



Board of Scientific Counselors

Office of Research and Development
United States Environmental Protection Agency

Second Program Review of the National Health and Environmental Effects Research Laboratory (NHEERL)

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Final Report of the Subcommittee
on the Review of NHEERL

November 19, 2002

NOTICE

This report has been written as part of the activities of the Board of Scientific Counselors (BOSC), a public advisory group that provides objective and independent counsel to the Assistant Administrator for the Office of Research and Development (ORD) of the U.S. Environmental Protection Agency (EPA). The Board is structured to provide a balanced expert assessment of the management and operation of ORD's research programs and its utilization of peer review. This report has not been reviewed for approval by the Agency; and hence, the contents of this report do not necessarily represent the views and policies of the EPA or other agencies in the federal government. Mention of trade names or commercial products does not constitute a recommendation for use.

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PREFACE

The Board of Scientific Counselors (BOSC) provides objective and independent counsel to the Assistant Administrator of the Office of Research and Development (AA/ORD) on the management and operation of ORD's research programs. The primary functions of BOSC are to: (1) evaluate science and engineering research programs, laboratories, and research-management practices of ORD and recommend actions to improve their quality and/or strengthen their relevance to the mission of the EPA; and (2) evaluate and provide advice concerning the use of peer review within ORD to sustain and enhance the quality of science in EPA.

In spring 2000, at the request of Henry Longest II, AA/ORD, the BOSC undertook peer reviews of the ORD Laboratories and Centers. This request came approximately 4 years after the initial BOSC review of the Laboratories and Centers, which was completed on April 30, 1998. Accordingly, the BOSC began the task of conducting programmatic, as opposed to scientific or technology, reviews of the Laboratories and Centers and proceeded to establish policies and procedures for conducting such reviews. The scheduled reviews occurred as follows:

- ❖ National Risk Management Research Laboratory, August 21-22, 2001, at Cincinnati, OH
- ❖ National Center for Environmental Assessment, October 10-11, 2001, at Washington, DC
- ❖ National Health and Environmental Effects Research Laboratory, October 30-31, 2001, at Research Triangle Park, NC
- ❖ National Exposure Research Laboratory, December 18-20, 2001, at Research Triangle Park, NC
- ❖ National Center for Environmental Research, January 23-24, 2002, at Washington, DC

As constructed, the Laboratory and Center reviews are expected to lead to a better understanding of the strategies employed by the respective Directors in accomplishing their missions, and to a better understanding as to how these strategies are implemented. BOSC also expects to develop a clearer perspective on how the operation of the Laboratories and Centers articulates with the strategic plan of the ORD and relates to the Multi-Year Research Plans (MYPs).

Each Laboratory and Center review consisted of two parts. The first part was a written self-study submitted to the review committee in advance of the date of its review, and the second part was a 2-day site visit conducted by the review committee. In the self-study, Directors were asked to prepare responses to questions aimed at a programmatic assessment of the organization. During the first day of the site visit, the Director made a brief presentation about the organization and was then asked to respond to questions from the review committee about the self-study document. Later, case studies were presented that reflected how the organization successfully addressed a specific issue faced by the Agency. The first day concluded with a poster session or informed interviews attended by staff scientists and other professionals. On the second day, the committee drafted a report that contained its findings and recommendations. At the end of the day, an exit interview was conducted with the Director.

All review teams were organized as Subcommittees of the BOSC and were headed by a chair and vice chair, both members of BOSC. Additional members of the Subcommittee were selected on the

basis of an appropriate technical discipline as well as having broad experience in science and research management, planning, and communication. The Chair of the BOSC attended some reviews as an ex-officio member.

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LIST OF ACRONYMS

AA/ORD	Assistant Administrator for the Office of Research and Development
ALD	Assistant Laboratory Director
BOSC	Board of Scientific Counselors
CRADA	Cooperative Research and Development Agreement
EMAP	Environmental Monitoring and Assessment Program
EPA	Environmental Protection Agency
FTE	Full-Time Equivalent
MYIP	Multi-Year Implementation Plan
MYP	Multi-Year Plan
NCEA	National Center for Environmental Assessment
NERL	National Exposure Research Laboratory
NHEERL	National Health and Environmental Effects Research Laboratory
NIH	National Institutes of Health
OPPTS	Office of Prevention, Pesticides and Toxic Substances
ORD	Office of Research and Development
RFA	Request for Application
RTP	Research Triangle Park
SES	Senior Executive Service

1.0 EXECUTIVE SUMMARY

The organizational diversity of the structure of the National Health and Environmental Effects Research Laboratory (NHEERL) dictated that the Subcommittee review be largely limited to interactions with the Laboratory leadership from its divisions and field stations, and be restricted to a high-level evaluation of the NHEERL strategic directions. Given its size, geographical dispersion, and scientific diversity, NHEERL faces daunting challenges to the development of a strategic plan that effectively supports the mission of ORD. Nonetheless, there is clear evidence that NHEERL has made significant progress in the implementation of a clearly articulated strategic plan that is effectively aligned with that of ORD. The NHEERL leadership and staff are committed to and have made progress in implementing the organizational and scientific cultural change that was intended by the reorganization of ORD research in 1995.

