



Board of Scientific Counselors

Office of Research and Development
United States Environmental Protection Agency

Second Program Review of the National Risk Management Research Laboratory (NRMRL)

Final Report of the Subcommittee
on the Review of NRMRL

November 19, 2002

**B
•
O
•
S
•
C**

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.

TABLE OF CONTENTS

Preface	3
Roster of the Board of Scientific Counselors Executive Committee	5
Roster of the Board of Scientific Counselors NRMRL Subcommittee	7
List of Acronyms	8
1.0 Executive Summary	9
2.0 Introduction	11
3.0 Laboratory Review	13
3.1 Response to Previous BOSC Evaluation	13
3.2 Measures of Success and Future Needs	13
3.3 Performance	16
3.4 Research Strengths and Challenges	18
3.5 Planning and Integration	22
4.0 Recommendations	27
Appendices	
A. Examples of Targeted E-mail Messages That Inform Potential Users of New Reports and Findings	29
B. NRMRL Self-Study	33

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.

BOARD OF SCIENTIFIC COUNSELORS EXECUTIVE COMMITTEE

Chair:

Jerald L. Schnoor, Ph.D., Professor, Department of Civil & Environmental Engineering, University of Iowa, Iowa City, IA

Members:

Daniel Acosta, Jr., Ph.D., Dean, College of Pharmacy, University of Cincinnati, Cincinnati, OH

Ann Bostrom, Ph.D., Associate Professor, School of Public Policy, Georgia Institute of Technology, Atlanta, GA

James S. Bus, Ph.D., Toxicology & Environmental Research & Consulting, The Dow Chemical Company, Midland, MI

William L. Chameides, Ph.D., Smithgall Chair and Regents Professor, School of Earth and Atmospheric Sciences, Georgia Institute of Technology, Atlanta, GA

James R. Clark, Ph.D., Exxon Mobil Research & Engineering Company, Fairfax, VA

Elaine J. Dorward-King, Ph.D., Global Executive, Environment, Health and Safety, Rio Tinto Borax, Valencia, CA

James H. Johnson, Jr., Ph.D., Dean, College of Engineering, Architecture, and Computer Sciences, Howard University, Washington, DC

Donald R. Mattison, M.D., Clinical Professor of Public Health, Mailman School of Public Health, Columbia University, Bedford Hills, NY

Bonnie J. McCay, Ph.D., Professor of Anthropology and Ecology, Department of Human Ecology, Cook College, Rutgers University, New Brunswick, NJ

Mitchell J. Small, Ph.D., Professor of Civil and Environmental Engineering, Department of Civil and Environmental Engineering, Carnegie-Mellon University, Pittsburgh, PA

Juarine Stewart, Ph.D., Professor, Department of Biological Sciences, Clark Atlanta University, Atlanta, GA

Herbert L. Windom, Ph.D., Skidaway Institute of Oceanography, Savannah, GA

Rae Zimmerman, Ph.D., Professor of Planning and Public Administration, Robert F. Wagner Graduate School of Public Service, New York University, New York, NY

Committee Staff:

Peter W. Preuss, Ph.D., ORD BOSC Liaison, National Center for Environmental Research, U.S. EPA, Washington, DC

Shirley R. Hamilton, Designated Federal Officer, National Center for Environmental Research, U.S. EPA, Washington, DC

Betty J. Overton, Alternate Designated Federal Officer, National Center for Environmental Research, U.S. EPA, Washington, DC

BOARD OF SCIENTIFIC COUNSELORS NRMRL SUBCOMMITTEE

BOSC Members:

- Chair: Mitchell J. Small, Ph.D.
Professor, Civil and Environmental Engineering/
Engineering and Public Policy
Carnegie Mellon University
Pittsburgh, PA
- Vice Chair: Elaine J. Dorward-King, Ph.D.
Global Executive, Environment, Health and Safety
Rio Tinto Borax
Valencia, CA
- Members: Amy K. Zander
Associate Professor
Department of Civil and Environmental Engineering
Clarkson University
Potsdam, NY
- David T. Allen
Department of Chemical Engineering
Center for Energy/Environmental Research
University of Texas, Austin
Austin, TX
- BOSC DFO: Shirley Hamilton
Designated Federal Officer
National Center for Environmental Research
U.S. EPA/ORD
Washington, DC
- Laboratory Director: E. Timothy Oppelt
Director
National Risk Management Research Laboratory
U.S. EPA/ORD
Cincinnati, OH

