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

JAN 14 2008

OFFICE OF
RESEARCH AND DEVELOPMENT

Gary S. Sayler, Ph.D.
Chair, Board of Scientific Counselors
Center for Environmental Biotechnology
The University of Tennessee
676 Dabney Hall
Knoxville, TN 37996

Dear Dr. Sayler:

On January 24, 2007, the Board of Scientific Counselors (BOSC) Mid-Cycle Subcommittee on Human Health Research met in Washington, DC, to evaluate the progress the Office of Research and Development's (ORD) Human Health Research Program had made since its 2005 BOSC review. The Subcommittee presented a draft report of its findings and recommendations to the Executive Committee of the BOSC. After receiving a copy of the final report dated July 23, 2007, the Human Health Research Program (HHRP) generated a response to the report, which is attached.

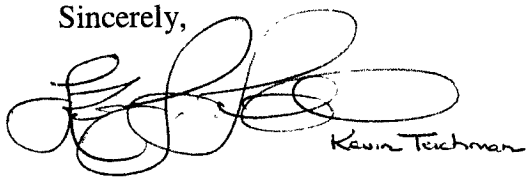
The HHRP benefited a great deal from the insight and advice offered by the Subcommittee, and the recommendations were greatly appreciated. The attached narrative identifies specific recommendations made by the Mid-Cycle Subcommittee, provides brief comments in response to each recommendation, and indicates how the HHRP will incorporate the findings of the Subcommittee into its activities. A table summarizing each recommendation, the action to be taken, and a schedule for completion of the action is also included.

ORD conducts periodic evaluations of its research programs' progress at intervals of 4–5 years. The purpose of these reviews is to determine progress with regard to relevance, quality, performance and scientific leadership. The reviews also focus on identifying how the scientific community and programmatic clients utilize ORD's scientific outputs to protect human health and the environment. In addition to these formal reviews, ORD evaluates program progress midway through the review cycle. These mid-cycle reviews provide critical feedback to the program concerning its progress since the last review and the extent to which recommendations from that review are being met.

The date for the next full review of the HHRP has tentatively been set for the end of 2008, and the input from this mid-cycle review will help us prepare for that program review.

Please pass along my personal thanks to the HHRP Mid-Cycle Subcommittee for a job well done.

Sincerely,



Kevin Y. Teichman, Ph.D.
Acting Deputy Assistant Administrator for Science

Attachment

cc: Dr. James Clark
Dr. Timothy Buckley
Dr. Joseph Landolph
Dr. Elaine Symanski

Office of Research and Development
Human Health Research Program
Response to the Board of Scientific Counselors
Mid-Cycle Review
January 24, 2007

Submitted by:
Hugh A. Tilson
National Program Director

ORD Response to Recommendations from the BOSC Mid-Cycle Review for the Human Health Research Program

The U.S. Environmental Protection Agency's (EPA) Office of Research and Development (ORD) relies on its Board of Scientific Counselors (BOSC) to conduct independent expert reviews of its environmental research programs every four to five years. Mid-cycle reviews are scheduled midway through the review cycle to provide feedback on progress since the last review, and offer advice concerning future directions and performance.

The BOSC Mid-Cycle Subcommittee for the Human Health Research Program (HHRP) met by teleconference on January 9, 2007, which was followed by a public meeting held on January 24, 2007. The mid-cycle review focused on ORD's detailed documentation of changes in the HHRP, a revised Multi-Year Plan (MYP), changes in the scope and focus of research activities, and adaptations to budgetary and other programmatic changes. A set of specific questions was used to guide the Subcommittee through the review.

The purpose of the following narrative is to respond to the recommendations made in the *Final Report of the Mid-Cycle Review of the Office of Research and Development's Human Health Research at the US Environmental Protection Agency*, dated July 23, 2007.