NHEERL is effectively maintaining an appropriate physical plant base needed to carry out its mission, as represented by significant new and/or remodeling construction projects in its Gulf Ecology, Atlantic Ecology, Mid-Continent Ecology, and Research Triangle Park (RTP) Divisions. In particular, the soon to be opened RTP facility is state-of-art and it should dramatically improve the laboratory conditions and investigator interactions relative to the existing physical laboratory facility. This new and extremely modern facility, along with the improvements being made to the other geographically separate divisions, likely will serve as a valuable resource for maintaining and recruiting a quality scientific staff.

NHEERL has invested significant effort in implementing a “cultural” change in organizational understanding and function, particularly as it relates to moving to team approaches for solving complex environmental and human health issues. Given that EPA ORD may be operating in a period of budgetary constraint in the coming years that could, in turn, produce an Agency-wide stable or downsized and aging workforce, NHEERL may face significant challenges in obtaining and maintaining a scientific workforce that is flexible enough to support the shifting and increasingly complex research directions described above. To address the need for flexibility, NHEERL participates in an ORD-wide task force exploring potential legislative solutions that enhance competitive compensation options for ORD-NHEERL scientists. These options include establishment of competitive, renewable term appointments for prestigious senior scientist positions, and/or an academic model limited tenure system similar to that used by the National Institutes of Health (NIH). The Subcommittee concurs that access to a broader and more flexible range of compensation and tenure options will be extremely valuable, if not essential, for implementation of an effective future NHEERL strategic science program.

As a key science-based resource for EPA, NHEERL is challenged to develop an internal culture that molds the Laboratory into a “problem solving” organization that delivers its science product to its key customers in a usable and timely manner. NHEERL leadership and staff are taking aggressive and effective steps to implement cultural and organizational changes necessary to deliver against these challenges. These NHEERL actions have been described throughout the body of this report.

2.0 LABORATORY REVIEW

The Board of Scientific Counselors (BOSC) established the Subcommittee for the National Health Effects and Environmental Research Laboratory (NHEERL) of the Office of Research and Development (ORD) at its meetings during 2000 and 2001. This Subcommittee was created to act as a resource for NHEERL.

The Subcommittee's work began with a series of study questions and site visits to update previous reviews and to target new issues. The final report of the first BOSC review of NHEERL was issued on April 30, 1998. NHEERL forwarded its response to the first review to the Assistant Administrator of ORD (AA/ORD) in 1999.

The NHEERL Subcommittee members included Dr. James Bus (Chair), Dr. Herbert Windom (Vice Chair), Dr. Steven Lewis, and Dr. Frederick Miller. The site visit was held October 30-31, 2001, at the NHEERL facility in Research Triangle Park (RTP), NC, and was open to the public.

The review of NHEERL consisted of: (1) an overview of NHEERL by the Laboratory Director; (2) a review of the self-study questions developed by the entire BOSC for all Laboratory/Center reviews; (3) an overview and discussion of key strategic directions and Multi-Year Plans (MYPs) of NHEERL; and (4) a review of progress since the preceding BOSC review and discussion of future challenges facing NHEERL. An agenda of the review meeting is provided in Appendix A, and a list of the documents distributed to the Subcommittee is included in Appendix B. The information and recommendations derived from the review were obtained by interactions of the Subcommittee with NHEERL leadership flowing from the dialog surrounding each major agenda item. The report organization reflects the self-study questions developed for the Laboratory/Center reviews by the BOSC. NHEERL's responses to the self-study questions is provided in Appendix C.

2.1 NHEERL Overview

NHEERL consists of 12 divisions and field stations, employing 1,242 individuals located in 8 different geographical locations. Because of the geographical separation and overall size of NHEERL, the review was conducted at the RTP, NC, site. The organizational diversity of the structure of NHEERL dictated that the Subcommittee review be largely limited to interactions with NHEERL leadership from its divisions and field stations, and be restricted to a high-level evaluation of NHEERL strategic directions. However, an opportunity was provided for the Subcommittee to hold discussions with NHEERL staff located at the RTP site.

NHEERL has a clearly articulated mission and is committed to its implementation through conducting research, providing leadership for resolution of health and environmental issues, and providing scientific advice in support of Agency responsibilities. NHEERL is effectively maintaining an appropriate physical plant base needed to carry out its mission, as represented by significant new and/or remodeling construction projects in its Gulf Ecology, Atlantic Ecology, Mid-Continent Ecology, and RTP Divisions. In particular, the soon to be opened RTP facility, of which the Subcommittee was provided a tour, is state-of-art and should dramatically improve the laboratory conditions and investigator interactions relative to the existing physical laboratory facility. This new and extremely modern facility, along with the improvements being made to the other geographically separate divisions, likely will serve as a valuable resource for maintaining and recruiting a quality scientific staff. In addition, the facility improvements make a strong statement to

the internal EPA and external non-EPA research communities that NHEERL is poised to effectively and efficiently support the increasingly complex research challenges in the years ahead.