LIST OF ACRONYMS

AA/ORD	Assistant Administrator for the Office of Research and Development
ARS	Agricultural Research Service
BOSC	Board of Scientific Counselors
EAWAG	Swiss Federal Institute for Environmental Science and Technology
EPA	Environmental Protection Agency
MYP	Multi-Year Plan
NCER	National Center for Environmental
NHEERL	National Health and Environmental Effects Research Laboratory
NIES	National Institute of Environmental Studies
NRC	National Research Council
NRMRL	National Risk Management Research Laboratory
ORD	Office of Research and Development
RCT	Research Coordination Team
RIVM	Dutch National Institute of Public Health and the Environment
RME	Risk Management Evaluation
RTP	Research Triangle Park
SITE	Superfund Innovative Technology Evaluation
SPC	Science Policy Council
STAR	Science to Achieve Results
USDA	U.S. Department of Agriculture

1.0 EXECUTIVE SUMMARY

This second Board of Scientific Counselors (BOSC) review of the National Risk Management Research Laboratory (NRMRL) took place August 21-22, 2001, in Cincinnati, OH. The first BOSC review of NRMRL was conducted in 1997, and a final report was issued in April 1998. In that report a number of significant problems at NRMRL were identified involving the Laboratory's adjustment to its new mission as ORD's central location for risk management research. This new mission includes a strong intramural program of research and technology transfer in the areas of air pollution prevention and control; water resources and supplies; land and subsurface protection and remediation; and sustainable technology, green design, and pollution prevention. In this adjustment, NRMRL has been challenged with adding significant new scientific expertise capable of addressing the physical, ecological, and social science elements of risk management that were previously lacking at the Laboratory, while maintaining its strong engineering and human health assessment capabilities needed to support pollution treatment and control research and technology transfer. NRMRL also needed to shift from a program with a heavy emphasis on extramural contracting, to one with predominant in-house capabilities, and to integrate divisions and programs across its facilities in Cincinnati, OH; Research Triangle Park (RTP), NC; Ada, OK; Edison, NJ; and Washington, DC.

This second review found that NRMRL has exerted significant effort and made very good progress in addressing the challenges and concerns noted in the first BOSC evaluation. A well-focused draft strategic plan and innovative multi-year planning efforts have allowed the Laboratory to begin to address a number of important new issues in risk management and to enable the human resources and infrastructure needed for its new mission. These efforts reflect significant improvements both in NRMRL's internal capabilities and in its coordination with the other ORD Laboratories and Centers. However, a number of difficulties remain that hinder full and effective implementation of these efforts, in particular, in communication with staff on the links between the strategic plan and management actions. Key findings and recommendations of the BOSC's second review include the following:

- ❖ NRMRL should revisit and finalize its Strategic Plan, with an enhanced communication plan to ensure adequate internal support and implementation.
- ❖ Further effort is needed to establish and track measures of performance and success, including the impact of publications, workshops, EPA Program Office and Region consultations, technology support, and overall scientific leadership and innovation.
- ❖ A staged-gate management process should be established to review projects at various stages of development and implementation to ensure continued progress and value, and to enable an appropriate turnover of ideas and initiatives.
- ❖ There are a number of research organizations in the United States and other countries that are appropriate for use by NRMRL for benchmarking its management efforts and scientific programs, and such benchmarking should not be further delayed.
- ❖ A clear human resources plan is needed to plan, facilitate, and track the Laboratory's continued shift in its skill mix and capabilities; significant needs remain in the social and ecological sciences, and visiting scientist programs should be considered for finding and attracting new talent.