Beginning on page 2 of the *Final Report,* the BOSC Subcommittee found evidence that ORD demonstrated the ability to respond to concerns and recommendations from the BOSC. The report also noted that specific passages in the revised *2006 HHRP Multi-Year Plan* (MYP) responded to questions concerning the scope, planning, and implementation of research. The Subcommittee also noted that the materials provided prior to and discussion with ORD during the mid-cycle review supported the conclusion that the program was moving in a direction consistent with the BOSC's advice. The Subcommittee also noted that there were a number of new initiatives presented that will further define the scope and relevancy of the program. These points were also made on page 7 of the Report.

> **Recommendation 1**: ORD is encouraged to proceed with these commitments.
>
> **Response**: ORD appreciates the positive feedback concerning the new directions described in the 2006 MYP and at the mid-cycle review. The program will continue to work toward greater partner involvement in planning and evaluating research products and develop emerging research areas such as community risk assessment and evaluation of public health impacts of risk management decisions.

At the bottom of page 2 of the report, the Subcommittee noted that ORD had refocused Long-Term Goal (LTG) 4 (Assessment of Risk Management Decisions) as a means to tie advancements in human health research and implementation of risk management decisions to overall improvements in public health. The report also observed that this goal is evolving to become a unifying theme for the program. This point was also made on pages 6–7 of the report.

> **Recommendation 2:** The Subcommittee recommended that ORD broaden the objective of LTG 4 to reflect the growing emphasis on evaluating and demonstrating the impact of its research on improving environmental health.

Response: ORD appreciates the support of the Subcommittee for using LTG 4 as a unifying theme for future research. ORD is currently having discussions with scientists and managers in its intramural and extramural programs, as well as with its programmatic partners, to define the scope of research in this area. A document *"A Framework for Assessing Public Health Impacts of Risk Management Decisions"* has been written to provide a conceptual basis for such research. ORD conducted a workshop on public health applications of human biomonitoring on September 24–25, 2007, and is planning a workshop for January 22–23, 2008, to address research needs and gaps articulated in the *Framework* document. Regardless of the outcome of the workshops, it is clear that the definition of LTG 4 will remain outcome-oriented, similar to the other long-term goals, i.e., measuring progress will focus on documenting cases in which risk assessors and risk managers use the methods, models and data to improve risk assessment and evaluate effectiveness of risk management decisions.

On page 3 of the Executive Summary, the Subcommittee noted progress in developing performance metrics for the program, particularly as it relates to the use of peer-reviewed publications as the basis for determining impact, developing linkages to annual performance goals and measures in the MYP, and providing measures of cost-effectiveness. These points were also raised on pages 8–9 of the report.

Recommendation 3: The Subcommittee recommended that performance-based measures such as bibliometric analyses that link directly to publications and their impact be developed to guide ORD in assessing the significance of its research. The Subcommittee recommended that the bibliometric information be stratified by intramural and extramural research activities and included as an integral component of performance metrics. The Subcommittee also recommended that ORD develop quantitative measures of cost-effectiveness (e.g., publications/FTE or publications/resources available) and try to link research outputs to annual performance goals and measures in the MYP.

Response: ORD agrees with the intent of these recommendations. Bibliometric analysis of peer-reviewed publications is now accepted as one of the primary tools by which ORD assesses the impact of research outputs. Conducting meaningful evaluations of cost-effectiveness (i.e., efficiency) of research outputs is also something ORD is working to do. ORD has been working with OMB, the BOSC, and other agencies including the National Academy of Sciences to identify the most appropriate performance and efficiency metrics for research programs. ORD will continue working to develop and implement these metrics, and the data will be provided at the next BOSC review. Since it is important for ORD to have common metrics to manage and improve program performance across labs and centers, and ORD's intramural and extramural efforts are complementary, these metrics are unlikely to stratify program performance across various sub-components. However, ORD will continue working to develop a balanced set of metrics and other data to adequately assess progress toward, and the achievement of, each Long-Term Goal.