2.2 Planning and Integration

2.2.1 Planning

- ❖ How does NHEERL's strategic plan articulate with the ORD Strategic Plan and with the EPA Strategic Plan?
- ❖ What are NHEERL's priorities and directions for the next 5 years?
- ❖ How does NHEERL use research results to set new research priorities, plan research, and discharge its mission?

Given its size, geographical dispersion, and scientific diversity, NHEERL faces daunting challenges to the development of a strategic plan that effectively supports the mission of ORD. Nonetheless, there is clear evidence that NHEERL has made significant progress in the implementation of a strategic plan that is effectively aligned with that of ORD. NHEERL has chosen to focus its planning efforts on two fundamental but related dimensions—*organizational* and *scientific*.

The first of these planning dimensions is an *organizational* strategy that parallels the five strategic goals of the ORD Strategic Plan: (1) support the EPA mission; (2) be a peak-performing organization; (3) lead the environmental science community; (4) integrate relevant areas of environmental science; and (5) anticipate future environmental issues. The NHEERL leadership has recognized that every member of the Laboratory must share responsibility in implementing the organizational strategy, and thus the NHEERL Director has aggressively embarked on a Laboratory-wide roll-out using the theme “the purpose of many, the power of one.” This roll-out, which touches on the five elements of the organization strategy, is to be commended, and provides clear evidence that the NHEERL leadership is strongly committed to, and making significant progress in, implementing an organizational cultural change that will deliver research consistent with the ORD Strategic Plan.

Recommendation 1: NHEERL leadership is strongly committed to, and making significant progress in, implementing an organizational cultural change that will deliver research consistent with the ORD Strategic Plan. Given the geographical and scientific diversity of NHEERL, the Laboratory Director is encouraged to aggressively continue efforts to build understanding of the importance of the overall NHEERL and ORD Strategic Plans across the NHEERL organization.

NHEERL has developed five areas of strategic organizational emphases that are designed to deliver an institutional cultural change that supports the overall ORD strategic goals. These five areas are: (1) problem solving—both what and how they do it; (2) integration and teamwork—a recognition that future research issues will be increasingly complex and cannot be effectively addressed by traditional single investigator approaches; (3) roles and responsibilities—effective delivery of the plan demands a well-aligned and motivated staff; (4) communication—the science must match up against ORD needs and be readily accepted by the broader scientific community; and (5) performance and success measures—a clear understanding of what constitutes success and the best

practices to achieve it. It is clear that NHEERL leadership and staff are committed to implementing the organizational cultural change that was intended by the reorganization of ORD in 1995.

The *scientific* strategic planning dimension of NHEERL is intended to assure that science efforts of NHEERL are appropriately focused on relevant questions, and that the planned research will fulfill critical data needs to address the issue. This strategy is implemented through development of specific Multi-Year Implementation Plans (MYIPs). ORD has identified 16 priority focus areas and associated MYIPs that identify specific efforts needed to support EPA's overall goals. NHEERL has developed corresponding MYIPs for 8 of these 16 areas.

Recommendation 2: ORD has identified 16 priority focus areas and associated MYIPs that identify specific efforts needed to support EPA's overall goals. NHEERL has developed corresponding MYIPs for 8 of these 16 areas. Although it is not appropriate or necessary for the Laboratory to have matching MYIPs for all 16 ORD focus areas, NHEERL should develop MYIPs for those remaining priority focus areas relevant to its mission.

NHEERL has developed, piloted, and implemented a creative "steering team" planning mechanism designed to encourage development of research plans that solve problems, and to build commitment and understanding within those elements across the breadth of EPA-ORD-NHEERL charged with accountability for the research issue. The teams are composed of a manager and scientist from each division, an appropriate NHEERL Assistant Laboratory Director (a model position originally created by NHEERL to specifically address Laboratory-wide research planning and integration and subsequently adopted by ORD), one representative from each of ORD's other Laboratories and National Center for Environmental Assessment (NCEA), at least one representative from a relevant Program Office, and at least one representative from the EPA Regional Science Council. The intent of these teams is to foster an environment that cultivates both a "top-down" and "bottom-up" approach to problem development and solving. NHEERL has seven steering teams currently in operation, covering most of the critical research focus areas. One major area, Ecological Research/Environmental Monitoring and Assessment Program (EMAP), does not yet have a team in place.

