolidates chemical safety-related research programs from eight previous ORD programs (Endocrine Disrupting Chemicals, Computational Toxicology, Pesticides and Toxics, Land Protection and Restoration, Human Health and Ecosystems, Sustainability (E-waste), Human Health Risk Assessment and Clean Air). The realignment will allow the Agency to streamline its work and be more effective in achieving public health and environmental protection.

How well will the requested budget allow EPA to advance its strategic research directions and meet EPA priorities?

The President's requested increase for this program, a 22.9 percent increase over the FY 2010 enacted budget to \$95.7M in the FY 2012 President's budget request, appears justified and should allow the program to achieve many of its goals as outlined by the interim National Program Director. Ensuring the safety of chemicals and preventing pollution is a high priority for the Administrator. The program realignment is consistent with past SAB advice encouraging EPA to invest in multiple pollutant and cumulative risk approaches, but the requested budget shows no clear investment in several key areas.

This program is forward-looking and visionary. If given adequate resources, it appears that it could lead EPA in a number of other areas, including improved ecological risk assessment through modeling and simulation, life-cycle assessment, improved exposure assessment (a critical need as EPA moves forward with developing routine aggregate exposure and cumulative risk assessments and considers the "exposome," the measure of all the exposures of an individual in a lifetime and how those exposures relate to disease), enhanced understanding of environmental impacts on the epigenome and computational approaches to green chemistry. More funding should be allocated in the future to these areas.

Placing the NextGen risk assessment program within the CSS program is appropriate because it will allow more seamless transfer of basic science into risk assessments. Special attention and coordination, however, will be required to ensure that the methodology is being translated into risk assessment practice, since such activities are still within the purview of ORD's separate Human Health Risk Assessment program. In addition, the SAB is concerned that there is no proactive budget initiative to develop ways of employing the results of the CSS program, including high throughput data, into hazard or risk assessment. This is a significant weakness.

Are the changes since the FY 2010 enacted budget and EPA's research budget trends appropriate, taking into consideration overall resources, FTEs, and intramural and extramural resources?

The request for increased resources for FY 2012 is appropriate for the CSS program. This integrated, transdisciplinary program leverages the talents and expertise of existing ORD staff to go beyond individual disciplines. The staff is well trained to conduct excellent research. By realigning these scientists to work with each other toward common new research goals, the Agency will be able to successfully implement the goal of true multi-disciplinary research. The Agency should take the time to ensure that staff scientists are formally developed as this program progresses and that they are brought on board this new initiative. Clearly, this research capacity is important for the success of the realignment.

Are there well-defined objectives/work products for next year's budget? Can these be accomplished with the given resources?

The SAB advises ORD to better define the specific objectives for the upcoming Fiscal Year. The CSS program is a new program that consolidates the strengths and assets of numerous former programs, so it is understandable that there are ambiguities in the presentation of specific objectives and the specific timeline for these goals. Some research areas appear overly broad, such as "targeted high priority needs." As a result, it is difficult at this time to fully assess whether the objectives can be accomplished with the given resources. However, the broad objectives do represent Agency steps toward conducting more transdisciplinary research.

Are there pivotal, "game-changing" investments that can advance the science?

The program has the potential to make game-changing contributions in predictive toxicology and in reducing uncertainty in risk assessment through the use of state-of-the-art screening methods and computational approaches.

This research program has a high potential to accomplish game-changing objectives. These include: 1) development of approaches to assess multiple contaminant exposures; 2) reducing the use of animal models to assess toxicity and relying more on predictive models; and 3) developing tools that can be used in the medical field to further our understanding of individualized medicine and individualized toxicology. The program has been very creative in accessing data sources (e.g., data on discontinued pharmaceuticals) at no cost to the Agency.

The program could serve as a model for the rest of ORD in the use of computer modeling and simulation as a first step, rather than empirical testing. By combining the endocrine disrupter screening program with the computational toxicology program, there is a significant opportunity for the former to be modernized and provide much more valuable information for decision-making.

Are there investments that will serve multiple program and multiple priority needs?

Much of the work in this program will serve other programs and other priority needs. One could make the argument that this program will generate information that will be required across programs within EPA and across different federal agencies. The SAB hopes that EPA and the federal government will be able to provide the investments to help make this happen.