In addition to those common metrics being developed and implemented, an analysis of how the Agency's research products are being used by risk assessors to inform the risk assessment/risk management process is a valid indicator of programmatic impact for the

HHRP. ORD will continue to search the databases used at the time of the last PART evaluation (i.e., IRIS, Integrated Risk Assessments, NAS, SAB, and FIFRA) to determine how ORD's research products are being used to understand exposures and risk. ORD has been evaluating information derived from technical documents published by other groups (e.g., California EPA, Health Canada, IPCS) to determine the extent to which ORD research is acknowledged. ORD is also working towards developing a survey to evaluate our partners' use of our research and the use of data mining tools to assess the frequency by which ORD products are cited in documents supporting regulatory decisions. With regard to linking research outputs to annual performance goals and measures, ORD will provide that information during the poster presentations at the next BOSC review.

On page 3 of the report, the Subcommittee noted that the HHRP effectively describes a timeline for achieving research goals, but it lacks a specific plan for evaluating progress. This point was also made on page 8 of the report.

Recommendation 4: The Subcommittee encourages ORD to further develop an evaluative mechanism that would allow for an assessment of how well goals have been met and appropriately document the plan in future revisions of the MYP.

Response: ORD has developed a process to evaluate how well goals have been met for each of its research programs. Each program has established annual performance goals (APGs) in its MYPs and has specified Annual Performance Measures (APMs) that will be delivered using a 3-year window. As a measure of performance, ORD assesses the extent to which planned APGs and APMs have been met on time. Since establishing performance metrics has been a relatively recent development, a description of these metrics was not included in the 2006 HHRP MYP. ORD is currently revising its guidance for all MYPs, and a section describing performance metrics for each program will be added. In addition, ORD is developing standard policies and procedures to guide the development and implementation of performance metrics.

On page 3 of the report, the Subcommittee indicated enthusiasm for the possibility of using environmental health indicators as a metric of performance for both ORD and the Agency. This was also noted on page 9 of the report.

Recommendation 5: The Subcommittee encouraged ORD to compile information and communicate results regarding efforts to quantify changes in environmental health status.

Response: ORD acknowledges the need to develop approaches to quantify changes in environmental health indicators following risk management decisions. Such a need has been articulated clearly in the *Report on the Environment* (ROE) and the *2006-2011 EPA Strategic Plan.* As mentioned previously in response to Recommendation 2, ORD has developed a framework document outlining research gaps and needs in this area and plans to develop approaches to address those needs at the January 2008 workshop. Grantees funded under the extramural Request for Applications on the development of environmental public health outcome indicators were invited to present their research at this meeting. In addition, ORD intends to present the results of two demonstration projects associated with this issue at the next BOSC review. The science to support

performance metrics of public health changes as a function of regulatory decision-making is a long-term goal of the Agency. Research from the HHRP, as well as other research programs, will contribute to that goal.

On page 3 of the report, the Subcommittee again indicated support for using assessment of risk management decisions as a unifying theme for the program. This point was also raised on page 10 of the report.

Recommendation 6: The Subcommittee recommended that the HHRP broaden its mission statement to reflect the greater diversity of information and participation necessary to achieve the objectives of LTG 4.

Response: ORD agrees with this recommendation. As indicated on page 10 of the 2006 HHRP MYP, "The main objective of the HHRP is to reduce uncertainties in the extrapolation necessary for the risk assessment process by providing a greater understanding of the fundamental determinants of exposure and dose and the basis for biological changes that follow exposure to environmental agents." This "mission statement" needs to be revised to reflect the evolution of the program toward using the evaluation of public health outcomes as an underlying principle for the program. Although a final mission statement will be subject to discussion and approval by the Human Health Research Program Coordination Team, a provisional definition is as follows: "The main objective of the HHRP is to develop the fundamental science necessary to reduce uncertainties in our understanding of exposure and risk, inform risk assessment/management processes, and determine the impacts of risk management decisions on environmental health status."