Recommendation 3: NHEERL has developed, piloted, and implemented a creative "steering team" planning mechanism designed to encourage development of research plans that solve problems, and to build commitment and understanding within those elements across the breadth of EPA-ORD-NHEERL charged with accountability for the research issue. Seven steering teams currently are in operation, covering most of the critical research focus areas. NHEERL is encouraged to develop a steering team supporting the Ecological Research/EMAP research focus, which represents one of the larger 2002 FTE (full-time equivalent) efforts. This team will be critical in shaping an effective integration and interpretation of data flowing from the EMAP, and in determining a future research direction of NHEERL that may require a significant investment in physical and intellectual resources (e.g., understanding the broader implications of human activities on ecological health).

NHEERL used the "Aquatic Stressors" ORD research priority area to pilot the concept and operations of a steering approach for developing and managing an MYIP. This pilot provided excellent experience on how to apply the steering team approach to complex problem solving, and moreover, affirmed for both the leadership and staff how such a team approach could result in desirable and effective cultural change for NHEERL. Although this pilot served as a useful model

for how to effectively initiate and implement complex problem-driven research, it did not define how decisions would be made to phase down research as customer needs are met. In the absence of a clearly delineated and appreciated process to sunset projects, the overall NHEERL research may drift from focused support of the ORD and NHEERL mission.

Recommendation 4: NHEERL should devise appropriate criteria for determining when it is time to sunset any given research activity. Such criteria will help assure that valuable Laboratory and intellectual resources continue to be productively applied to science needs relevant to the ORD mission.

NHEERL also is using the steering team approach to assist in the planning for potential over-the-horizon research issues. For example, a Molecular Profile Steering Group has been assembled to explore the implications of the emerging “omics” (genomics, proteomics, metabonomics) technology. NHEERL has appropriately recognized that this complex technology is likely to result in generation of large quantities of “health data” that will pose significant interpretational challenges. Similarly, they also have recognized that this technology is expertise and resource expensive, and thus, have sought appropriate collaborative opportunities particularly within the large molecular biology research community in RTP. The Subcommittee agrees that this effort is very timely and will position NHEERL to engage effectively on this technology.

2.2.2 Integration

- ❖ How does NHEERL integrate research with other ORD Laboratories and Centers according to the risk paradigm?
- ❖ How does NHEERL integrate research across and within its Divisions according to the risk paradigm?
- ❖ How has NHEERL achieved/maintained balance between human health and ecological research?
- ❖ How does NHEERL integrate research with EPA’s Program and Regional Offices, other federal agencies, and other research centers worldwide?

As noted in Section 2.2.1, NHEERL steering teams play an important integrative function in the development and implementation of research MYIPs. Their cross-NHEERL-ORD-EPA composition appears to be an effective mechanism for assuring that research is targeted to the highest priority data needs.

Within NHEERL itself, a Synergy Workgroup has been established with representatives participating from the nine NHEERL divisions. The Synergy Workgroup is intended to stimulate intra-divisional discussions and collaborations, and its activities have included development of an Intranet Website containing searchable information on ongoing NHEERL projects, and facilitation of several joint intramural Requests for Applications (RFAs). NHEERL also has sponsored an internal workshop to explore mechanisms to enhance the utility of data gathered from EMAP.

Recommendation 5: NHEERL has established a Synergy Workgroup constituted with representatives from the nine NHEERL divisions. The Synergy Workgroup is intended to stimulate intra-divisional discussions and collaborations, and its activities have included

development of an Intranet Website containing searchable information on ongoing NHEERL projects, and facilitation of several joint intramural RFAs. NHEERL should develop tools for tracking the translation of Synergy Workgroup activities into research activities linked to the NHEERL Strategic Plan. Communication and individual/group incentive plans also may need to be developed to encourage active and effective engagement of the Workgroup.

NHEERL has implemented several strategic activities designed to foster interactions outside of the Laboratory itself. In addition to the steering teams used to guide development of MYIPs, NHEERL has supported activities such as a joint workshop with the National Exposure Research Laboratory (NERL) and NCEA to define potential collaborative on exposure-to-dose modeling. An outcome from the workshop was the detailing of two NHEERL scientists to NERL to stimulate improved incorporation of exposure information into design and interpretation of animal toxicology studies.

Recommendation 6: NHEERL has implemented several strategic activities designed to foster interactions outside of the Laboratory itself, including sponsoring joint workshops with other EPA Laboratories and Centers. NHEERL is encouraged to continue to seek opportunities and provide funding for exchanges of scientific expertise with other relevant EPA Offices and ORD Laboratories and Centers. In particular, emphasis on identifying activities that build improved understanding of environmental exposures and their relationships to laboratory experimentation and modeling is valued.