- ❖ Improved internal and external communications expertise and programs are needed to ensure that internal messages are recognized and not lost, and to proactively seek and reach target audiences for NRMRL's products.
- ❖ A cross-organizational, multi-functional team should be established to develop a plan for an internal, bottom-up review of opportunities for improving NRMRL's administrative and operational efficiency.
- ❖ The internal grants program is an important source of innovative research at NRMRL and should be maintained as a separate and viable component of the Laboratory's activities.
- ❖ More careful planning is needed to identify the role of post-doctoral fellows in NRMRL's strategic planning, and to provide the appropriate mentoring and resources.
- ❖ Further efforts are needed to provide for better interaction and more complementary efforts between NRMRL and the National Center for Environmental Research's (NCER) extramural Science to Achieve Results (STAR) program and its grant recipients; a recent workshop on mercury that included NRMRL and NCER co-sponsorship can serve as a model of one mechanism for achieving this.
- ❖ More frequent review and consultation of the NRMRL efforts to implement this and previous BOSC recommendations by a standing BOSC subcommittee would be beneficial, but may require additional support and subcommittee members to allow for timely and effective evaluation and feedback.

The Subcommittee found a high level of expertise, dedication, and commitment displayed by the NRMRL management and staff, and we are thankful for their full cooperation and participation in this review process. The BOSC is confident that with this capability and commitment, NRMRL will continue to advance and lead in its important risk management research mission.

2.0 INTRODUCTION

The BOSC established the Subcommittee for the National Risk Management Research Laboratory (NRMRL) at its meetings during 2000 and 2001. The Subcommittee was established as one of five Laboratory/Center subcommittees for the BOSC to act as a resource for the ORD Laboratories and Centers.

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

The NRMRL Subcommittee members who conducted this second review include Dr. Mitchell J. Small (Chair), Dr. Elaine Dorward-King (Vice Chair), Dr. David T. Allen, and Dr. Amy K. Zander. On August 21-22, 2001, the Subcommittee members held a meeting with NRMRL management and staff at the Laboratory's headquarters in Cincinnati, OH, which was open to the public. The meeting included presentations and question-and-answer sessions with the Laboratory Director, E. Timothy Oppelt, and supporting NRMRL managers and key staff, as well as separate meetings with Laboratory scientists and post-doctoral researchers. Further details of the process of the meeting are summarized in the BOSC "Summary Minutes of the Public Meeting August 21-22, 2001." The agenda for the site visit is provided in Appendix A.

The review of NRMRL followed a set of self-study questions developed by the entire BOSC for all of the ORD Laboratories and Centers. These questions are identified in the text of this report. In response to these questions, the NRMRL management and staff prepared a self-study report, which was distributed to the Subcommittee prior to the August meeting. This report, along with other information describing the programs and activities of NRMRL (see Appendix B for a list of materials distributed to the Subcommittee, and Appendix D for NRMRL's response to the self-study questions), provided a basis for discussion during the August review meeting, and general input for this evaluation. This report is organized around the BOSC questions and NRMRL's responses to them.

3.0 LABORATORY REVIEW

3.1 Response to Previous BOSC Evaluation

- ✧ What were the three to five most serious problems identified in the first BOSC Review? How has NRMRL responded to these problems and the BOSC recommendations related to them?

The 1998 BOSC review of NRMRL resulted in a number of recommendations centered on the issues of planning, human resources, transition to an intramural research program, and the communication of research. This BOSC review panel noted that significant progress had been made since 1998 in addressing the recommendations, particularly in developing the mission, values, and strategic plan for the Laboratory. The NRMRL Strategic Plan (draft) is aligned, and indeed pre-dates, the ORD Strategic Plan as well as EPA's Strategic Plan. The Laboratory has taken steps to shift to risk management research, broadening its skill mix, changing its research focus, and seeking greater integration of research with the rest of ORD. Pursuit, development, and implementation of Multi-Year Plans (MYPs) is an example. There have been some difficulties in implementation of the Strategic Plan, and it is important that implementation continues. In particular, communications to staff identifying the links between the Strategic Plan and management actions need to be improved; there is some sense by staff that a Strategic Plan was developed but never finalized or acted upon. NRMRL is encouraged to revisit its strategic plan and eliminate those objectives, which upon examination, are not priorities or do not deliver adequate benefits for the resources required.

Recommendation 1: NRMRL should revisit and finalize its Strategic Plan, with an enhanced communication plan to ensure adequate internal support and implementation.

Additional findings and recommendations with regard to specific issues and recommendations from the 1998 report are addressed in detail in the sections that follow, in conjunction with the other self-study questions.

3.2 Measures of Success and Future Needs

- ✧ How does NRMRL measure the efficacy and results of its performance? Target indicators? Metrics of success? Show quantitative measures of performance.