On page 4 of the report, the Subcommittee noted that it had received the document *"A Framework for an Environmental Accountability Research Program"* that appeared to be reasonable starting point to define the scope of a program to evaluate the effectiveness of risk management decisions. However, the document did not appear to be a retrospective analysis.

Recommendation 7: The Subcommittee recommended that a plan be developed that would allow the Program's stakeholders and clients to link and track specific risk management decisions with risk assessments and the underlying research supported by ORD.

Response: The document *"A Framework for an Environmental Accountability Research Program"* was recently revised and re-titled *"A Framework for Assessing Public Health Impacts of Risk Management Decisions."* The objective of this document was to provide a conceptual basis for developing a research program to assess public health impacts of risk management decisions. In that respect, the document identifies several research needs and gaps articulated in the ROE as the basis for a research program. A workshop on public health applications of human biomonitoring was held in September 2007 and another workshop is being held in January 2008, to develop approaches to address those research needs and gaps. The overall message from the ROE is that the linkages between source-to-exposure-to-effect are not sufficiently developed to support reasonable evaluation of changes in pubic health measures, such as disease outcome, following risk

management decisions. ORD's emerging research program will focus on developing these linkages and reducing the uncertainties associated with them.

With regard to the need to develop a plan to link and track specific risk assessment and risk management decisions with underlying research supported by ORD, the HHRP is developing a client survey and data mining tools that will help us identify what research outputs were useful in supporting specific risk assessment and risk management decisions. These systematic data will be used to assess the extent to which research outputs (i.e., peer-reviewed publications) are being used to support human health risk assessments and regulatory decisions.

On page 6 of the report, the Subcommittee noted that there were numerous textual passages in the MYP and elsewhere to support the conclusion that the HHRP was moving in a direction consistent with the recommendations of the BOSC review in 2005. However, the Subcommittee noted difficulty finding the appropriate information to support this conclusion.

Recommendation 8: The BOSC Subcommittee recommends that in future reviews, ORD not only respond to review comments, but also identify the specific changes in documents such as the MYP as a result of review comments.

Response: ORD appreciates the difficulty of trying to track changes in the MYP that were made in response to previous recommendations. Such information could have been included in the narrative provided to the Subcommittee prior to the mid-cycle review. The authors of the revised HHRP MYP concentrated on addressing each recommendation from the previous review, which in many instances resulted in changes in multiple sections of the MYP. In the future, ORD will try to document such changes in a more user-friendly format.

On page 9 of the report, the Subcommittee noted that review articles or other summary documents may be particularly valuable metrics of research success and productivity in describing research progress related to a particular topic.

Recommendation 9: The Subcommittee recommended that ORD develop review or summary documents to demonstrate the productivity and responsiveness of the program.

Response: ORD acknowledges the utility of developing review or summary documents concerning progress in its research programs. ORD science managers are encouraging researchers to develop review articles whenever a body of work has evolved sufficiently. A review article describing ORD's research on the mode of action (MOA) for arsenic is a primary example. A review article on conazole research is being planned. The National Center for Environmental Research (NCER), which oversees the extramural grants program, has developed a summary document for a Request for Applications (RFA) concerning the development of biomarkers for pesticide exposure in children. NCER is also developing a document summarizing the accomplishments of their children's environmental health research over the last 10 years. This will include results from the multi-disciplinary Children's Environmental Health Research Centers. The National Exposure Research Laboratory (NERL) has also produced a summary document that compiles data from 13 studies and presents important findings on understanding

children's real world exposures. This summary document received the 2007 Children's Environmental Health Excellence Award for Science Achievement from EPA's Office of Children's Health Protection.

On page 10 of the report, the Subcommittee noted the importance of assessing how responsive the HHRP is to partner program offices. It was also noted that the current HHRP fails to describe the method or process for evaluating how the HHRP meets the needs of Program and Region Offices.

Recommendation 10: The Subcommittee recommended that the HHRP develop a process to evaluate responsiveness of ORD to Program and Region Office needs.

