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

September 2, 2005

OFFICE OF
RESEARCH AND DEVELOPMENT

Dr. James H. Johnson, Jr.
Chair, Board of Scientific Counselors
Dean, College of Engineering, Architecture and Computer Sciences
Howard University
2366 6th Street NW
Washington, DC 20059

Dear Dr. Johnson:

On February 29-March 2 of this year, Dr. Klaunig chaired the Human Health Subcommittee of the Board of Scientific Counselors' evaluation of the Office of Research and Development's (ORD) Human Health Research Program in Research Triangle Park, NC. Following that review, the Subcommittee presented a report of its findings and recommendations about program relevance, quality, performance and scientific leadership to the Executive Committee of the Board of Scientific Counselors. After a receiving a copy of the final report, the Human Health Research Program generated a response to the BOSCs report, which is now transmitted to you for your consideration.

The response of the Human Health Research Program to the reviewers' comments and recommendations is based on input from members of the Human Health Research Working Group, program and regional office stakeholders, the Associate Directors for Health, and the Acting National Program Director for Human Health. The enclosed narrative identifies specific recommendations made by the reviewers for each of the four Long-Term Goals, provides a brief comment in response, and indicates how the Human Health Research Program will incorporate the committee's findings into its operation. Also attached is a table summarizing each recommendation, the action to be taken, and a schedule for completion of the action. The Program benefitted considerably from your insight and advice and your recommendations were greatly appreciated.

As indicated in the Charge for the Human Health Research Program, ORD intends to conduct periodic evaluations of its program's progress at intervals of four to five years. The purpose of the reviews is to determine progress with regard to relevance, quality, performance, and scientific leadership; identify when clients are applying research to strengthen environmental decisions; and evaluate client feedback about the research. In addition to a formal review every four to five years, ORD intends to conduct an interim evaluation of the Program's

progress midway through the review cycle. Within the next year or so, a subset of the Human Health Research Program subcommittee will be invited to participate in a one-day review to evaluate the status of the changes the Program has agreed to implement. In this context, we look forward to the possibility of working with you again.

Sincerely yours,

William H. Farland, Ph.D.
Acting Deputy Assistant Administrator for Science

Enclosure

cc: Dr. James Klaunig (Human Health Subcommittee, Chair)
Dr. James R. Clark (Human Health Subcommittee, Vice-Chair)
Dr. Timothy Buckley
Dr. Harvey Clewell
Dr. Michael Jayjock
Dr. Joseph Landolph
Dr. Donald Mattison
Dr. Elaine Symanski

Office of Research and Development (ORD) Response to the Board of Scientific Counselors (BOSC) July 2005 Final Report That Reviews ORD's Human Health Research Program

BOSC Human Health Subcommittee:
Dr. James Klaunig, Chair
Dr. James R. Clark, Vice-Chair and Liaison to the BOSC Executive Committee
Dr. Timothy Buckley
Dr. Harvey Clewell
Dr. Michael Jayjock
Dr. Joseph Landolph
Dr. Donald Mattison
Dr. Elaine Symanski

Submitted:
Hugh Tilson, Ph.D.
Acting National Program Director
Human Health Research Program
Office of Research and Development

The following is a narrative response to the recommendations and observations offered by the Human Health Subcommittee of the Board of Scientific Counselors' review of ORD's Human Health Research Program (HHRP). The review was held on February 28- March 2, 2005, at Research Triangle Park, NC. Overall, the Subcommittee found that the HHRP was of high scientific quality and appropriately focused. In addition, the program was found to be multi-disciplinary, displayed good stakeholder participation, informed risk assessments, and achieved the goal of reducing uncertainty. The Subcommittee offered a number of observations and recommendations, which are being used to guide the program during the annual planning cycle and revision of the Human Health Multi-Year Plan (HH MYP). The following response outlines actions that are being taken by the HHRP in response to the review.

Actions being taken or planned are described for each section of the Report of the Subcommittee on Human Health Research. Several recommendations were repeated from one section to the next. In such cases, overlapping recommendations have been combined and discussed in the order in which they first appeared in the review document. Peer review comments or recommendations are shown below in *italics.* Comments, where needed for clarification are in plain format, while actions underway or planned are in **bold-faced type.**

EXECUTIVE SUMMARY

Overall Opportunities (pp. 4-5)

1. *Today there are regulatory mandates playing out in the rest of the world that are driving the overall scientific development of human health exposure assessment for the multitude of common and relatively unstudied substances to which humans are exposed. Significant resources are about to the committed, especially in the European Union (EU), to develop the exposure and risk assessment tools needed to reasonably accomplish these mandates. Even if EPA ORD is not designing this type of research, it should monitor, engage in, and advise these research efforts of others. Scientists within the Human Health Research Program should contribute their considerable skills and knowledge to the EU Research Planning (p.4)*

The subcommittee noted an area of opportunity for further participation, i.e., examining involvement and potential collaboration with similar programs in the EU and Health Canada. These interactions should be coordinated at a much high level with the Agency than currently is occurring (p. 8).

There are specific scientific activities occurring in the EU that should receive intense Agency interest, interaction, and potential coordination. EPA should pursue further interaction and engagement of international agencies including the EU and Canada (p. 10).

To some extent the direction, choice and focus of research topics are undoubtedly areas where national politics interacts and shapes the development of specific scientific programs. The current focus of EPA ORD research on pesticides and only a relatively few substances has remained

unchanged for sometime and was the subject of some previous comments during Agency reviews in past years. The difference today is that there are regulatory mandates playing out in the rest of the world that are driving the overall scientific development of human health exposure assessment for the multitude of common and relatively unstudied substances to which humans are exposed. Significant resources are about to be committed, especially in the European Union (EU) to develop the exposure and risk assessment tools needed to reasonably accomplish these mandates. Because these mandates are quite different, the tools being developed will also have a dissimilar perspective and approach than that displayed in the ORD Research Plan. Even if EPA ORD is not designing this type of research it should monitor, engage in and advise these research efforts of others. This commitment should happen with greater intensity and at a significantly higher level within the EPA research organization than has occurred to date. This will allow the Agency to advise and participate in the development of this particular piece of science. At the very least scientists within ORD should contribute their considerable skill and knowledge to the EU Research Planning. Given this interaction and interchange, the outstanding scientific management extant within EPA ORD might also benefit these international programs simply by virtue of its powerful example. This contact and participation would assure that the Agency's scientific staff remains in-touch with and knowledgeable about what is transpiring in this critical realm. It would also put them in an excellent position to enlist and act as full collaborating and operational partners in developing these tools if the decision to do so happens (p.26).

As noted above, there are specific scientific activities occurring in the European Union that should receive intense Agency interest, interaction and potential coordination. Indeed, it is highly probable that specific elements of the EPA ORD research effort will not overlap with these EU programs, but they could certainly benefit from them (p. 31).

The EU has significant resources and a strong regulatory mandate for the assessment of existing chemicals. Health Canada also has a strong regulatory mandate to conduct exposure and risk assessment on literally thousands of existing chemicals in commerce. EPA interaction and potential collaboration with these programs should be coordinated at a much higher level within the Agency that is currently occurring (p.31).