Realizing success requires setting goals and determining when and how it will be known that the goals are met. This process is initiated by stating achievable and measurable performance measures. NRMRL has developed a working draft of an organizational Strategic Plan. Core values and a core vision have been developed and shared throughout the organization. NRMRL seeks to be the first place that environmental decision makers come for risk reduction solutions, and the first place environmental professionals choose to work. The NRMRL Strategic Plan is a valuable start to achieving this vision. However, to move toward achievement of the goals within the Strategic Plan, both qualitative and quantitative criteria and indicators of success are required, and these must be measurable. Although a number of the very important indicators of success are difficult to measure in a quantitative manner (e.g., science quality, relevance, and impact), these can be qualitatively ascertained through such mechanisms as solicited letters from users, or unsolicited comments on the Laboratory's Website.

Journal publications are an important means for disseminating peer reviewed scientific results. However, they may not be the only, or even the best, way to reach the largest target population.

Like other organizations (especially universities), the Laboratory appears inclined to rely upon publication counts for individuals, but these are not a complete measure of success. In particular, journal quality varies widely. Journal publications should be considered as well as the value of the journal to the research community and the number of citations of a particular article. These additional measures can allow a more complete evaluation of the quality, use, and impact of a publication.

Information is a major product of the organization. An attempt should be made to measure all of the ways in which information developed at NRMRL is used. Citation of NRMRL work within internal ORD reports written by program directors is an effective measure. Another measure of performance is citation within National Research Council (NRC) reviews and reports; these constitute a form of external evaluation. Number of external hits to the Website maintained by NRMRL can provide a measure of the use of the Laboratory's information by the public.

Feedback from constituents such as other government program managers also can be directly solicited. A letter of recognition could be requested from a Program Office manager known to have significantly utilized information generated by NRMRL.

The appropriate value should be given and measurement tools developed for all of the products developed by NRMRL. Manuals of practice, guidelines, tools developed, techniques outlined, capstone reports prepared, and other products should be noted and tracked when important to the goals of NRMRL. Credit for development of these products is important to the people working at NRMRL, as well as to the Laboratory's constituents. Tools for measurement of success, both for organizational evaluation and individual professional promotion should be designed as much as possible for measurement and assessment, both qualitative and quantitative. This allows indication of when an objective has been successfully met. This also requires tracking of baseline data as needed to allow for quantification and documentation of the final result. Furthermore, tools for measurement of success should be developed that place the deserved value on all products developed for dissemination by the organization. These should include measurement tools for production and dissemination of manuals, guidelines, Web-based information, capstone reports, risk management evaluations, patents, etc., as well as the more traditionally measured peer reviewed publications. Finally, the organization should continue ongoing efforts to disseminate information through technology transfer initiatives such as workshops. Feedback from user groups such as program directors assisted by the organization and workshop attendees should be solicited and documented to aid in the measurement of impact and success.

Recommendation 2: NRMRL should make further effort to establish and track measures of performance and success, including the impact of publications, workshops, EPA Program Office and Region consultations, technology support, and overall scientific leadership and innovation.

❖ How does NRMRL use research results to set new research priorities, plan research, and discharge its mission?

Research priorities will shift with the advent of new discoveries as well as with the completion of certain projects and changes in research needs. It is important to have a process in place that redirects the research funding and personnel to meet these new priorities. Under the current system of priority setting, there is little incentive to move from a research topic that may have served its purpose to a new more-important topic. There does not seem to be a clear definition and set of

criteria for determining what makes a project promising, and therefore worthy of further expenditure and support. A staged-gate approach to project management and priority setting would aid in ensuring projects deserving of resources receive them and that others that may not be as promising are terminated. Staged-gate management identifies particular junctures in the development, implementation, and eventual completion of a project, where the progress and relevance of the project to the organization's goals and needs are assessed, and decisions made regarding further commitment, support, and levels of activity. Termination of a project should not be viewed as a critique of the investigator involved, only of a shift in the organization's needs and priorities.¹ Research activities should be monitored through a structured review process based on a set of criteria such as a staged-gate approach. Continuation of a particular project or research agenda should be earned by progression through a known set of steps and the meeting of specific criteria.