Response: At one level, addressing Program and Region Office needs occurs each year during the annual planning cycle. Program and Regional Office staff have representatives on the HHRP Research Coordination Team, which is responsible for both participating in revising the MYP every 3–4 years and prioritizing research on an annual basis. The responsiveness of ORD to partner needs is a key component in discussions concerning priorities. ORD has developed performance metrics to evaluate how its research products and expertise are used by EPA clients to support key risk assessment and risk management decisions relevant to the Agency (i.e., IRIS, Integrated Risk Assessment, SAB, NAS, and FIFRA). ORD is now in the process of developing a partner survey to evaluate how ORD's research products are being used and assess overall partner satisfaction. ORD is working toward having the results of such a survey available at the time of the next BOSC review.

On page 10 of the report, the Subcommittee noted that the description of the research questions and activities that support LTG 4 might be better focused.

Recommendation 11: The Subcommittee requested clarification concerning the research component of the first research track for LTG 4 and the rationale for the 10 research questions described on page 60 of the HHRP MYP. The Subcommittee also noted a lack of connection between the 10 research questions and the APMs in the MYP. In addition, the Subcommittee requested clarification as to how research activities and outputs from the other LTGs were associated with LTG 4. This information could be particularly useful if LTG 4 becomes a unifying theme for the HHRP over the next 3–5 years. The Subcommittee also recommended that a process be established by which client offices would be able to communicate back to ORD concerning which products are used and how. A lack of APMs related to the RFA supported by NCER was also noted.

Response: When the MYP was drafted in 2005 and finalized in 2006, the scope of the research program for LTG 4 was not clear. Research Track 1 of LTG 4 (ROE) was included in the MYP to show that HHRP researchers were intimately involved in developing the document that would guide our research program in the future. The ten questions included in the MYP represented areas where our researchers thought the program might go over the next 3–5 years. The Subcommittee correctly points out the absence of a strong relationship between these questions and the APMs in the MYP. To provide more focus for a research program in this area, ORD has formulated the "*Framework for Assessing Public Health Impacts of Risk Management Decisions.*" This

document identified research needs and gaps articulated in the ROE. ORD plans to develop approaches to address these needs and gaps at the January 2008 workshop. The results of the workshop will be used to develop more appropriate research questions and relevant APMs for this LTG. These will be described at the next BOSC review.

With regard to communication, ORD is already involved in dialogue with our partners concerning research in this area. This dialogue consists of briefings and discussion within the HHRP Research Coordination Team. Our partners have also been involved in developing the *Framework* document and will play an active role in the January 2008 workshop. APMs relevant to the RFA were not included in 2006, because grants had not been funded at that time. New APMs for the projects funded through the 2006 RFA have since been added to the revised Table of APMs for the HHRP.

On page 11 of the report, the Subcommittee noted that they had received the *"Framework for Assessing Public Health Impacts of Risk Management Decisions."*

Recommendation 12: The Subcommittee requested additional details concerning the criteria for prioritizing which risk management decisions to evaluate and information concerning resources needed to implement a program in this area. The Subcommittee noted the need to develop benchmarks of progress for this effort.

Response: The *"Framework for Assessing Public Health Impacts of Risk Management Decisions"* articulates a broad conceptual basis for a research program in this area. ORD conducted a workshop on public health applications of human biomonitoring in September 2007. Identifying which research needs and gaps to address will be the focus of the January 2008 workshop. Determining the resources for a program in this area will be dependent on the research proposed by the workshop. Once research plans have been developed and resources identified, performance metrics can be established. The issue of additional resources is also addressed in Recommendation 14 below.

On page 12 of the report, the Subcommittee noted two collaborative efforts related to LTG 4, but were not sure as to the relevance of the United States (U.S.)-Mexico Border Program.

Recommendation 13: The Subcommittee requested clarification of the contribution of the U.S.-Mexico Border Program to LTG 4.