Health and environmental implications of nanotechnology appeared throughout the presentations and was included for CSS as well. However, the National Institutes of Health and other federal programs engage in public-private partnerships to fund the development of nanotechnology applications and products. The budget allocated to evaluating the health and environmental impacts of nanotechnology is not sufficient for EPA to anticipate possible future environmental issues associated with development of this technology. Resources committed to developing nanotechnology by private companies dwarf those allocated for assessing its impacts.

3.5. Human Health Risk Assessment

ORD described this program as providing an interface between researchers in other ORD programs who are generating new findings and data and regulators in the EPA program and regional offices who make regulatory, enforcement and remedial action decisions. The three parts of the program are: 1) Integrated Risk Information System (IRIS) and other priority health hazard assessments; 2) risk assessment models, methods, and guidance and 3) air quality Integrated Science Assessments.

How well will the requested budget allow EPA to advance its strategic research directions and meet EPA priorities?

Inasmuch as the 2012 budget represents only a slight reduction, a 1 percent reduction from the FY 2010 enacted budget to \$5.7M in the FY 2012 President's budget request, the Human Health Risk Assessment (HHRA) program appears to be in a reasonable position to maintain its strategic research and meet its top priorities. The increase in FTEs by 13 also appears to be appropriate. Presumably many of these will be EPA scientists with specialized risk assessment training. However, the IRIS reviews in progress are ambitious and the Agency will be required to

manage these reviews carefully. Moreover, it will be challenging for the Agency to incorporate new information, especially types of information resulting from Tox21 program, into IRIS and other assessments. IRIS assessments and the Integrated Science Assessments for National Ambient Air Quality Standards are important products that provide a foundation for protection of the public from chemical risks. The SAB is pleased that ORD is increasing the speed of producing these assessments. Given the basically flat budget, it is hoped that this increased efficiency will allow greater focus on cumulative risk assessment or groups of chemicals. The plan for a transition to multipollutant assessment needs to be clarified.

Are the changes since the FY 2010 enacted budget and EPA's research budget trends appropriate, taking into consideration overall resources, FTEs, and intramural and extramural resources?

It will be difficult for the Agency to keep abreast of the “-omics” revolution and be able to use the latest computational toxicology tools to protect public and environmental health. Thus, the budget changes since 2010 do not appear to be sufficient for innovation and modernization of risk assessment for the Agency. As EPA moves from a risk management paradigm to a sustainability paradigm, increased resources will be needed. If the Agency is to make progress addressing the tens of thousands of chemicals of concern, it will be necessary to make an investment in using computational toxicology methods and conducting multipollutant risk assessment rather than only focusing on one chemical at a time.

Are there well-defined objectives/work products for next year's budget? Can these be accomplished with the given resources?

The objectives/work products for the next year were well articulated and it appears that the modest goals as outlined can be accomplished with the given resources, as they were in 2010 and 2011. But eventually more funds will be needed as described above.

Are there pivotal, “game -hanging” investments that can advance the science?

Integrating Tox21 data into risk assessment will require investments that will be essential to modernize our ability to predict human and environmental health risks. It is not clear to the SAB who makes these investments at EPA. Formalizing and clarifying the linkage between the CSS research program and HHRA will assist in ensuring that output from CSS is used by HHRA in a scientifically sound and defensible way.

The multi-pollutant, cumulative risk approach is a potential paradigm shift in how to assess chemical risks. Perhaps the ambient air pollution multi-pollutant science assessment under way could be considered a pilot for evaluating multi-pollutant assessments.

Are there investments that will serve multiple program and multiple priority needs?

The HHRA program inherently serves multiple program needs. IRIS assessments clearly link to all the other integrated ORD programs. The IRIS assessments are used by basic science

programs as well as regulatory programs not just in EPA but in other agencies and by states as well. This program is a shared federal resource.

The Integrated Science Assessments are extremely important to the National Ambient Air Quality Standard reviews and thus are integrally related to the ACE program.

There are strong potential linkages to the CSS program – the HHRA program will clearly need to work with CSS to use the CSS output appropriately and maximally.

3.6. Homeland Security

ORD described three major responsibilities of the Homeland Security research (HSR) program. Research is designed to 1) protect water systems from attacks and for detecting and recovering from successful attacks affecting water systems; 2) decontaminate buildings and outdoor areas impacted by a terrorist attack by leading efforts to establish clearance goals and clean up and 3) be part of a nationwide laboratory network with the capability and capacity to analyze for chemical, biological and radiological agents for routine monitoring and in response to a terrorist attacks.