Comments: ORD agrees with the BOSC recommendations that the HHRP be expanded, where possible, to include research designed to improve the overall scientific development of human health exposure assessment for the multitude of common and relatively unstudied substances to which humans are exposed. ORD also recognizes the importance of developing partnerships with other organizations (e.g., the European Union, Canada, etc.) to build on their research and efforts for reducing risks to humans.

Actions: The acting NPD for HH will meet with the EPA Program Offices and regions and conduct a customer value analysis of their current and emerging research needs. This list will then be reviewed and prioritized by the Research Coordination Team and used in the development of the next version of the HH MYP. The acting NPD for HH and key ORD researchers will meet with the Director, OPPT, to develop strategies for engaging ORD researchers with the various European and Canadian organizations who are designing

related research programs addressing uncertainties for high priority chemicals and classes of chemicals. ORD researchers will actively participate in future EU and Canadian workshops designed to develop new approaches for addressing risk assessment to chemicals.

Time Line: ORD researchers attended a recent EU workshop in Italy in June 2005. The acting NPD for HH will meet with the Director, OPPT, during 2005 to identify European, Canadian, and other international programs where the ORD HH research program can benefit by collaborating with these organizations. ORD researchers will meet with selected Canadian and other country scientists during 2005 and early 2006 to identify ways to integrate ORD's human health research on toxic chemicals with these on-going and planned activities.

2. *The creation of the new National Center for Computational Toxicology (NCCT) may produce challenges with regard to teamwork. This transition should be monitored to ensure that collaboration continues to be encouraged and not organizationally impeded (p. 5, 16)*

The high effectiveness of the research program owes a great deal to the atmosphere of cooperation and teamwork that has been created and maintained by the Agency management. It is crucial that efforts to maintain this highly effective environment be continued and perhaps increased when the new National Center for Computational Toxicology is created (p.30).

Comments: ORD agrees that formation of the NCCT could be perceived to pose challenges to the future cohesiveness of the HHRP, particularly as it relates to development of predictive models as described in the BOSC review. However, the NCCT has been established to help establish an Agency vision for future research that integrates emerging computing and molecular biology technologies to address the highest priority Agency needs. The Acting National Program Director (NPD) for Human Health and the Director of NCCT have already had discussions concerning this issue. It was agreed that the focus of the NCCT will be on the application of computational methods to predict effects of environmental stressors. Research from the HHRP will be crucial for the development of these methods in at least two important respects: 1) validated molecular methods will be needed to generate data that can be used to develop databases for toxicogenomic studies and 2) fundamental studies on biological pathways and key critical molecular endpoints will be needed to develop computational methods and approaches. It was agreed that the HHRP and the NCCT are interrelated and interdependent programs that will require regular dialogue and discussion to maintain optimal effectiveness.

Action: The Acting NPD for Human Health will meet on a regular basis with the Director of NCCT to assess progress of their respective programs. The revised HH MYP will include a narrative outlining the relationship between the two programs. The Director of the NCCT will be asked to provide input and feedback into the writing of the revised HH MYP, including the development of annual performance goals (APGs) and measures (APMs) that describe collaborative efforts between the two programs. Scientists in the NCCT will continue to meet with the ORD HH research teams associated with research themes developed from the revised HH MYP.

Time line: Effective immediately, meetings between the NPD and the Director will be scheduled on a quarterly basis. Input from NCCT will be included in the draft version of the HH MYP, which is projected for February 1, 2006.

Program Relevance (pp.5-6)

1. The subcommittee noted that a greater level of interaction between the externally funded University Centers and in-house research could result in more significant research progress, as seen, for instance, in the case of the potential role of GST polymorphisms in autism. EPA has established an extramural research grants program and an extramural Environmental Health Centers Program that utilize the efforts of scientists at research institutes and universities to aid the Agency in developing areas of toxicology and carcinogenesis that need to be explored beyond EPA's immediate capabilities (p.6)

There was less evidence of an interaction of the in-house program with the extramural Children's Centers. A greater level of interaction might result in useful in-house research initiatives, for example in the area of the potential role of GST polymorphisms in autism (p. 44).

Comment: ORD agrees that there can be better coordination between the intramural and extramural research programs, particularly in the planning of research activities and the use of information derived from the STAR program for risk assessment.

Action: ORD will sponsor scientist-to-scientist workshops on collaborations for Children's Environmental Health Research and Computational Toxicology. The purpose of these workshops will be to exchange information about the research being planned both extramurally and intramurally in the areas of children's research and computational toxicology. Working groups will be formed based on identification of areas of common interest to the scientists (e.g., oxidative stress, asthma, computational toxicology). The NPD for HH, the NPD for Pesticides and Toxics, the Director for NCCT, and scientists from the National Center for Environmental Research (NCER) will meet on a regular basis with these working groups to determine progress and impact of the research on risk assessment. The role of the STAR program will be more clearly articulated in the development of annual performance measures for the revised HH MYP.

Time line: The Acting NPD for HH, the NPD for Pesticides and Toxics, the Director for NCCT, and key NCER staff will plan a series of symposiums to exchange research findings and identify new areas for research between the ORD researchers, the STAR grantees, and other interested public and private sector scientists. An initial Children's Research workshop was held on July 11-12, 2005, in Research Triangle Park, NC. An ORD/STAR Computational Toxicology workshop was held on July 18-19, 2005 in Research Triangle Park, NC. Working groups for specific research areas identified during these initial meetings were established by September 1, 2005.

Effectively immediately, the NPD HH will also hold regular meetings with NCER staff to develop RFAs that augment the on-going intramural research program. Discussions concerning Program and Regional Office needs will be conducted in the context of regular weekly meetings of the Human Health Working Group. Annual performance measures will be developed for the revised HH MYP showing contribution of the STAR program to the overall HHRP. Draft revised HH MYP is scheduled for February 1, 2006.

2. The posters and publications of ORD scientists showed clear evidence that collaboration is occurring between Agency scientists and scientists from other governmental agencies (e.g., National Institute of Environmental Health Sciences [NIEHS]). However, a listing of intergovernmental agency collaborations between the Human Health Research Program of ORD and its sister governmental agencies was missing from the review documents, so the full extent of this partnering could not be judged accurately and given the appropriate credit (p.6, 16).

Information about research coordination was largely available through conversations with scientists and managers. This feature of ORD's human health research program is a strength that should be more prominently described and presented (p. 36).

Comment: ORD agrees that establishing collaborations and partnerships with other Federal and non-Federal research organizations will ultimately strengthen ORD's overall research program. There are numerous instances of ORD collaborations with governmental research organizations other than NIEHS that where not highlighted adequately during the recent BOSC review. ORD attempted to capture the scientific leadership provided to these organizations in Table 7 of the materials provided to the BOSC. ORD realizes that this table does not document specific examples of research collaborations, but it does provide an overview of how ORD is reaching out to the broader community to achieve it's scientific objectives.

Action: A listing of intergovernmental agency collaborations between the HHRP will developed and updated yearly. The updated listing will be provided at the next available review of the program.

Time line: Mid-cycle review projected for 2007; next full review projected for 2009.

3. The public benefits from doing good science could be further enhanced in the written materials presented to the subcommittee (p.6).