Response: The 2012 U.S.-Mexico Border Program is a collaboration between the U.S. and Mexico through the Pan-American Health Organization (PAHO) to improve the environment and protect the health of people living along the border. ORD continues to support this program by providing expertise and advice in identifying public health needs of the border region. At the time the 2006 HHRP MYP was written, this program funded a series of intramural and extramural efforts focused on tracking environmentally-based disease, developing environmental health indicators, and linking urinary biomarkers to exposure. Since that time, however, the ROE was made available, which clearly provides the appropriate direction for a research program in this area.

On page 12 of the report, the Subcommittee commented on the budget allocated to LTG 4.

Recommendation 14: The Subcommittee recommended that additional demonstration projects be funded to the extent possible given available resources.

Response: ORD agrees with this recommendation and will fund additional demonstration projects subject to available resources and competing priorities.

On page 13 of the report, the Subcommittee mentioned the process by which chemicals or chemical classes are identified for study by the HHRP, but was unclear as to how the program addressed emerging issues.

Recommendation 15: The Subcommittee recommends that the MYP should explicitly describe how specific chemical concerns or toxicity effect issues that emerge on a short timeframe are addressed.

Response: How ORD addresses emerging issues is handled primarily through the annual planning process and through discussion with ORD senior managers, including the National Program Directors. Decisions are based on the scope of the issue, the nature of the chemical class or toxicity effect, and resources available for redirection. For example, much of the research related to computational toxicology was originally included in the HHRP. As the need for a greater effort in this area became an ORD priority, ORD senior management chose to form the National Center for Computational Toxicology (NCCT) and find additional resources to address this rapidly growing area. At the present time, mechanistic work done in HHRP contributes to model development in the NCCT, and there is considerable collaboration between the scientists in the two programs.

Another case in point is nanotechnology. Initially, Agency concerns about this area were generally associated with fate and transport issues, and the extramural program was engaged to develop a grants program to address these issues. Potential effects on human health were being addressed by other agencies such as the National Institutes of Health, and the Agency did not devote significant resources to evaluate these questions. As the scientific and programmatic issues facing the Agency have become more clearly delineated, a decision was made by ORD senior management to develop a research strategy for nanotechnology. This strategy was recently completed, and it is expected that this research program will be placed administratively in the Land Research Program.

Some emerging issues are of a smaller magnitude and often handled by one of the existing problem-driven MYPs (i.e., Air, Safe Pesticides/Safe Products, Drinking Water). For example, research issues related to the perfluorinated chemicals were considered by ORD senior management to fall into the domain of the Safe Pesticides/Safe Products MYP. However, some questions such as the long-term consequences of developmental exposure to these chemicals during the life span were considered to be more suitable for a multi-media program such as the HHRP. Another emerging research need concerns the potential health risk of flame retardants, i.e., the polybrominated diphenyl ethers. At the present time, research on these chemicals is supported by the HHRP because of both the need for mechanistic and dose-response data and the multi-media aspects of problem, i.e., assessment of the critical route of exposure, bioavailability, and metabolic transformation of these compounds. In this case, the capability and capacity to study chemicals having a

comparable mode of action already exists in the HHRP, and the issue is compatible with the strategic directions of the program.

The MYPs for all ORD programs lay out a course of research based on the programmatic issues, scientific direction, and resources available at the time they are written. Through the annual planning process, which involves programmatic and scientific considerations, annual performance measures are updated to reflect changes over time. The Subcommittee is correct that this process is not described in the MYP. HHRP will recommend that the process for dealing with emerging issues be included in the new guidance for ORD's MYPs.

On page 20 in Appendix C of the report, the Subcommittee noted the progress made in documenting the interaction between ORD scientists and international groups.

Recommendation 16: The Subcommittee recommended that the documentation package for the next review should include a section describing specific research interactions of HHRP scientists with international programs.

Response: ORD agrees with this recommendation and will include a short description of international activities in the documentation package for the next review.