How well will the requested budget allow EPA to advance its strategic research directions and meet EPA priorities?

This program has a well defined mission. The ORD Center for Homeland Security was initially charged to develop and deliver products quickly, with the plan that the Homeland Security Research Center would be sunsetted after three years. However, it has been positively received within the Agency and by the users of its products and continues to enjoy support from many stakeholders. Therefore, ORD has supported maintaining the program because it recognizes its value. However, in the FY 2012 President's budget, HSR is slated for a 24.9 percent reduction from the FY 2010 enacted budget to \$26.7M in the FY 2012 President's budget request, due mostly to maturation of its initial research products.

Over half of the \$24.7M request is directed towards monitoring and decontamination after a chemical, biological or radiological release, including response to a wide area anthrax attack. The safe buildings program was eliminated in the requested FY 2012 budget. The program activities related to developing contamination approaches to wide areas is limited because the budget allows only for small pilot level tests. The efforts are focused on evaluating single agent releases and no budget is provided to address release of mixtures.

Are the changes since the 2010 budget and EPA's research budget trends appropriate, taking into consideration overall resources, FTEs, and intramural and extramural resources?

The cuts in the budget are likely to limit the ability of the HSR program to interact with EPA's regional and program offices, important clients for ORD's water related research. These interactions are especially important for disseminating recently developed real-time water monitoring and decision-making tools. EPA must plan for the resources needed to disseminate these models and real-time tools available for states and communities to use.

A 75 percent reduction in methods development for analyses of chemical, biological and radiological warfare agents is a huge reduction in a single program. The changes since the 2010 budget may be appropriate as several programs within the Center for Homeland Security are mature.

Are there well-defined objectives/work projects for next year's budget? Can these be accomplished with the given resources?

This program has a well defined mission and the FY 2012 requested budget describes many HSR activities that are maturing. The SAB is concerned, however, that many of the 2012 activities are related to data collection efforts, which are resource-intensive and may be damaged if budgets are cut rapidly. The FY 2012 requested budget describes the planned research objectives broadly and does not detail the research tasks to be performed to achieve these objectives. For example, in "developing microbial risk assessment methodologies," is the need really to develop methods? Or is it to develop more data that could be used in these risk assessments? More detail is needed to fully evaluate whether the requested budget is sufficient, in general, to allow EPA to accomplish the stated objectives.

Are there pivotal "game-changing" investments that can advance the science?

There do not appear to be many game changing investments supported by the requested budget that can advance the science. The relatively small budget and homeland security mission primarily focus on monitoring and decontamination after a chemical, biological, or radiological release preclude many game-changing advances.

One example, however, of a pivotal, "game-changing" investment is the CANARY early detection system for drinking water contamination, developed collaboratively as part of the homeland security initiatives program. CANARY was designed to detect when there has been intentional or unintentional contamination of a drinking water system by monitoring and analyzing through its unique software. The CANARY system is a free software tool available worldwide to drinking water utilities striving to provide safe water to their customers. The software is in use in over 20 major U.S. cities including Cincinnati, Philadelphia, New York, Los Angeles and San Francisco. CANARY has been accessed by more than 600 utilities in 15 countries. The tool resulted from an investment in interagency collaboration between two Federal agencies, the EPA's ORD and DOE's Sandia Laboratories. The SAB commends the Agency for demonstrating that interagency innovative collaboration not only works, but can be accomplished relatively inexpensively.

Are there investments that will serve multiple program or multiple priority needs?

The majority of proposed research activities are directed to monitoring and decontamination after a chemical, biological or radiological release. EPA makes a significant contribution to the nation's ability to respond to natural disaster and unconventional warfare because of the Agency's expertise in identifying and handling toxic substances in environmental media. Within the Agency and ORD's emphasis on sustainability, HSR could serve multiple priority needs and programs and also provide opportunities for game-changing research if it were better integrated

with research developing resilience of the built environment in the face of sudden disruptions and natural disasters.

3.7. Economics and Decision Science

Sustainability is a challenge grounded in the human dimensions of a coupled human and natural system. Humans are the driving force of environmental changes both good and bad, and human institutions and behavior must change if a transition toward a sustainable economy is to be achieved. Thus it is striking that EPA's budget accords so little explicit attention to research on the human elements of coupled systems.