Several other NHEERL integration activities are worthy of note in that they are indicative of active exploration of future research needs of ORD and EPA. For example, the Ecosystem Protection Research Plan of ORD is being re-examined for a potential need to expand research efforts beyond just toxic chemical stressors to aquatic life and wildlife. The re-examination includes questions relating to impacts of human activities (e.g., urban and agricultural land use, etc.) on nutrient enrichment, habitat alterations, and sedimentation associated with human activities. Such efforts signal acknowledgment by NHEERL that successes of EPA regulatory activities in controlling chemical stressors to the environment should not be interpreted to mean that potential environmental stressors are diminishing, but rather that these other existing or emerging non-chemical influences may be equally or more important than chemical stressors. Although the NHEERL Self-Study did not indicate any plans or strategies to engage the social sciences, support and interactions from these disciplines should be considered and/or sought to effectively implement future research strategies addressing these changes. NHEERL has instituted a seminar series with the EPA Office of Prevention, Pesticides and Toxic Substances (OPPTS) that provides opportunities for NHEERL scientists to communicate and receive feedback on their research findings with this regulatory office. Finally, NHEERL has established Cooperative Research and Development Agreements (CRADAs) and other active research interactions/collaborations with other federal agencies, industry, and international organizations.

Recommendation 7: NHEERL has instituted a seminar series with EPA's OPPTS that provides opportunities for NHEERL scientists to communicate and receive feedback on their research findings with this regulatory office. ORD and NHEERL should investigate cost-sharing mechanisms that encourage scientific exchanges such as joint seminar programs within the Agency.

2.2.3 Management and Research Changes

- ❖ Specifically, how has the NHEERL research management and research program changed since the last BOSC review?

NHEERL has invested significant effort in implementing a “cultural” change in organizational understanding and function, particularly as it relates to moving to team approaches for solving complex environmental and human health issues. NHEERL recognized that such progress is catalyzed by providing improved opportunities for the frontline research leadership, the Branch Chiefs, to communicate, mentor, and advise NHEERL scientific employees. To meet this objective, NHEERL reorganizations over the last several years have increased the senior supervisor/employee ratio from 1:30 to 1:17. The purpose of this restructuring has been to eliminate additional layers of management between staff and senior leadership, and to facilitate communication and mentorship mechanisms that enhance the function of interdisciplinary teams.

Since the last review, new Directors have been hired for all four research divisions as well as a Deputy Associate Director for Ecology to improve coordination across these divisions. NHEERL has likewise recruited leaders to two of five health divisions, and has successfully elevated two of these division leadership roles to Senior Executive Service (SES) status. Linking these positions to SES status will significantly aid retention and potential future recruitment into these critical leadership roles.

A Management Journal Club has been established for current NHEERL leaders to improve managerial and leadership skills by identifying business literature describing best leadership and business practices. These activities have been extended by establishing a contract with Temple University to develop a curriculum that will facilitate leadership implementation of ORD’s strategic goals. The institution of these leadership training and development activities will strengthen the overall leadership skills of NHEERL, and are illustrative of the commitment of NHEERL leadership to institutionalize the desired cultural change described in the sections above.

NHEERL also is developing a leadership development program that will provide both classroom and 2-3 year “stretch” assignment opportunities to high-potential employees. Importantly, the Laboratory is developing a process to objectively identify employees with high potential for assuming NHEERL science leadership and managerial positions.

NHEERL has accurately described several areas of shifts in research emphases that are anticipated in the next several years (see Section I.C, Table 3, p.15, NHEERL Self-Study). In almost all cases, these shifts in research emphases indicate movement from more simplistic research activities (e.g., single pollutant/stressor focus) to more complex research emphases (e.g., cumulative/aggregate risks, habitat alterations, nutrient impacts, etc.), and clearly mirror major strategic EPA and ORD research and regulatory shifts. The NHEERL organizational strategy described in Section 2.2.1 should serve as an effective vehicle for assuring an effective transition to these shifting research emphases. In particular, NHEERL will have to develop creative mechanisms for providing appropriate scientific intellectual and technical resources to meet this changing research agenda (see Section 2.3).

2.3 Research Implementation

- ❖ What are NHEERL’s unique research capabilities and strengths to accomplish its objectives?

- ❖ Are the human resources at NHEERL's disposal appropriate for its mission, goals, and objectives?
- ❖ Does NHEERL have the appropriate mix of workforce, facilities, and infrastructure to plan, prioritize, implement, and communicate results?

As noted in Section 2.1, NHEERL has made significant investments in building/remodeling facilities that will support state-of-art research for many years to come. These resources include laboratory and field research modules that encompass the broad range of human health and environmental research responsibilities nested within NHEERL.

NHEERL faces significant challenges, however, in obtaining and maintaining a scientific workforce that is flexible enough to support the shifting and increasingly complex research directions described above. These challenges must be met in the face of a period of constrained EPA ORD budgets and an aging workforce. NHEERL has developed a four-step workforce planning process in anticipation of these pressures. To address the need for flexibility, NHEERL participates in an ORD-wide task force exploring potential legislative solutions that enhance competitive compensation options for ORD-NHEERL scientists. These options include establishment of competitive, renewable term appointments for prestigious senior scientist positions, and/or an academic model limited tenure system similar to that used by the National Institutes of Health (NIH). The Subcommittee concurs that access to a broader and more flexible range of compensation and tenure options will be extremely valuable, if not essential, for implementation of an effective future NHEERL strategic science program.