On page 21 in Appendix C of the report, the Subcommittee indicated that a list of inter-governmental agency collaborations between HHRP and sister governmental agencies was missing from the 2005 review. This point was also made on page 23 of the *Final Report*.

Recommendation 17: The Subcommittee recommended that ORD create diagrammatic representations of intergovernmental interactions and provide a table documenting specific interactions for the next review.

Response: ORD agrees with this recommendation and will include this information in the documentation package for the next review.

On page 21 in Appendix C of the *Final Report*, the Subcommittee noted that progress had been made to improve communication between extramural and intramural scientists.

Recommendation 18: The Subcommittee recommended that efforts to promote communication between intramural and extramural scientists be continued and reinforced.

Response: Interactions between intramural and extramural researchers will continue to be a high priority for the HHRP. Several scientist-to-scientist meetings and conferences have been planned to promote such communication.

On page 26 in Appendix C of the *Final Report*, the Subcommittee noted that the BOSC had recommended that HHRP create a pilot group to begin thinking about whether pesticide exposure contributes to the incidence of neurodegenerative diseases in humans.

Recommendation 19: The Subcommittee recommended that ORD begin pilot studies, alone or with other collaborators, on the topic of neurodegenerative diseases in humans.

Response: Research to provide a linkage between pesticide exposure and neurodegenerative disease has been supported in the past by the extramural program and a small effort in the Neurotoxicology Division of the National Health and Environmental Effects Research Laboratory. Support for research in this area, however, has not received a high priority from OPPTS or other programmatic clients. It is possible that as the research program on evaluation of public health impacts of risk management decisions begins to identify areas for future research, this topic could emerge as a high priority in that context.

Human Health Research Program
Summary of Recommendations and Proposed ORD Actions and Timelines

Recommendation	ORD Action	Timeline for Action
Recommendation 1: Proceed with the initiatives presented at the mid-cycle review that will further define the scope and relevancy of the program.	**Response**: The program will continue to both work toward greater partner involvement in planning and evaluating research products and develop emerging research areas such as community risk assessment and evaluation of public health impacts of risk management decisions.	Progress towards these initiatives will be discussed at the next review of the HHRP.
Recommendation 2: Broaden the objective of LTG 4 to reflect the growing emphasis on evaluating and demonstrating the impact of its research on improving environmental health.	**Response:** ORD will work with its scientists and partners to define the scope of LTG 4.	ORD is in the process of exploring data mining tools to determine the extent to which products are used by risk assessors and risk managers. Results will be presented at the next review of the HHRP. ORD is also working with our partners to develop potential metrics for evaluating public health impacts of risk management decisions. A framework document has been written; a workshop to plan research will be held in January 2008.
Recommendation 3: Develop performance-based measures such as bibliometric analyses that link directly to publications and their impact.	**Response:** Bibliometric analysis of peer-review publications will continue and quantitative evaluations of cost-effectiveness will be developed. The impact of scientific outputs on risk assessments and other scientific publications will be evaluated.	ORD is constantly updating its bibliography. Performance-based metrics will be reported at the next review of the HHRP.
Recommendation 4: Develop an evaluative mechanism that would allow for an assessment of how well goals have been met and appropriately document the plan in future revisions of the MYP.	**Response**: ORD already tracks progress with regard to APGs and APMs; discussion of the process is not included in the current MYP. ORD will recommend that a description of performance metrics be included in the new guidance for MYPs.	Completed. In addition, an explanatory section on performance metrics will be included in the next revision of the MYP.
Recommendation 5: Compile information and communicate results regarding efforts to quantify changes in environmental health status.	**Response:** ORD is working on approaches to capture information on public health impacts of risk management decisions.	ORD will report progress on this recommendation at the next BOSC review.
Recommendation 6: The Subcommittee recommended that the HHRP broaden its mission statement to reflect the greater diversity of information and participation necessary to achieve the objectives of LTG 4.	**Response**: ORD agrees the mission statement should be revised.	ORD will use a revised definition at the next BOSC review.
Recommendation 7: Develop a plan that would allow the Program's stakeholders	**Response:** ORD already tracks some risk assessment decisions as part of the	Additional performance metrics of partner usage of