The public benefits from doing good science are not clearly or completely presented within the proposed work. Certainly, understanding and substantially reducing cancer and non-cancer risks are vitally important and clearly recognized in this plan. The panel advises that it is also important and valuable that the technical work products be able to render the scientific determination of de minimus or acceptably low levels of human health risk from chemical exposure. The value of confident-knowledge regarding the relative safety offered by improved exposure and risk assessment tools of previously feared exposures and putative risks represents an arguably significant improvement to the public health. In addition to calming fear and its potential

adverse consequences, these scientifically supported determinations allow for the continuing focus of finite resources on other potentially significant health risks. Some of the "delisting" examples in the plan point up these successful scientific determinations, but this factor is not articulated as a decided and very important benefit of the program (p. 25).

Although the Agency's focus on children as a susceptible population subgroup appears well justified, the justification presented was largely based on a consensus of recommendations across external advisory bodies (e.g., OPPT, NRC). This justification can be strengthened by the Agency's own scientific assessment of the public health benefit to be achieved through a research focus on children as a particular subpopulation. Such justification is likely to become more important in considering future potential subpopulation research foci that may be less obvious than children (pp. 33-34).

The single dimensional model presented in this program did not fully represent what is a dynamic multidimensional research program. Although the Agency's focus on children as a susceptible population subgroup appears well justified, the justification can be strengthened by EPA's own scientific assessment of the public health benefit to be achieved through a research focus on children as a particular subpopulation (p.10).

While the research is appropriately directed, its justification could be more fully developed. This can be accomplished through a description of the scientific basis supporting the decision to focus on children's health (e.g., What is the scientific and public health rationale for research on this subpopulation relative to the elderly?) (p.10)

Further effort needs to be invested in articulating the benefits of the program to the public, so they appreciate the many past, present, and future successes of EPA in protecting human health and the environment (p. 14).

Comment: ORD agrees that the public health benefits of some components of the program, especially susceptible subpopulations, could have been articulated more clearly in terms of both the scientific needs and the programmatic or legislative mandates. This did not seem to be a problem in the case of Long-Term Goal 1 (Use of Mechanistic Information in Risk Assessment). ORD acknowledges that the overall strategic direction of the program is dependent on external scientific panels, as well as the needs of ORD's regional and program office clients. Input from these two relatively diverse sources, when considered in light of the stated research mission of the Agency and ORD, provides the rationale for a core research program to reduce uncertainty in risk assessment. ORD also recognizes that the current research program concerning susceptible subpopulations is somewhat diffuse, and that the rationale for studying subpopulations other than children was not well developed.

Action: ORD will carefully consider both the scientific needs as well as the programmatic needs in the future to determine how to focus its susceptible subpopulation research around life stage (children and the elderly). The public health rationale for this strategy will be more specifically addressed in the next revision of the HH MYP.

Time line: The draft version of the HH MYP is scheduled for February 1, 2006.

Program Quality (pp. 6-7)
1. To better evaluate the quality and performance of the Human Health Research Program, the reviewers would have benefitted from a bibliometric analysis of publications; such an analysis would be a useful parameter for showing the impact of this EPA research on the field (p. 7).

Comment: A bibliometric analysis was made available to the Subcommittee of the Human Health BOSC prior to the drafting of the final report dated May 18, 2005.

Action: A bibliometric analysis will be made available to the Subcommittee at the time of the next review.

Time line: An analysis will be available at the next full cycle review projected in 2009.

Program Performance (p. 7)
1. EPA's overarching conceptual framework description for the core human health program that represents the LTGs and their interaction could be expanded and more fully developed. The overall criteria and framework for decisions regarding why specific elements are vital and have been included in the research program were not always clear to the subcommittee members. Although the research program appears appropriately directed and focused, its scientific basis, justification, and conceptualization could be further developed. The presentation of the justification of research priorities appeared to some members of the subcommittee to be largely defined by external advisory bodies, such as the NRC. Although advice from such advisory groups provides an important element of justification, further clarification of the role of the scientists of the Human Health Research Program in defining and setting these priorities is suggested. The materials presented to the subcommittee lacked sufficient detail relating the specific program elements to be able to reasonably conclude that the focus is consistent with the stated goals. Details such as exactly how the work is going to be planned and processed are critical, and while not presented in the pre-meeting materials, they were in most cases clearly articulated during the meeting (p.7, 26).

The overall criteria and framework for decisions regarding why specific elements are vital and have been included in the research program could be further enhanced in the written material presented to the subcommittee. A more transparent explanation of these aspects would be most valuable (p.10, 25).

The rational level of detail regarding how the program is specifically set up to identify and address critical issues is not obvious, however (p.30).

Related to the need for a more fully develop conceptual framework for EPA's core human health research strategy is the need to provide a more clear health rationale. The actual research strategy appears well defined and appropriately directed but its rationale (i.e., how and why it has been selected) is less clear. To a large extent, ORD assumes its public health rationale based on

the advice and consultation of external advisory groups including the National Academy of Sciences. Although the perspective of such science-based bodies is an important element to the rationale, ORD needs to clearly articulate its own rationale. At both the level of the research program as well as the individual research project, the core Human Health research can be strengthened by presenting a clear public health rationale.

Comment: The HHRP is a relatively large program designed to address a number of high priority science objectives as well as client program and regional office needs. ORD agrees that there is a need to better articulate an overarching or unifying theme that provides the scientific rationale for each component of the program.

Action: ORD will work with its client regional and program offices to develop a more coherent overarching rationale for the core research program. This rationale will serve as the central organizing theme for the revision of the HH MYP.

Time line: The Human Health Working Group is meeting regularly to discuss revisions of the HH MYP. The first step in such a revision is to develop an overarching theme that clearly shows the rationale for a core research program on human health. A revision of the HH MYP is scheduled for completion by February 1, 2006.

Program Leadership (pp. 7-8)
1. A minority of the subcommittee, however, expressed concern that the direction and leadership of the program was influenced too strongly by external advisory groups (p.8).

Comment: It is true that direction and leadership of the program is influenced by external-to-ORD scientific advisory groups. As described in the Overview Chapter of the Human Health Program, the input from these groups is considered along with the scientific needs identified by ORD, the needs identified by the EPA program and regional office clients, and the mission of the Agency. What may not have been clear from the materials provided to the Subcommittee is, that in addition to this top-down approach for identifying scientific research needs, there is extensive opportunity for feedback provided by the individual ORD scientists in the development of implementation plans to address the strategic needs. This bottom-up input from the ORD scientists occurs during scientist-to-scientist interaction and regular meetings of theme-related working groups.

Action: Future descriptions of the program will articulate in greater detail the leadership of ORD's scientists in the development of the HHRP. The discussion regarding the development of annual performance measures for the revised HH MYP will reflect how the ORD scientists provide input through scientist-to-scientist meetings and interactions with working groups at the program project level (e.g., asthma research team, oxidative stress research team.

Time line: Scientist-to-scientist meetings and working group meetings at the project level are occurring at the present time. The input from these meetings will be used to develop and/or refine research activities and annual performance measures for the next revision of

the HH MYP. A draft of the HH MYP is scheduled for February 1, 2006.