Recommendation 8: NHEERL faces significant challenges in obtaining and maintaining a scientific workforce that is flexible enough to support the shifting and increasingly complex research directions incumbent to the ORD-NHEERL mission. EPA executive leadership should be encouraged to work with NHEERL leadership to seek legislative/administrative solutions that expand ORD-NHEERL options for recruiting and retaining a suitably flexible and talented scientific staff.

NHEERL has striven to increase the scientific- and experienced-based flexibility within its existing staff by instituting staff rotational assignments. Although these efforts are to be applauded, there was no apparent strategy for how such rotational assignments would contribute to the NHEERL technical and leadership career development strategic objectives and needs.

Recommendation 9: NHEERL has striven to increase the scientific- and experienced-based flexibility within its existing staff by instituting staff rotational assignments. A specific strategy/process should be developed, however, for linking staff rotational assignments to the strategic scientific and leadership needs of NHEERL. Such a strategy/process should be differentiated from a rotational assignment program that is merely intended for technology transfer.

NHEERL has actively and successfully participated in the post-doctoral program implemented by ORD in 1998. Over 45 post-doctoral fellows have been hired into 3-year appointments across the Laboratory, and have brought much strength to the research program by virtue of the new ideas, technical skills and intellectual/social diversity. NHEERL also has used the post-doctoral program as a potential pipeline for permanent positions within the Laboratory, and has hired four fellows as of June 2002.

Recommendation 10: NHEERL has actively and successfully participated in the post-doctoral program implemented by ORD in 1998. NHEERL needs to carefully track and consider the implications of hiring post-doctoral fellows into permanent laboratory positions. Such hires offer the advantages of more rapid integration into existing laboratory research and familiarity with the scientific and interpersonal skills of the individual. However, a potential disadvantage is that if the overall research staff becomes disproportionately populated by former post-doctoral fellows, the research program may run the risk of becoming “in grown”, i.e., scientific and individual diversity may suffer.

Much to its credit, NHEERL is actively engaged in supporting programs that encourage increased gender and racial diversity in the sciences. NHEERL has collaborative arrangements with several historically black colleges and universities in the RTP area, and has begun to develop agreements with both Hispanic and Native American organizations/institutions as well. These efforts support the maintenance and enhancement of a future “pipeline” of research-qualified, under-represented populations.

2.4 Communication

❖ How does NHEERL communicate results within its organization, within ORD, within EPA, to outside Agencies, and to the outside world?

As a scientific organization, a primary mechanism of communication is directed at the scientific community through publications placed in the scientific literature. NHEERL tracks its publication history and it appears to have consistently performed to high scientific and productivity standards.

NHEERL makes wide use of electronic and conventional printed media to more broadly distribute messages describing its research activities and accomplishments. These include specific Intra- and Internet Websites, a published Annual Accomplishments Report, briefing and fact sheets, etc. Much of the printed media is replicated on the Internet site, which further enhances NHEERL outreach.

The mechanisms of NHEERL’s strategy to communicate its organizational and scientific research activities both internally and within ORD and EPA are described in the sections above (e.g., MYIP steering teams, Synergy Workgroup, etc.). These mechanisms seem to be effectively supporting development of research plans that are aligned with the current and future needs of ORD and EPA.

An important purpose of the NHEERL scientific work product is that it be broadly used and integrated into the activities and functions of other EPA ORD Laboratories/Centers, and various Program and Regional Offices. However, NHEERL does not appear to have articulated a coordinated mechanism for assessing/tracking how its products are used, or the level of customer satisfaction with the quality and relevance of its overall work products (includes both work plans and actual outputs). Implementation of a customer satisfaction assessment program might provide valuable insights for potential process improvements and staff effectiveness, as well as elevating NHEERL “market visibility” within key elements of ORD and EPA.

Recommendation 11: An important purpose of the NHEERL scientific work product is that it be broadly used and integrated into the activities and functions of other EPA ORD Laboratories/Centers, and various Program and Regional Offices. However, NHEERL does not appear to have articulated a coordinated mechanism for assessing/tracking how its

products are used, or the level of customer satisfaction with the quality and relevance of its overall work products (includes both work plans and actual outputs). NHEERL should consider developing a process for assessing customer satisfaction with its work products.

2.5 Performance and Measures of Success

- ✧ What other research organizations (U.S. or international) are similar in their purpose and operation? How does NHEERL's performance compare to theirs (benchmarking)?
- ✧ How does NHEERL measure the efficiency and results of its performance? Target indicators? Metrics of success? Show quantitative measures of performance.
- ✧ Identify and discuss five cases where there has been a need for NHEERL's research in EPA Program Offices or Regions. Include two to three examples where this need has been effectively met, and two to three examples where it has not. Why or why not?
- ✧ Identify and discuss five cases where there has been a need for NHEERL's research by stakeholders outside EPA (e.g., other federal agencies, state agencies, businesses, citizen groups, or other organizations).