Risk management evaluations (RMEs) are a significant new tool recently developed by NRMRL to evaluate risk management options and research needs in emerging areas of environmental risk. At the time of this BOSC review, four RMEs were underway or in various stages of completion. While seemingly limited to the evaluation of completely new areas, RMEs also can be used to evaluate progress of an existing line of inquiry and to determine future directions for existing projects. To ensure responsiveness to needs of its constituent groups, NRMRL should continue its efforts to set and direct research priorities through interaction and coordination with the Regional Science Council, the Science Policy Council (SPC), and Research Coordination Teams (RCTs). These efforts should continue to be aided by the development and use of RMEs.

Recommendation 3: A staged-gate management process should be established to review projects at various stages of development and implementation to ensure continued progress and value, and to enable an appropriate turnover of ideas and initiatives.

❖ Are the human resources at NRMRL's disposal appropriate for its mission, goals, and objectives?

Researchers and technicians are the center of the research activities at NRMRL. A critical mass of research talent is necessary to carry out the mission, goals, and objectives of the organization. This talent also is critical to be able to respond to new research initiatives with the appropriate resources, human and otherwise.

NRMRL appears to operate on a very tight budget. Human resources are a major expenditure within that budget. The current plan for research staffing consists of judicious hiring following a retirement. This does not necessarily allow for structured movement toward fulfillment of the Strategic Plan. In the periods between retirements, changes in research focus are enacted through the short-term hiring of post-doctoral associates. Although these are, in general, very talented individuals, they do not (in many cases) see NRMRL as a career path. It is rare for a post-doctoral associate to remain with NRMRL for longer than a few years. Their expertise then is lost to the organization. NRMRL should exercise caution in using post-doctoral positions as the sole basis for

¹ Care must be taken to ensure that these assessments and redirection of resources occur in a stable and predictable manner. If the priorities of the organization and its associated commitments shift too often and in a manner that is too unpredictable, this can have a demoralizing impact on the research scientists and staff, and impair the quality of research, especially long-term efforts that take time to nurture and develop.

changing the organization's skill mix. In particular, longer-term hires of ecologists, health, social, and behavioral scientists must be made to fully meet the challenges of the NRMRL Strategic Plan.²

- ❖ Does NRMRL have the appropriate mix of workforce, facilities, and infrastructure to plan, prioritize, implement, and communicate its results?

Implementation of the Strategic Plan and achievement of its goals requires the appropriate mix of human resources and facilities as well as the proper channels for communication of plans within the organization and for dissemination of research results.

NRMRL's research and support facilities appear sufficient and appropriate for its research and communication missions. The new building at RTP will provide up-to-date research facilities and space. Thus, space does not seem to be a limiting factor in reaching NRMRL's goals.

The Subcommittee members were concerned that the current mechanism for (in-house) contracted funding of various laboratory and analytical services for NRMRL introduces significant losses in time, efficiency, and resources. Such a system made sense when in-house requirements for such services at the Laboratory were lower and intermittent. With the growth of the in-house research program engendered by NRMRL's reorganization and refocus of its mission, however, there now appears to be sufficient, ongoing demand for many of the services that have been historically addressed through the in-house contractors. Such a reorganization, from in-house contractors to EPA staff, is believed by many of the NRMRL staff to have led to significant improvements in efficiency at another ORD Laboratory—National Health and Environmental Effects Research Laboratory (NHEERL). The recent shift in focus to in-house research has resulted in a need for technical support staff in all areas. NRMRL should investigate the possibility of shifting in-house contractors to EPA staff in the manner undertaken by NHEERL during the 1990s.

The appropriate mix of research staff remains a problem due to the slow turnover of full-time employees and the use of post-doctoral associates to fill research expertise needs in some areas. It is important to set goals for hiring with a long-term plan for how the workforce mix should look in 5 years. Hires then can be determined to allow achievement of the stated goals. A 5-year plan for human resource development should be generated for NRMRL. This plan should take into account research priorities and the current age and skill distribution within the organization. This plan should contain an ongoing, yearly, systematic review to track progress in achieving the goals specified in the human resource plan (see Recommendation 5 for further elaboration and discussion of specific current needs).

3.3 Performance

- ❖ What other research organizations (U.S. or international) are similar in purpose and operation? How does NRMRL's performance compare to theirs (benchmarking)?
- ❖ Identify and discuss five cases where there has been a need for NRMRL 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?