2. Another area of opportunity relates to leadership transition. There is evidence of a gap in the Human Health Research Program between the number of senior, established scientists currently holding leadership positions and younger, less experienced researchers. EPA managers should give some thought to culturing and developing individuals for leadership positions (through mentorship). The subcommittee recommends that EPA plan for leadership succession, both in the technical and management arenas (p.8).

Planning needs to be done to ensure a transition to new leaders when senior leaders retire (p.24).

Comment: ORD recognizes that the work force is aging and that emerging programs such as computational toxicology will require personnel with training in disciplines and expertise not currently represented in large numbers in the workforce. ORD is aggressively seeking ways to ensure an appropriate mix of skills, talents, capabilities, and expertise in it's future workforce to address emerging human health research needs.

Action: ORD's Science Council is preparing a draft workforce plan to address the needs for leadership succession and the recruitment of scientists in emerging areas.

Time-line: A workplace planning document is scheduled to be presented to ORD's Executive Council by April 1, 2006.

Long-Term Goal 1 Use of Mechanistic Information in Risk Assessment (p.9).
1. The Agency has successfully utilized its extramural grants program to advance its research agenda. These programs need to be better advertised, and perhaps even better financed and expanded, however, to attract the widest possible competitive applicant pool (p.9, 17).

Comment: Seeking the high caliber extramural science collaborations to provide skills and expertise not readily available through the ORD workforce is a key goal for ORD. Every effort will be made to continue to improve on the current extramural grant program.

Action: The Acting NPD for HH will work with the key ORD scientists to identify ways to expand the communication of the STAR grant application process to the broader applicant pool. Proposed topics for mechanistic research and other areas will be identified during the next update of the HH MYP, with those most appropriate for STAR research being identified and advertised.

Time-line: A draft of the revised HH MYP is scheduled for February 1, 2006 . Appropriate STAR grant RFAs will be issued during the spring of 2006.

2. New, broad strategies should be developed by the Human Health Research Program to manage

the risks from the thousands of new chemicals that are being synthesized and released into the environment (p.9)

Comment: ORD recognizes the great challenge represented by the thousands of chemicals being synthesized and released into the environment. Development of a testing approach, however, is not considered to be in the scope of the core HH research program. The HHRP provides sound science methods and models that can be used by other parts of the ORD research program to develop appropriate testing strategies through other ORD research programs such as the Safe Pesticides/Safe Products Program (SP2), the EDCs Research Program, and the Computational Toxicology Research Program. ORD recognizes the need to coordinate the sound science products coming from the HHRP as they apply to the development of high-throughput testing strategies.

Action: The HHRP will coordinate efforts with the NPD for Pesticides and Toxics (SP2 and EDCs) and the Director of the NCCT to ensure HH performance measures are relevant to the development of approaches to improve efficiencies of testing strategies. Starting immediately, the NPD for HH will meet at least quarterly with the NPD for Pesticides and Toxics and the Director of the NCCT to evaluate progress. The Pesticides/Toxics working group and Director of the NCCT will be asked for input concerning the development of annual performance measures to be included in the next revision of the HH MYP.

Time-line: A draft of the HH MYP is scheduled for February 1, 2006.

Long-Term Goal 2 Aggregate/Cumulative Risk (pp. 9-10)
1. The work shows a propensity to develop new data and to mine available data to inform risk assessment decisions. Assessments should be more comprehensive, however, and include a wider array of chemicals important to human exposure (p. 10).

The overall ORD research program for Aggregate/Cumulative Risk appears to remain focused on pesticides and a few other specific toxicants such as dioxin, chlorinated solvents, metals and glycol ethers. Focusing a program on pesticides and specific toxicants makes sense for the early efforts in the nascent field of exposure and risk assessment. Indeed, these areas certainly are the most data-rich area and are well supported by a strong U.S.-based regulatory mandate as well as the recommendations of various advising groups. However, there was no evidence presented in the reference material or provided during the meeting of a general research effort to understand and evaluate the exposure and risk to the literally thousands of existing chemicals to which people are exposed in commerce today (p. 27)

It is reasonably well established that the risks of most types of personal chemical exposures are not being assessed at this point. These are the exposures that are happening predominately from residential exposure sources. Many, perhaps the vast majority, of these exposures and risk may be de minimus or insignificant; however, any scientific research plan designed to render answers about the aggregate and cumulative risk to humans from chemical exposure should reasonably address this significant portion of the total amount of chemical exposure experienced by humans.

Any technical program that aspires to lead in the realm of human health risk assessment from chemicals should not ignore this reality. Similarly, any rational plan should have a specific and a systematic research strategy to address the multitude of substances to which individuals are exposed to everyday (p. 27).

Given the well defined source-exposure-dose-effect continuum that currently exists in the plan, the actual research should logically start with defining a critical taxonomy and characterization of the universe of sources extant or entering into typical human microenvironments. Given this universe, a reasonable number of hypothesis-driving models should be formulated and tested within it. All of this should be followed up with the development of fate and transport models to characterize the contact and delivery of these substances to people via various routes (p. 27).

Comment: ORD recognizes the need to expand it's research portfolio to characterize and reduce risks associated with real-world exposures to the large numbers of chemicals being synthesized and distributed. Early ORD human health research was designed to develop the sound science tools needed to address risk associated. With the genesis of the current program occurring proximate to the implementation of FQPA (1996), the majority of the research employed sentinel pesticides as the test chemical for developing and validating the research tools. ORD's future research program will be designed to address cumulative risks associated with real-world exposures reflecting numerous classes of chemicals that are found in the environment.

Action: The acting NPD for HH will meet with the EPA Program Offices and regions and conduct a customer value analysis of their current and emerging science needs. This will include the development of a rationale for developing hypotheses and then planning research to address the highest human risks resulting from exposures to mixtures of multiple chemicals. This list will then be prioritized by the Research Coordination Team and used in the development of the next version of the HH MYP.

Time Line: The next draft of the HH MYP is scheduled for February 1, 2006.

Long-Term Goal 3 Susceptible Subpopulations (pp.10-11)

1. *The current level of involvement of program offices, regional offices, and other stakeholders provides strength to the program; it should be sustained and possibly upgraded (p.10).*

It appears as if the Program and Regional Offices are involved in the planning and prioritization of research; however, the panel suggests a broadening of this list to include other members listed as stakeholders. This would include qualified scientists with professional standing in the other stakeholder groups mentioned in the background material (p. 26).

Comment: ORD agrees that it is important to be as inclusive as possible in having stakeholders involved in the identification of strategic needs for research. However, it is ORD's position that once an exhaustive list of potential research areas have been identified, that the actual planning and prioritization of research at the project level follow the official ORD planning process, which includes regional and program office clients. The BOSC review has been used to establish

priorities at the LTG level and for themes within a LTG during the most recent annual planning cycle. Recommendations from the BOSC review and other external review activities will be used in the next revision of the HH MYP.

Action: Recommendations from the BOSC review and other external reviews will be used in establishing priorities across and within LTGs, as well as determining directions for future research.

Time-line: A draft of the HH MYP revision is scheduled for February 1, 2006.

2. There is a need to expand EPA expertise to include community-based participatory research (p.10).

Community-based research permeates and is a strength of LTG3. There is growing recognition of the value of Community-Based Participatory Research (CBPR) as a means for conducting such research. Although STAR grantees have embraced principles of CBPR, there appears to be little or no ORD intramural capacity or expertise. If community research continues to be a part of this LTG (as it should), ORD should acquire this intramural capability (pp. 35-36).