Economics remains a low priority for EPA, and decision sciences were eliminated altogether in the 2008 reorganization that transferred the Economics and Decision Science extramural research program to the National Center for Environmental Economics (NCEE). The fragments of social science research continue to be subjected to the disinvestments of a declining budget. A long-term dataset, the Pollution Abatement Cost and Expenditure survey series, is a casualty of these cuts, limiting our ability to understand the economic implications of environmental regulation. This is a serious loss because of the length of time needed to collect data on industries making long-term capital investments in response to globalization and national economic shifts, as well as environmental regulations. NCEE retains a function as an internal "consulting group," available for studies in the Office of Policy and elsewhere within the Agency. This is an important function, not only to help EPA meet its immediate responsibilities involving economic analysis, but also as a way to maintain awareness within EPA of the perspectives and utility of understanding the human dimensions of environmental problems.

Social science has no explicit place within the four major research programs around which ORD is being reorganized. The SAB appreciates the need for social science as a cross-cutting theme, but that understanding needs to be translated into a durable institutional presence in the Agency if the human dimensions of sustainability are to become a permanent part of EPA's approach.

The SAB has commented repeatedly on the neglect of social and behavioral at EPA. A time of politically frightening budget deficits is not the moment for a sweeping investment in the social sciences. But people and the institutions that shape human behavior, including markets and informal norms, as well as the regulations and laws that fall within EPA's legal responsibility, are central to sustainability. Environmental protection requires research related to these dimensions to achieve sustainable outcomes.

How well will the requested budget allow EPA to advance its strategic research directions and meet EPA priorities?

It appears that the total budget devoted to Economics and Decision Science (EDS) is \$1M (plus an additional \$0.4M for NCEE), a reduction of \$.2M from FY 2010 enacted funding of 1.2M. This is barely enough to keep the Center alive, much less to advance strategic directions.

Are the changes since the FY 2010 enacted budget and EPA's research trends appropriate, taking into consideration overall resources, FTEs, and intramural and extramural resources?

The President's requested FY 2012 budget for EDS represents a 17 percent decrease from the FY10 level and is only 43 percent of the EDS budget in FY 2007. The SAB believes that the EDS budget should be increased. Economics and especially decision sciences cut across the Agency's goals, yet the budget marginalizes them. This marginalization is misguided because relatively small investments in these areas can provide large benefits. The one appropriate research investment to note is ORD's requirement that STAR grant applications include a social scientist on applicants' research teams.

The EDS research program was transferred from ORD to the NCEE in 2008. Since 2008, EPA has disinvested in decision science research and the SAB believes this disinvestment was a mistake. The SAB advises EPA to return responsibility for decision science research to ORD and develop an explicit research enterprise in environmental behavioral, social, and decision sciences. Such an enterprise need not be a separate new program, but would provide institutional support for integrating environmental behavioral, social, and decision sciences into ORD's transdisciplinary research programs.

Are there well defined objectives/work products for next year's budget? Can these be accomplished with the given resources?

It appears that efforts will be directed towards children's health protection and valuation of water resources, but only two projects seem to be well defined, both relating to water valuation. These activities involve modeling cost-effective nutrient management options for the Chesapeake Bay and modeling welfare impacts of ocean acidification.

The limited budget makes it difficult to accomplish very much, and these few projects may be sensible, given that they address problems that cut broadly across the Agency.

Are there pivotal, "game-changing" investments that can advance the science?

This program would be game-changing if the investments were adequate. The budget is too small to be game-changing in any sense. The SAB supports NCEE's plans to direct a substantial portion of its limited funds to external grants, especially for graduate student research. This is a good way to leverage resources and to bring new economists into environmental research. However, there is little evidence that this program can similarly affect the other social, behavioral and decision sciences.

The SAB deplores the elimination of decision sciences from the portfolio. It is apparent in the Agency's strategic plan that the decision sciences, and more generally the behavioral and social sciences, should be playing increasing roles in EPA's portfolio of research activities. Needs for research in social, behavioral, and decision science are apparent in the *Strategic Plan*, but receive virtually no funding in the President's FY 2012 requested budget.

Are there investments that will serve multiple programs or multiple priority needs?

The entire, albeit very small, budget serves multiple programs at EPA that require the results of economic research.