Given the diversity and complexity of the NHEERL organization, its leadership has approached benchmarking not from the perspective of seeking side-by-side performance measure comparisons, but rather, NHEERL leadership has sought to identify and benchmark best practices such as strategic plan development and implementation, laboratory management, communication tools, flexible hiring practices, etc. By approaching benchmarking in this way, NHEERL has expanded the potential institutions and organizations that serve as useful benchmarking opportunities (e.g., within ORD itself, industry, research institutes, other government agencies, etc.). This approach seems very thoughtful and worthwhile, and will likely lead to effective and creative refinement in NHEERL operational practices and behaviors.

Recommendation 12: NHEERL leadership has sought to identify and benchmark best practices such as strategic plan development and implementation, laboratory management, communication tools, flexible hiring practices, etc. This approach seems very thoughtful and worthwhile, and will likely lead to effective and creative refinement in NHEERL operational practices and behaviors. NHEERL is encouraged to continue to seek mechanisms for identifying and implementing a "best practices" approach to benchmarking both within and external to EPA and ORD.

As noted in Section 2.4, NHEERL routinely tracks the numbers of its scientific publications. However, it was not apparent how NHEERL evaluates the quality of that record, both from its scientific impact and timeliness of delivery in support of other EPA customer needs. By thoughtfully addressing this question, NHEERL might identify potential mechanisms that may be helpful in elevating value and use of its products.

Recommendation 13: NHEERL routinely tracks the numbers of its scientific publications. However, it was not apparent how NHEERL evaluates the quality of that record, both from its scientific impact and timeliness of delivery in support of other EPA customer needs. A mechanism should be developed which quantitates/evaluates the scientific and regulatory impact (both use and value) of its scientific work products.

NHEERL scientists/leaders have a demonstrated record of EPA-level awards recognition (e.g., Honor Awards, Scientific and Technological Achievement Award). NHEERL has consistently garnered approximately 42-44 percent of these awards. Although this percentage compares favorably to the entire eligible and relevant EPA employee base, routine gathering of such data will provide insight into whether NHEERL staff are being equitably recognized, and if not, lead to implementation of corrective plans. Finally, it is unclear as to whether NHEERL has the internal capability (i.e., budgets and/or administrative authority) for establishing recognition programs for its own staff.

NHEERL has instituted a program by which each of its nine divisions routinely (approximately every 3-4 years) undergoes an external scientific peer review of the quality and scientific impact of its research. These reviews provide valuable feedback to the Laboratory and division management, as well as to the staff itself. Given the geographical and scientific diversity of NHEERL, this approach, although costly, is valuable.

Recommendation 14: NHEERL has instituted a program by which each of its nine divisions routinely (approximately every 3-4 years) undergoes an external scientific peer review of the quality and scientific impact of its research. Given the geographical and scientific diversity of NHEERL, this approach, although costly, is valuable. NHEERL is encouraged to continue its practice of seeking regular scientific peer reviews of its divisions. The 3-4 year review cycle for each division is appropriate to meet this need. NHEERL leadership should implement a mechanism, however, to evaluate and track how the peer review information is translated into refinements of laboratory science and operations.

The information, conclusions, and recommendations derived from perspectives provided in the case reports supplied in the NHEERL Self-Study are distributed throughout the body of this report. The case reports served to highlight appropriate areas of Subcommittee interest in NHEERL efforts directed at strategic planning, implementation, technology and personnel needs, communication, etc.

2.6 Challenges Over the Next 5 Years

As a key science-based resource for EPA, NHEERL is challenged to develop an internal culture that molds the Laboratory into a “problem solving” organization that delivers its science product to its key customers in a usable and timely manner. Given the increasing complexity and diversity of the scientific problems it will face, NHEERL must develop effective strategies for fostering intra- and inter- Laboratory and Center collaborations. NHEERL leadership and staff are taking aggressive and effective steps to implement cultural and organizational changes necessary to deliver against these challenges. These NHEERL actions have been described throughout the body of this report.