Comment: ORD currently employs community-based participatory research, particularly in the STAR program. It will be applied where necessary in ORD intramural research projects. Once appropriate intramural CBPR projects are identified, ORD will partner with qualified scientists and experts within the Federal and non-Federal scientific community to gain and utilize the necessary skills, expertise and experience needed to fully address the research objectives.

Action: Whenever ORD begins to plan research involving communities, it will involve the participation of the scientific and local community. Concerns about the need for intramural expertise will be transmitted to the ORD's Science and Executive Councils in the context of workforce planning.

Time-line: Effective immediately. A workplace planning document is scheduled to be presented to ORD's Executive Council by April 1, 2006.

Long-Term Goal 4 Evaluating Public Health Outcome (p.11)

1. The subcommittee members thought that the goals of this program could be further focused to guide future activities and that a process needs to be articulated for making decisions about which actions to evaluate, which endpoints to study, and which environmental indicators to apply. Long-term success of this program will be dependent in part on the ability to develop strong interactions with other EPA programs and utilize research from other LTGs. Thus, it is recommended that a mechanism be put into place with formal and informal components to promote dialogue among the LTGs and to provide a process for assessing research outputs (p.11).

To facilitate coordination, it is recommended that a mechanism be put into place, which has both formal and informal components to not only promote dialogue but also to elaborate a process

for evaluating research outputs as suitable inputs for the activities carried out by the program. Within this rubric, the program has the potential - in the future - of providing the nucleus for evaluating the research of the ORD, in terms of its relevance to environmental health. As an emerging area of research with a clear public health focus, it will be incumbent upon the leadership to highlight the relevance and importance of this program as it relates to the research carried out in the areas of (1) Harmonization of cancer and non-cancer risk assessments, (2) Aggregate and cumulative exposure and risk, and (3) Susceptible subpopulations (p. 39).

The program will require additional monies and personnel to broaden expertise in areas of public health, especially in biostatistics and environmental epidemiology (p.11, 41).

It is recommended that as the program expands, recruiting scientists who are experts in the area of evaluating public health outcomes would strengthen the leadership of the program even further (p. 42).

Comment: ORD recognizes that research on Evaluating Public Health Outcomes is an emerging topic. Considerable discussion is being held within ORD and with our regional and program office clients to determine the scope and direction of this program. The Human Health Working Group is currently discussing how this program will interact with the other components of the HH MYP. The next version of the HH MYP will integrate this area with the other LTGs and more definitive annual performance measures will be developed.

Action: The Human Health Working Group is meeting regularly to discuss the revision of the HH MYP. The scope and focus of research on Evaluating Public Outcomes will be more clearly articulated. The relationship between the other three LTGs and this area will be developed. Depending on the program that is developed, ORD will have to address the question of resources to support the research. Discussions are underway with NCER to determine the extent to which resources from the STAR program could be used to support research in LTG4.

Time-line: A revised version of the HH MYP is scheduled for February 1, 2006.

LONG-TERM GOAL 1:
Use of Mechanistic Information in Risk Assessment

Performance (pp. 18-23)

1. The goals and the priorities of the Human Health Research Program are clear. There are also well-delineated schedules for the program to be implemented. However, there are some apparent discrepancies between the specific projects and performance measures listed in the 2003 LTG1 and the current suite of projects relevant to today's Human Health Program and their deliverables and performance measures. This should be addressed by updating these items in the next iteration of the Multi-Year Plan (p. 20).

The MYP is in need of updating to reflect current research activities (p. 21).

Comment: ORD agrees that the HH MYP needs to be revised to reflect current and future research activities. The HH MYP provided to the Subcommittee was presented to the ORD Executive Committee in 2003 and there have numerous changes since that time. ORD considered revising the MYP prior to the review, but decided not to proceed for two key reasons: limited time available to engage our regional and program office clients, and the desire to gain retro- and

prospective science input from the BOSC.

Action: ORD is currently working with regional and program office clients to develop a revised version of the HHRP MYP.

Time-line: A draft revision of the HH MYP is projected for February 1, 2006.

LONG-TERM GOAL 2
Aggregate/Cumulative Risk

Performance (pp. 30-31)

1. In general, there appears to be a concerted effort to provide excellent coordination and integration across the themes; however, there seems to be little integration of exposure assessment across themes that deal primarily with health effects (p. 30).

The research theme "Aggregate/Cumulative Risk" is an overall term designed to include another critical theme of better exposure assessment models. It appears that this critical aspect may have gotten somewhat lost in the combination, and any reasonable focus or attention relative to exposure assessment model development under aggregate/cumulative risk is not plainly stated (p.30).

Comment: ORD agrees that the materials provided to the BOSC did not link the exposure and effects research activities as clearly as could have been possible. ORD also recognizes the continued need to develop exposure assessment models and methods for assessing human health risks.

Action: The HH Working Group is developing a revised research plan. The team will seek ways to improve the integration of the effects and exposure research activities and focus new research activities on the development of innovative exposure assessment tools.

Time-line: A draft of the revised HH MYP is scheduled for February 1, 2006.

LONG-TERM GOAL 3
Susceptible Subpopulations

Overall Comments (pp. 32-33)

1. The Subcommittee noted that this program has emphasized / embraced the strength/benefits of multi-disciplinary interaction within and between LTGs. This is likely to be fertile ground for environmental health discovery. This interaction in fact appears to be occurring and is a strength to the current program. EPA should acknowledge the importance of this interaction, take credit for it, and encourage its continued development (p. 32).

Comment: ORD appreciates the comment from the BOSC that there appears to be good multidisciplinary interaction within and between LTGs. ORD understands the importance of such interdisciplinary studies and will continue to foster them in the future.

Action: ORD will continue to encourage multi-disciplinary research approaches to address complex environmental research needs articulated by ORD's program and regional office clients. Such encouragement will be transmitted during regularly scheduled meetings of ORD's research team meetings and during the annual planning cycle. Multidisciplinary research program projects will be documented in the revised version of the HH MYP.
Time-line: A draft version of the HH MYP is scheduled for February 1, 2006.

2. Peer review is recognized as a critical component of EPA's human health research program. This process can be facilitated and enhanced by: 1) providing the reports/critiques from previous reviews; and 2) asking EPA to tailor their presentations to the review criteria and critiques from previous reviews (p. 32).

Comment: This is the first time that the entire ORD HHRP has been reviewed by an external peer-review panel, so copies of previous reviews were not available. A document entitled "Human Health Research Strategy" was reviewed by a Subcommittee of the Science Advisory Board and the results of that review could have been made available. Prior to this review, ORD's approach to external review was to ensure that each ORD Division and/or key research programs was reviewed by an external panel of relevant scientific experts on a routine basis. The results of these reviews could have also been made available. However, in some cases these organizational or project specific reviews include multiple research areas or disciplines that fall both within and outside the HHRP domain (i.e., SP2, EDCs, Air, Water). The Overview of the Human Health Research Program attempted to provide definitions and examples of how the research program addressed the review criteria from a conceptual point-of-view. The ORD presentations during the BOSC review were designed to address the scientific questions associated with the overall program and each LTG.