TABLE OF ACRONYMS

ACE	Air, Climate and Energy Research Program
CSS	Chemical Safety for Sustainability Research Program
HHRA	Human Health Risk Assessment
HSR	Homeland Security Research Program
iNPD	Interim National Program Director
IRIS	Integrated Risk Information System
ORD	Office of Research and Development
SBIR	Small Business Innovation Research
SHC	Sustainable and Healthy Communities Research Program
SSWR	Safe and Sustainable Water Resources Research Program

REFERENCES

- Intergovernmental Panel on Climate Change. 2007 Climate change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Summary for Policymakers. Authors Netz, B.; Davidson, O. R.; Bosch, P. R.; Dave, R.; Meyer, L. A. Editors Netz, B.; Davidson, O. R.; Bosch, P. R.; Dave, R.; Meyer, L. A.. 23 pp. Web site: <http://www.ipcc.ch/pdf/assessment-report/ar4/wg3/ar4-wg3-spm.pdf>.
- Olshansky, S. Jay et al. 2005. A Potential Decline in Life Expectancy in the United States in the 21st Century. *New England Journal of Medicine*. 352:11, 2005.
- Pope, Arden, Majid Ezzati, and Douglas W. Dockery. 2009. Fine-Particulate Air Pollution and Life Expectancy in the United States. *New England Journal of Medicine*. 360:376, 2009.
- University of Massachusetts Political Economy Research Institute, James Heintz, Heidi Garrett-Peltier, Ben Zippere. 2011. New Jobs Cleaner Air; Employment Effects Under Planned Changes to the EPA's Air Pollution Rules. *Ceres Report*. 2011. www.ceres.org/epajobsreport

Attachment A: Extracts from *EPA's FY 2012 Budget in Brief* for the SAB

EPA Research and Development

Transformational Solutions through Science Innovation

EPA's Office of Research and Development provides critical support to the Agency's environmental policy decisions and regulatory actions to protect human health and the environment. EPA research has provided effective solutions to environmental problems for the past 40 years. The Agency's research has informed risk reduction approaches that have resulted in cleaner air, land and water. However, today's increasingly complex public health and environmental problems require an evolved approach to research. Scientific innovation is needed to produce transformational solutions beyond those more narrowly targeted to single chemicals or problems.

To address these new challenges, in FY 2012 EPA is strengthening its planning and delivery of science by implementing an integrated research approach that looks at problems from a systems perspective. Research will leverage the diverse capabilities of in-house scientists and engineers and bridge traditional scientific disciplines. In addition, research plans will incorporate input from external stakeholders such as Federal, State, and local government agencies, non-governmental organizations, industry, and communities affected by environmental problems.

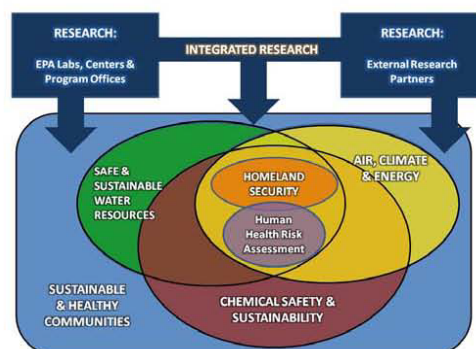
EPA will implement this new approach by realigning and integrating the work of twelve of its base research programs into four new research programs:

- **Air, Climate, and Energy**
- **Safe and Sustainable Water Resources**
- **Sustainable and Healthy Communities**
- **Chemical Safety and Sustainability**

This integration capitalizes on existing capabilities and promotes the use of a transdisciplinary perspective to further EPA's mission.

For example, available tools have failed to fully address complex aspects of chemical risk such as the impact of life-stage vulnerability, genetic susceptibility, disproportionate exposures, and cumulative risk. By formally integrating chemicals research, EPA will combine developments in computational, physico-chemical, and biological science to advance science in the sustainable development, use, and assessment of chemicals.

Within the new integrated programs, EPA will continue research to address targeted, existing problems and provide technical support, with an emphasis on sustainable applications and outcomes. The Human Health Risk Assessment and Homeland Security Research programs also will continue as key components of EPA's overall research portfolio.