Recommendation	ORD Action	Timeline for Action
and partners to link and track specific risk management decisions with risk assessments and the underlying research supported by ORD.	PART assessment. ORD is working on developing data mining tools that would provide additional information or how its research is used by our partners and others.	products will be discussed at the next BOSC review.
Recommendation 8: In future reviews, ORD should not only respond to review comments, but also identify the specific changes in documents such as the MYP as a result of review comments.	**Response:** In the future, ORD will document specific changes in documents such as the MYP.	ORD plans to revise the MYP in 2009. Comments from the next BOSC review leading to revisions in the MYP will be documented.
Recommendation 9: Develop review or summary documents to demonstrate the productivity and responsiveness of the program.	**Response:** ORD has or is in the process of developing summary documents or reviews for completed projects.	A summary document on biomarkers for pesticide exposure in children has been completed. Review articles on arsenic and conazole research are being written.
Recommendation 10: Develop a process to evaluate the responsiveness of ORD to program and regional office needs.	**Response:** ORD uses the annual planning process to evaluate responsiveness to its partners' needs; ORD is developing data mining tools and a survey to provide additional input.	Results from the partner survey and data analysis of how products are used by our partners will be presented at the next BOSC review.
Recommendation 11: Clarify the relationship between the scientific questions in the MYP for LTG 4 and the proposed research program and APMs, especially for the STAR program.	**Response**: ORD will provide clarifying information concerning LTG 4.	Presentations at the next BOSC review will provide a list of scientific questions and link those to research; APMs will be provided that are indicative of research in the STAR program.
Recommendation 12: Develop criteria for which risk management decisions will be evaluated and information concerning resources related to implement a program in LTG 4.	**Response:** ORD will provide criteria and resource information following its planning workshop on evaluating public health impacts of risk management decisions.	ORD will conduct a planning workshop in January 2008. Resource implications of the planned research will be assessed by ORD management by June 2008.
Recommendation 13: Clarify the contribution of the U.S.-Mexico Border Program to LTG 4.	**Response:** At the time the MYP was written in 2006, the Border project was being used to identify research gaps and needs for LTG 4. The ROE is now being used to identify those needs.	Completed.
Recommendation 14: Obtain additional resources for demonstration projects for LTG 4.	**Response:** Additional demonstration projects will be considered in light of available resources and competing priorities.	This issue will be addressed at the next BOSC review.
Recommendation 15: The MYP should explicitly describe how specific chemical concerns or toxicity effect issues that emerge on a short timeframe are addressed.	**Response:** ORD has a process by which emerging needs are addressed in its research programs. ORD will recommend that the guidance for MYPs address this issue.	Completed.
Recommendation 16: The documentation package for the next review should include a section describing	**Response**: The documentation package for the next review will include this information.	The next BOSC review is tentatively planned for the end of 2008.

Recommendation	ORD Action	Timeline for Action
specific research interactions of HHRP scientists with international programs.		
Recommendation 17: Create diagrammatic representations of intergovernmental interactions and provide a table documenting specific interactions for the next review.	**Response**: The documentation package for the next review will include this information.	The next BOSC review is tentatively planned for the end of 2008.
Recommendation 18: Efforts to promote communication between intramural and extramural scientists should be continued and reinforced.	**Response**: Interactions between intramural and extramural researchers will continue to be a high priority for the HHRP. Several scientist-to-scientist meetings and conferences have been planned to promote such communication.	Completed.
Recommendation 19: Begin pilot studies, alone or with other collaborators, on the topic of neurodegenerative diseases in humans.	**Response**: ORD will explore the programmatic need for research on neurodegenerative diseases in humans.	A response to this recommendation will be documented in the package for the next BOSC review.