Action: A copy of the results from the peer review of the HHRP will be provided at the next review along with other relevant organizational/research topic reviews. Documentation of how the HHRP addressed each of the recommendations made by the Subcommittee will be provided. Written and oral presentations will be tailored to address the review criteria more closely.

Time-line: The next full review of the HHRP is projected to be in 2009.

Relevance (pp. 33-36)

1. The Agency's asthma research involves establishment of a new Cell Biology Group, which should be a dynamic group, with very strong leadership. The finding of this group that exposure of transgenic IL-5 mice to diesel combustion products caused airflow obstruction in the presence of a methacholine challenge is very interesting. There is a very good set of collaborations here between immunologists, cell biologists, and engineers. It would be very useful to have regular group meetings, both within ORD for this group and also interagency meetings at which regulatory representatives from EPA are present, to strengthen the focus of this group (p. 34).

Comment: An ORD Asthma Research Coordination Team exists and was actively involved in developing the written materials and posters for the external review of the HHRP. The Team will continue to meet on a regular basis to discuss research progress.

Action: The ORD Asthma Research Coordination Team will meet on a quarterly basis.

Time-line: Effectively immediately.

2. Research related to susceptibility from aging is focused on a limited number of pollutants. Chief among these are TCE, benzene, pesticides, and PM10. It appears that this group meets frequently

and is very active in attending meetings of the Society of Gerontology and other aging societies and presenting their research at these meetings. It is important that this group speak to the children's group at least once per year in a Super-Group of Susceptible Populations, share data, and share approaches, and determine whether common approaches can be adopted by both groups in studying these two types of susceptible populations (p. 35).

Comment: ORD recognizes that the need for closer relationships between the children's and aging research groups as many of the sound science tools and research findings from one program may be useful in developing hypotheses and/or answering key questions for the other. Many of the scientists who are developing the relatively new aging research program have previously participated in earlier children's research programs. Their involvement in past and current research activities will help facilitate the linkages and integration of these activities.

Action: At least once a year, research involved in the children's and aging research programs will meet to discuss on-going research, including sharing data and common approaches.

Time-line: A meeting of children's and aging research groups will be held by April 1, 2006.

3. The studies described in the area of source-to-effects modeling of early life exposure have primarily focused on the kinetic half of the modeling spectrum, from source to target-tissue dose. Future efforts should begin to extend quantitative evaluation into the area of dynamics, from target-tissue dose to response (p. 35).

Comment: ORD recognizes the need to expand early successes of the PBPK modeling effects into the PBPD modeling arena to better characterize the exposure-target-tissue-dose to response linkages. The integration of ORD's modeling expertise in addressing high priority science issues is key to reducing uncertainty in risk assessment.

Action: The Acting NPD for HH will organize a workshop with the ORD and Program Office modelers to identify and prioritize research needs and develop strategies for integrating this expertise to addressing the highest priority risk issues.

Time-line: A workshop will be conducted in 2006 and the results included in the next revision of the HH MYP.

4. Involvement of Regional and Program Office stakeholders varies. Whereas OPPT is very effectively involved not only in acquiring research findings, but more importantly in planning and defining the research agenda, involvement of other program offices such as OAR, ODW, and regional offices does not appear to be as consistently strong, although this variability may stem from the relevance of the program office to the core Human Health Research Program (p. 35).

Comment: ORD recognizes that there has been significant interaction with OPPTS over the years. This interaction is in large part due to the fact that OPPTS has historically articulated needs for methods development and the interpretation of results from toxicology studies in areas pertaining to expertise extant in ORD at the time. More recently, uncertainties outlined by FQPA (1996) related aggregate/cumulative risks and to the application of uncertainty or safety factors in risk assessment have been cogently expressed by OPPTS and have served as the driver of much research in the existing HH MYP. ORD notes, however, that many generic issues raised by OPPTS (e.g., application of mechanistic information in risk assessment, principles for the application of safety factors to protect children, principles for the prediction of chemicals in mixtures) are relevant to other program and regional office clients. ORD also notes that there has been significant interaction with other program offices with regard to research needs regarding chemical mixtures and asthma research.

Action: The NPD for HH will hold separate discussions with representatives of the regional and program clients prior to the revision of the HH MYP. Research needs articulated by all of the clients will be discussed by the Human Health Working Group needs will be matched to capabilities to ensure those issues more specific to air and water are addressed either in the HH MYP or in some other MYP (i.e., SP2, Drinking Water, Particulate Matter).
Time-line: The NPD has conducted briefings with regional and program client offices. Input from those briefings is being used to develop the next revision of the HH MYP, which is scheduled for February 1, 2006.

LONG-TERM GOAL 4
Evaluation of Public Health Outcomes

Relevance (pp. 39-40)

1. *Other collaborative activities should be identified to allow for the sharing of expertise and for leveraging effort across agencies (p. 40).*

Comments: ORD has established an memorandum of understanding with CDC for a environmental tracking program, which includes an exchange network project and a public health air surveillance evaluation project. ORD is currently involved in a US Mexico Border program and ORD's STAR program is developing an RFA that will focus on linking environmental and health databases.
Action: ORD will explore other opportunities to leverage with other agencies for work in this area. As the scope and direction of this program becomes clearer, then the appropriate agencies can be approached.
Time-line: A draft revised version of the HH MYP is scheduled for February 1, 2006 .
Quality (pp. 40-41)

1. Given the magnitude of the scope of this evaluation, it is recommended that the program specify focused goals that will guide its activities over the near term, as well as articulate a process for making decisions regarding which action to evaluate, which health endpoint to study, and most importantly which environmental health indicator to apply. Without question, the greatest challenge will lie in developing, selecting, and applying environmental health indicators that might provide the linkages between risk management decisions and specific health endpoints (p. 40).

Comment: Research on Evaluating Public Health Outcomes is an emerging topic. Considerable discussion is being held within ORD and with our regional and program office clients to determine the scope and direction of this program. The Human Health Working Group is currently discussing how this program will interact with the other components of the HH MYP. The next version of the HH MYP will integrate this area with the other LTGs and more definitive annual performance measures will be developed.
Action: The Human Health Working Group is meeting regularly to discuss the revision of the HH MYP. The scope and focus of research on Evaluating Public Outcomes will be more clearly articulated. The relationship between the other three LTGs and this area will be developed. Depending on the program that is developed, ORD will have to address the question of resources to support the research. Discussions are underway with NCER to determine the extent to which resources from the STAR program could be used to support research in LTG4.

Time-line: A revised version of the HH MYP is scheduled for February 1, 2006 .
2. With respect to the intramural "Demonstration" project that has been recently initiated, the subcommittee was informed that criteria will be developed for evaluating and selecting projects on the basis of quality, relevance, and feasibility over the short-term. It is recommended that these criteria be made explicit and communicated to the program and regional offices so that projects are developed and selected with the greatest potential for success (p. 41).
Comment: ORD has developed a set of criteria for the review of "demonstration projects" to be conducted by program and regional offices. A set of 6 proposals has been selected for final review.