EPA Office of Research and Development FY 2010 to FY 2012 in FORMER Program/Project Structure ¹

Appropriation	Program/Project		2010 Enacted		2011 CR ²		2012 Pres Bud ³		2012 vs 2010	
			\$000	FTE	\$000	FTE	\$000	FTE	\$000	FTE
Science & Technology	Earmarks		\$4,700	0.0	\$4,700	0.0	\$0	0.0	-\$4,700	0.0
	Homeland Security	Total Program	\$32,861	55.5	\$32,861	55.5	\$24,684	62.7	-\$8,177	7.2
		Decontamination	\$20,890	40.2	\$20,890	40.2	\$15,637	44.0	-\$5,253	3.8
		Safe Buildings	\$1,996	0.0	\$1,996	0.0	\$0	0.0	-\$1,996	0.0
		Other Research	\$9,975	15.3	\$9,975	15.3	\$9,047	18.7	-\$928	3.4
	Human Health Risk Assessment		\$44,789	173.7	\$44,789	173.7	\$44,108	187.4	-\$681	13.7
	Research: Global Change		\$20,826	35.5	\$20,826	35.5	\$20,810	41.2	-\$16	5.7
	Research: Clean Air		\$81,917	269.5	\$81,917	269.5	\$83,313	262.8	\$1,396	-6.7
	Research: Drinking Water		\$49,155	190.2	\$49,155	190.2	\$52,547	196.2	\$3,392	6.0
	Research: Water Quality		\$61,918	236.8	\$61,918	236.8	\$66,229	243.4	\$4,311	6.6
	Research: Human Health and Ecosystems	Total Program	\$161,511	484.9	\$159,511	484.9	\$145,446	475.0	-\$16,065	-9.9
		Human Health Research	\$84,904	211.2	\$83,904	211.2	\$45,392	112.2	-\$39,512	-99.0
		Ecosystems Research	\$76,607	273.7	\$75,607	273.7	\$60,906	255.7	-\$15,701	-18.0
		Other Research ⁴	\$0	0.0	\$0	0.0	\$39,148	107.1	\$39,148	107.1
	Research: Land Protection		\$14,111	58.8	\$14,111	58.8	\$13,601	57.3	-\$510	-1.5
	Research: Fellowships		\$11,083	2.6	\$11,083	2.6	\$17,261	6.4	\$6,178	3.8
	Research: Sustainability		\$27,287	70.8	\$27,287	70.8	\$26,788	67.0	-\$499	-3.8
	Research: Pesticides and Toxics		\$27,347	137.4	\$27,347	137.4	\$27,159	135.3	-\$188	-2.1
	Research: Endocrine Disruptors		\$11,355	50.1	\$11,355	50.1	\$16,888	46.1	\$5,533	-4.0
	Research: Computational Toxicology		\$20,048	32.7	\$20,048	32.7	\$21,211	34.4	\$1,163	1.7
	S&T Appropriation Total		\$568,908	1798.5	\$566,908	1798.5	\$560,045	1815.2	-\$8,863	16.7
LUST	Research: Land Protection		\$345	1.9	\$345	1.9	\$454	1.6	\$109	-0.3
Inland Oil Spills	Research: Land Protection		\$639	0.9	\$639	0.9	\$614	0.9	-\$25	0.0
Superfund	Homeland Security		\$2,166	2.0	\$2,166	2.0	\$1,968	2.0	-\$198	0.0
	Human Health Risk Assessment		\$3,404	14.9	\$3,404	14.9	\$3,342	14.9	-\$62	0.0
	Research: Sustainability		\$73	0.0	\$73	0.0	\$0	0.0	-\$73	0.0
	Research: Land Protection		\$21,191	93.1	\$21,191	93.1	\$17,706	89.5	-\$3,485	-3.6
	Superfund Appropriation Total		\$26,834	110.0	\$26,834	110.0	\$23,016	106.4	-\$3,818	-3.6
GRAND TOTAL			\$596,726	1911.3	\$594,726	1911.3	\$584,129	1924.1	-\$12,597	12.8

NOTES:

¹FY 2010 Enacted includes the \$2M supplemental for research to determine human health and environmental impacts of oil spill dispersants. Differences in totals between new and former program areas reflect transfers and cross-walk adjustments for workforce support costs.

²FY 2011 CR represents an annualized continuing resolution based on FY 2010 Enacted levels excluding supplemental appropriations.

³FY 2012 total for Research: Sustainable and Healthy Communities excludes \$0.5M in Agency green conferencing resources not included as part of the Office of Research and Development budget.