3.0 RECOMMENDATIONS

1. NHEERL leadership is strongly committed to, and making significant progress in, implementing an organizational cultural change that will deliver research consistent with the ORD strategic plan. Given the geographical and scientific diversity of NHEERL, the Laboratory Director is encouraged to aggressively continue efforts to build understanding of the importance of the overall NHEERL and ORD Strategic Plans across the NHEERL organization.
2. ORD has identified 16 priority focus areas and associated MYIPs that identify specific efforts needed to support EPA's overall goals. NHEERL has developed corresponding MYIPs for 8 of these 16 areas. Although it is not appropriate or necessary for the Laboratory to have matching MYIPs for all 16 ORD focus areas, NHEERL should develop MYIPs for those remaining priority focus areas relevant to its mission.
3. NHEERL has developed, piloted, and implemented a creative "steering team" planning mechanism designed to encourage development of research plans that solve problems, and to build commitment and understanding within those elements across the breadth of EPA-ORD-NHEERL charged with accountability for the research issue. Seven steering teams currently are in operation, covering most of the critical research focus areas. NHEERL is encouraged to develop a steering team supporting the Ecological Research/EMAP research focus, which represents one of the larger 2002 FTE efforts. This team will be critical in shaping an effective integration and interpretation of data flowing from the EMAP, and in determining a future research direction of NHEERL that may require a significant investment in physical and intellectual resources (e.g., understanding the broader implications of human activities on ecological health).
4. NHEERL should devise appropriate criteria for determining when it is time to sunset any given research activity. Such criteria will help assure that valuable laboratory and intellectual resources continue to be productively applied to science needs relevant to the ORD mission.
5. NHEERL has established a Synergy Workgroup constituted with representatives from the nine NHEERL divisions. The Synergy Workgroup is intended to stimulate intra-divisional discussions and collaborations, and its activities have included development of an Intranet Website containing searchable information on ongoing NHEERL projects, and facilitation of several joint intramural RFAs. NHEERL should develop tools for tracking the translation of Synergy Workgroup activities into research activities linked to the NHEERL Strategic Plan. Communication and individual/group incentive plans also may need to be developed to encourage active and effective engagement of the Workgroup.
6. NHEERL has implemented several strategic activities designed to foster interactions outside of the Laboratory itself, including sponsoring joint workshops with other EPA Laboratories and Centers. NHEERL is encouraged to continue to seek opportunities and provide funding for exchanges of scientific expertise with other relevant EPA Offices or ORD Laboratories and Centers. In particular, emphasis on identifying activities that build improved understanding of environmental exposures and their relationships to laboratory experimentation and modeling is valued.
7. NHEERL has instituted a seminar series with EPA's OPPTS that provides opportunities for NHEERL scientists to communicate and receive feedback on their research findings with this

- regulatory office. ORD and NHEERL should investigate cost-sharing mechanisms that encourage scientific exchanges such as joint seminar programs within the Agency.
8. NHEERL faces significant challenges in obtaining and maintaining a scientific workforce that is flexible enough to support the shifting and increasingly complex research directions incumbent to the ORD-NHEERL mission. EPA executive leadership should be encouraged to work with NHEERL leadership to seek legislative/administrative solutions that expand ORD-NHEERL options for recruiting and retaining a suitably flexible and talented scientific staff.
 9. NHEERL has striven to increase the scientific- and experienced-based flexibility within its existing staff by instituting staff rotational assignments. A specific strategy/process should be developed, however, for linking staff rotational assignments to the strategic scientific and leadership needs of NHEERL. Such a strategy/process should be differentiated from a rotational assignment program that is merely intended for technology transfer.
 10. NHEERL has actively and successfully participated in the post-doctoral program implemented by ORD in 1998. NHEERL needs to carefully track and consider the implications of hiring post-doctoral fellows into permanent laboratory positions. Such hires offer the advantages of more rapid integration into existing laboratory research and familiarity with the scientific and interpersonal skills of the individual. However, a potential disadvantage is that if the overall research staff becomes disproportionately populated by former post-doctoral fellows, the research program may run the risk of becoming “in grown”, i.e., scientific and individual diversity may suffer.
 11. An important purpose of the NHEERL scientific work product is that it be broadly used and integrated into the activities and functions of other ORD Laboratories/Centers, and various EPA Program and Regional Offices. However, NHEERL does not appear to have articulated a coordinated mechanism for assessing/tracking how its products are used, or the level of customer satisfaction with the quality and relevance of its overall work products (includes both work plans and actual outputs). NHEERL should consider developing a process for assessing customer satisfaction with its work products.
 12. NHEERL leadership has sought to identify and benchmark best practices such as strategic plan development and implementation, laboratory management, communication tools, flexible hiring practices, etc. This approach seems very thoughtful and worthwhile, and will likely lead to effective and creative refinement in NHEERL operational practices and behaviors. NHEERL is encouraged to continue to seek mechanisms for identifying and implementing a “best practices” approach to benchmarking within and external to EPA and ORD.
 13. NHEERL routinely tracks the numbers of its scientific publications. However, it was not apparent how NHEERL evaluates the quality of that record, both from its scientific impact and timeliness of delivery in support of other EPA customer needs. A mechanism should be developed which quantitates/evaluates the scientific and regulatory impact (both use and value) of its scientific work products.
 14. NHEERL has instituted a program by which each of its nine divisions routinely (approximately every 3-4 years) undergoes an external scientific peer review of the quality and scientific impact of its research. Given the geographical and scientific diversity of NHEERL, this approach, although costly, is valuable. NHEERL is encouraged to continue its practice of seeking regular

scientific peer reviews of its divisions. The 3-4 year review cycle for each division is appropriate to meet this need. NHEERL leadership should implement a mechanism, however, to evaluate and track how the peer review information is translated into refinements of laboratory science and operations.

APPENDIX: NHEERL Self-Study