Action: ORD will fund 6 proposals from regional and program offices by the end of FY05.
Time-line: Funding notifications provided to applicants by October 31, 2005.
Performance (p. 41)
1.. As the program gains definition, it is also recommended that the program solicit external review of its activities on a periodic basis to aid the leadership in evaluating the program's activities as they relate to short-term goals and in articulating the scope of activities that are likely to allow the program to achieve its long-term goals (p. 42).
Comment: ORD agrees that external peer review of activities in this LTG will be necessary. ORD suggests using a mid-cycle review of the HHRP is evaluate progress in this area.
Action: Use Subcommittee of the BOSC to evaluate progress in this LTG.
Time- line: A mid-cycle review of the HHRP is projected for 2007.

Human Health Research Program
Summary of BOSC Comments From July 2005 Final Report and Proposed ORD Actions

Recommendations	Action Items	R&D Criteria*
1). There are specific scientific activities occurring in the EU that should receive intense Agency interest, interaction, and potential coordination. EPA should pursue further interaction and engagement of international agencies including the EU and Canada (p. 4,8,10,26, 31)	Action: The acting NPD for HH will meet with the EPA Program Offices and regions and conduct a customer value analysis of their current and emerging research needs. This list will then be reviewed and prioritized by the Research Coordination Team and used in the development of the next version of the HH MYP. The acting NPD for HH and key ORD researchers will meet with OPPT managers to develop strategies for engaging ORD researchers with the various European and Canadian organizations who are designing related research programs addressing uncertainties for high priority chemicals and classes of chemicals. ORD researchers will actively participate in future EU and Canadian workshops designed to develop new approaches for addressing risk assessment to chemicals. Time Line: ORD researchers attended a recent EU workshop in Italy in June 2005. The acting NPD for HH will meet with OPPT managers during 2005 to identify European, Canadian, and other international programs where the ORD HH research program can benefit by collaborating with these organizations. ORD researchers will meet with selected Canadian and other country scientists during 2005 and early 2006 to identify ways to integrate ORD's human health research on toxic chemicals with these on-going and planned activities.	R
2). Creation of new National Center for Computational Toxicology should not interfere with collaborations with Human Health Program (p. 5,16,30).	Action: The Acting NPD for Human Health will meet on a regular basis with the Director of NCCT to assess progress of their respective programs. The revised HH MYP will include a narrative outlining the relationship between the two programs. The Director of the NCCT will be asked to provide input and feedback into the writing of the revised HH MYP, including the development of annual performance goals (APGs) and measures (APMs) that	R

Recommendations	Action Items	R&D Criteria*
	describe collaborative efforts between the two programs. Scientists in the NCCT will continue to meet with the ORD HH research teams associated with research themes developed from the revised HH MYP. Time line: Effective immediately, meetings between the NPD and the Director will be scheduled on a quarterly basis. Input from NCCT will be included in the draft version of the HH MYP, which is projected for February 1, 2006.	
3). There needs to be a greater level of interaction between the intramural and extramural programs (p.6,44).	Action: ORD will sponsor scientist-to-scientist workshops on collaborations for Children's Environmental Health Research and Computational Toxicology. The purpose of these workshops will be to exchange information about the research being planned both extramurally and intramurally in the areas of children's research and computational toxicology. Working groups will be formed based on identification of areas of common interest to the scientists (e.g., oxidative stress, asthma, computational toxicology). The NPD for HH, the NPD for Pesticides and Toxics, the Director for NCCT, and scientists from the National Center for Environmental Research (NCER) will meet on a regular basis with these working groups to determine progress and impact of the research on risk assessment. The role of the STAR program will be more clearly articulated in the development of annual performance measures for the revised HH MYP. Time line: The Acting NPD for HH, the NPD for Pesticides and Toxics, the Director for NCCT, and key NCER staff will plan a series of symposiums to exchange research findings and identify new areas for research between the ORD researchers, the STAR grantees, and other interested public and private sector scientists. An initial Children's Research workshop was held on July 11-12, 2005, in Research Triangle Park, NC. An ORD/STAR Computational Toxicology	R

Recommendations	Action Items	R&D Criteria*
	workshop was held on July 18-19, 2005 in Research Triangle Park, NC. Working groups for specific research areas identified during these initial meetings were established by September 1, 2005. Effectively immediately, the NPD HH will also hold regular meetings with NCER staff to develop RFAs that augment the on-going intramural research program. Discussions concerning Program and Regional Office needs will be conducted in the context of regular weekly meetings of the Human Health Working Group. Annual performance measures will be developed for the revised HH MYP showing contribution of the STAR program to the overall HHRP. Draft revised HH MYP is scheduled for November 1, 2005.....	
4). There needs to be greater documentation of collaboration between EPA scientists and scientists from other governmental agencies (p. 6, 16, 36).	Action: A listing of intergovernmental agency collaborations between the HHRP will be provided at the next available review of the program. Time-line: Mid-cycle review projected for 2007; next full review projected for 2009.	R
5). Program needs to better articulate public health benefits (p.6, 10, 14, 25, 33-34).	Action: In the future, ORD intends to focus its susceptible subpopulation research on life stage issues (children and the elderly). The public health rationale for this strategy will be more specifically addressed in the next revision of the HH MYP. Time-line: The draft version of the HH MYP is scheduled for February 1, 2006.	R
6). The program needs to conduct a bibliometric analysis of published research (p.7).	Action: A bibliometric analysis will be made available to the Subcommittee at the time of the next review. Time-line: An analysis will be available at the next full cycle review projected in 2009.	Q
7). Conceptual framework for research program needs to be better articulated (p.7, 10, 25,26,30)	Action: ORD will work with its client regional and program offices to develop a more coherent overarching rationale for the core research program. This rationale	P

Recommendations	Action Items	R&D Criteria*
	will serve as the central organizing theme for the revision of the HH MYP. Time-line: The Human Health Working Group is meeting regularly to discuss revisions of the HP MYP. The first step in such a revision is to develop an overarching theme that clearly shows the rationale for a core research program on human health. A revision of the HH MYP is scheduled for completion by February 1, 2006.	
8). Direction of research is influenced too strongly by external advisory groups (p.8)	Action: Future descriptions of the program will articulate in greater detail the leadership of ORD's scientists in the development of the HHRP. The development of annual performance measures for the revised HH MYP will include input from ORD scientists through scientist-to-scientist meetings and interactions with working groups at the program project level (e.g., asthma research team, oxidative stress research team. Time-line: Scientist-to-scientist meetings and working group meetings at the project level are occurring at the present time. Input will be used to develop annual performance measures for the next revision of the HH MYP. A draft of the HH MYP is scheduled for February 1, 2006.	SL
9). Program needs to plan for leadership succession (p.8, 24)	Action: ORD's Science Council is preparing a draft workforce plan to address the needs for leadership succession and the recruitment of scientists in emerging areas. Time-line: A workplace planning document is scheduled to be presented to ORD's Executive Council by April1, 2006.	SL
10). Extramural grants program needs to be better advertised (p.9, 17).	Action: The Acting NPD for HH will work with the key ORD scientists to identify ways to expand the communication of the STAR grant application process to the broader applicant pool. Proposed topics for mechanistic research and other areas will be identified during the next update of the HH MYP, with those most appropriate	R