⁴FY 2012 resources for nanotechnology and other areas will now appear separately from the Human Health and Ecosystems research areas.

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EPA Office of Research and Development FY 2010 to FY 2012 in NEW Program/Project Structure¹

Appropriation	Program/Project	2010 Enacted		2011 CR ²		2012 Pres Bud ³		2012 vs 2010	
		\$000	FTE	\$000	FTE	\$000	FTE	\$000	FTE
Science & Technology	Earmarks	\$4,700	0.0	\$4,700	0.0	\$0	0.0	-\$4,700	0.0
	Homeland Security								
	Total Program	\$32,861	55.5	\$32,861	55.5	\$24,684	62.7	-\$8,177	7.2
	Decontamination	\$20,890	40.2	\$20,890	40.2	\$15,637	44.0	-\$5,253	3.8
	Safe Buildings	\$1,996	0.0	\$1,996	0.0	\$0	0.0	-\$1,996	0.0
	Other Research	\$9,975	15.3	\$9,975	15.3	\$9,047	18.7	-\$928	3.4
	Human Health Risk Assessment	\$42,899	167.6	\$42,899	167.6	\$42,400	180.9	-\$499	13.3
	Research: Air, Climate and Energy								
	Total Program	\$111,449	313.6	\$111,449	313.6	\$108,000	309.6	-\$3,449	-4.0
	Global Change Research	\$20,822	35.5	\$20,822	35.5	\$20,805	41.2	-\$17	5.7
	Clean Air Research	\$81,605	268.5	\$81,605	268.5	\$83,102	261.8	\$1,497	-6.7
	Other Research	\$9,022	9.6	\$9,022	9.6	\$4,093	6.6	-\$4,929	-3.0
	Research: Safe and Sustainable Water Resources								
	Total Program	\$111,073	427.0	\$111,073	427.0	\$118,776	439.6	\$7,703	12.6
	Drinking Water Research	\$49,129	190.2	\$49,129	190.2	\$52,521	196.2	\$3,392	6.0
	Water Quality Research	\$61,944	236.8	\$61,944	236.8	\$66,255	243.4	\$4,311	6.6
	Research: Sustainable and Healthy Communities								
	Total Program	\$188,095	551.1	\$188,095	551.1	\$170,528	529.7	-\$17,567	-21.4
	Human Health Research	\$54,180	106.7	\$53,180	106.7	\$45,392	112.2	-\$8,788	5.5
	Ecosystems Research	\$71,698	272.4	\$70,698	272.4	\$60,906	255.7	-\$10,792	-16.7
	Other Research	\$62,217	172.0	\$62,217	172.0	\$64,230	161.8	\$2,013	-10.2
	Research: Chemical Safety and Sustainability								
	Total Program	\$77,831	283.7	\$77,831	283.7	\$95,657	292.7	\$17,826	9.0
	Endocrine Disruptors Research	\$11,350	50.1	\$11,350	50.1	\$16,883	46.1	\$5,533	-4.0
	Computational Toxicology Research	\$20,044	32.7	\$20,044	32.7	\$21,209	34.4	\$1,165	1.7
	Other Research	\$46,437	200.9	\$46,437	200.9	\$57,565	212.2	\$11,128	11.3
	S&T Appropriation Total	\$568,908	1798.5	\$566,908	1798.5	\$560,045	1815.2	-\$8,863	16.7
LUST	Research: Sustainable and Healthy Communities	\$345	1.9	\$345	1.9	\$454	1.6	\$109	-0.3
Inland Oil Spills	Research: Sustainable and Healthy Communities	\$639	0.9	\$639	0.9	\$614	0.9	-\$25	0.0
Superfund	Homeland Security	\$2,166	2.0	\$2,166	2.0	\$1,968	2.0	-\$198	0.0
	Human Health Risk Assessment	\$3,404	14.9	\$3,404	14.9	\$3,342	14.9	-\$62	0.0
	Research: Sustainable and Healthy Communities	\$21,264	93.1	\$21,264	93.1	\$17,706	89.5	-\$3,558	-3.6
	Superfund Appropriation Total	\$26,834	110.0	\$26,834	110.0	\$23,016	106.4	-\$3,818	-3.6
GRAND TOTAL		\$596,726	1911.3	\$594,726	1911.3	\$584,129	1924.1	-\$12,597	12.8

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