Recommendations	Action Items	R&D Criteria*
	for STAR research being identified and advertised. Time-line: A draft of the revised HH MYP is scheduled for February 1, 2006. Appropriate STAR grant RFAs will be issued during the spring of 2006.	
11). Broad strategies should be developed to manage risks from thousands of new chemicals (p.9).	Action: The HHRP will coordinate efforts with the NPD for SP2 and the Director of the NCCT to ensure HH performance measures are relevant to the development of approaches to improve efficiencies of testing strategies. Starting immediately, the NPD for HH will meet with the NPD for SP2 and the Director of the NCCT at least quarterly to evaluate progress. The SP2 working group and Director of the NCCT will be asked for input concerning the development of annual performance measures to be included in the next revision of the HH MYP. Time-line: A draft of the HH MYP is scheduled for February 1, 2006.	P
12). Exposure research should include a wider range of chemicals (p.10, 27).	Action: The acting NPD for HH will meet with the EPA Program Offices and regions and conduct a customer value analysis of their current and emerging science needs. This will include the development of a rationale for developing hypotheses and then planning research to address the highest human risks resulting from exposures to mixtures of multiple chemicals. This list will then be prioritized by the Research Coordination Team and used in the development of the next version of the HH MYP. Time Line: The next draft of the HH MYP is scheduled for February 1, 2006.	P
13) Panel suggests a broadening of stakeholders involved in planning and prioritization of research (p.10,26).	Action: Recommendations from the BOSC review will be used in establishing priorities across and within LTGs, as well as determining directions for future research. Time-line: Effectively immediately. A draft of the HH MYP revision is scheduled	R

Recommendations	Action Items	R&D Criteria*
	for February 1, 2006.	
14). There is a need to expand EPA expertise to include community-based participatory research (p.10, 35-36).	Action: Whenever ORD begins to plan research involving communities, it will involve the participation of the community. Concerns about the need for intramural expertise will be transmitted to the ORD's Science and Executive Councils in the context of workforce planning. Time-line: Effective immediately. A workplace planning document is scheduled to be presented to ORD's Executive Council by April 1, 2006.	P
15). LTG 4 Evaluation of Public Health Outcomes needs to be better focused and a mechanism put in place to develop future research in this area (p.11,39, 41, 42).	Action: The Human Health Working Group is meeting regularly to discuss the revision of the HH MYP. The scope and focus of research on Evaluating Public Outcomes will be more clearly articulated. The relationship between the other three LTGs and this area will be developed. Depending on the program that is developed, ORD will have to address the question of resources to support the research. Discussions are underway with NCER to determine the extent to which resources from the STAR program could be used to support research in LTG4. Time-line: A revised version of the HH MYP is scheduled for February 1, 2006.	R
16). The Human Health Multi-Year Plan needs to be revised (20,21).	Action: ORD is currently working with regional and program office clients to develop a revised version of the HHRP MYP. Time-line: A draft version is projected for February 1, 2006	P
17). Better integration of exposure with effects research (p.30)	Action: The HH Working Group is developing a revised research plan. The team will seek ways to improve the integration of the effects and exposure research activities and focus new research activities on the development of innovative exposure assessment tools. Time-line: A draft of the revised HH MYP is scheduled for February 1, 2006.	P

Recommendations	Action Items	R&D Criteria*
18). Program needs to promote better integration of Susceptible Subpopulation research with other Long-Term Goals (p.32)	Action: ORD will continue to encourage multi-disciplinary research approaches to address complex environmental research needs articulated by ORD's program and regional office clients. Such encouragement will be transmitted during regularly scheduled meetings of ORD's research team meetings and during the annual planning cycle. Multi-disciplinary research program projects will be documented in the revised version of the HH MYP. Time-line: A draft version of the HH MYP is scheduled for February 1, 2006.	R
19). Peer review [program evaluation] will be enhanced by providing critiques from previous reviews and tailoring presentations to review criteria (p.32).	Action: A copy of the results from the evaluation of the HHRP will be provided at the next review. Documentation of how the HHRP addressed each of the recommendations made by the Subcommittee will be provided. Written and oral presentations will be tailored to address the review criteria more closely. Time-line: The next review of the HHRP is projected to be in 2009.	R
20). Asthma research program should have regular group meetings both within ORD and across Agencies (p.34).	Action: The ORD Asthma Research Coordination Team will meet on a quarterly basis. Time-line: Effectively immediately.	R
21). Researchers working on aging should meet with those working on children's issues (p.35).	Action: At least once a year, research involved in the children's and aging research programs will meet to discuss on-going research, including sharing data and common approaches. Time-line: A meeting of children's and aging research groups will be held by April 1, 2006.	R
22). Source-to-effect research should progress to include pharmacodynamic issues (p.35).	Action: The Acting NPD for HH will organize a workshop with the ORD and Program Office modelers to identify and prioritize research needs and develop strategies for integrating this expertise to addressing the highest priority risk issues.	R

Recommendations	Action Items	R&D Criteria*
	Time-line: A workshop will be conducted in 2006 and the results included in the next revision of the HH MYP.	
23). Should ensure involvement of stakeholders other than OPPTS (p.35).	Action: The acting NPD for HH will hold separate discussions with representatives of the regional and program clients prior to the revision of the HH MYP. Research needs articulated by all of the clients will be discussed by the Human Health Working Group needs will be matched to capabilities to ensure those issues more specific to air and water are addressed either in the HH MYP or in some other MYP (i.e., SP2, Drinking Water, Particulate Matter). Time-line: The acting NPD has conducted briefings with regional and program client offices. Input from those briefings is being used to develop the next revision of the HH MYP, which is scheduled for February 1, 2006.	R
24). Other collaborative activities should be identified to allow for the sharing of expertise and for leveraging effort across agencies (p.40).	Action: ORD will explore other opportunities to leverage with other agencies for work in this area. As the scope and direction of this program becomes clearer, then the appropriate agencies can be approached. Time-line: A draft revised version of the HH MYP is scheduled for February 1, 2006.	R
25). Program should specify specific goals and articulate a process for making decisions (p.40).	Action: The Human Health Working Group is meeting regularly to discuss the revision of the HH MYP. The scope and focus of research on Evaluating Public Outcomes will be more clearly articulated. The relationship between the other three LTGs and this area will be developed. Depending on the program that is developed, ORD will have to address the question of resources to support the research. Discussions are underway with NCER to determine the extent to which resources from the STAR program could be used to support research in LTG4. Time-line: A revised version of the HH	Q

Recommendations	Action Items	R&D Criteria*
	MYP is scheduled for February 1, 2006.	
26). Criteria for "Demonstration" projects for Long-Term Goal 4 should be made explicit and communicated to program and regional offices (p.41).	Action: Review criteria have been developed and ORD will fund 4 proposals from regional and program offices by end of FY05. Time-line: Funding notifications provided to applicants by October 31, 2005.	Q
27). Research in Long-Term Goal should be reviewed externally on a periodic basis (p.42).	Action: Use Subcommittee of the BOSC to evaluate progress in this LTG. Time-line: A mid-cycle review of the HHRP is projected for 2007.	SL

*R&D Investment Criteria are Relevance (R), Quality (Q), Performance (P), and Scientific Leadership (SL)