² See the second and third questions in Section 3.5 for more in-depth discussion of the particular skill areas where further staff growth is needed.

- ✧ Identify and discuss five cases where there has been a need for NRMRL's research by stakeholders outside of EPA (e.g., other federal agencies, state agencies, businesses, citizen groups, or other organizations).

The evaluation of the performance of any complex organization can benefit from benchmarking against other organizations. Recognizing this, the previous BOSC review recommended that NRMRL undertake a comparison of the Laboratory's performance with other, similar research organizations. This comparison was not performed, in large part because (as indicated by NRMRL management) NRMRL found it difficult to identify other organizations that had missions that closely matched those of the Laboratory. Although the review panel agrees that there are few, if any, organizations that precisely match the mission of NRMRL, there are a number of organizations that are attempting to achieve outcomes similar to the outcomes that NRMRL needs to achieve. These outcomes include recruiting environmental scientists and engineers, communicating the results of environmental research to broad constituencies, and providing regulatory decision-makers with scientific information.

NRMRL's performance in achieving specific outcomes would benefit from comparison and benchmarking with organizations that attempt to achieve similar outcomes. The organizations that NRMRL should use in benchmarking activities will depend on the outcome that is being considered. For example, in benchmarking recruitment and professional development activities, NRMRL should consider comparing its efforts with academic institutions, with national laboratories (both in the United States and internationally³), and in the private sector. In benchmarking communication and outreach activities, NRMRL should consider benchmarking against other offices within EPA, as well as other federal and international governmental organizations with strong communication and outreach responsibilities. Examples in the United States include the National Oceanic and Atmospheric Administration (NOAA), and the U.S. Department of Agriculture Agricultural Research Service (USDA-ARS). Finally, in benchmarking its mechanisms for providing regulatory decision-makers with scientific information, NRMRL should consider institutions in other countries (for example, Environment Canada and the Dutch Ministry for the Environment) and institutions in the states. This benchmarking exercise would allow NRMRL to identify best practices; it also would allow NRMRL to understand how many of its customers (such as state environmental agencies) communicate information regarding risk management to decision-makers. This information about its customers would allow NRMRL to better refine its communication strategies. NRMRL's performance in recruitment/professional development, outreach, and communication should be benchmarked against the performance of organizations, both U.S. and international, that attempt to achieve similar outcomes.

Recommendation 4: There are a number of research organizations in the United States and other countries that are appropriate for use by NRMRL for benchmarking its management efforts and scientific programs, and such benchmarking should not be further delayed.

In comparing its performance to the performance of other institutions seeking similar outcomes, NRMRL should use both qualitative and quantitative measures of performance. General issues

³ Examples of international environmental research organizations that should be considered for the benchmarking of NRMRL and other ORD Laboratories and Centers include: the Swiss Federal Institute for Environmental Science and Technology (EAWAG); the National Institute of Environmental Studies (NIES) in Japan; and the Dutch National Institute of Public Health and the Environment (RIVM).

regarding performance metrics were discussed in the previous section, but additional insight can be gained by considering case studies. In that spirit, the BOSC requested that NRMRL identify cases where there has been a need for the Laboratory's research in EPA Program Offices or Regions, and cases where there has been a need for the Laboratory's research by stakeholders outside of EPA.

In responding to this request, NRMRL identified a variety of cases that highlight the complexity of performance evaluation for the Laboratory. For example, one of the cases cited as an example of NRMRL meeting EPA Program Office needs was work done in support of the Office of Air and Radiation's decision regarding regulating mercury emissions from coal-fired utilities. In this case NRMRL provided timely information on potential mercury control strategies and prepared both technical reports and internal memoranda. Although it could be argued that this type of success could be tracked by counts of technical reports, simple publication counts would not differentiate reports that have a profound impact on the direction of the nation's environmental policies from those that address a more limited need.

In another example, NRMRL cited the success of the Superfund Innovative Technology Evaluation (SITE) program, which promotes the development, commercialization, and implementation of innovative hazardous waste treatment technologies. In this case, NRMRL communicates technical information concerning innovative technologies to parties charged with remediating contaminated sites. The communication may take the form of data from field tests, technical data on technologies, or published reports. Again, merely counting reports issued or guidance provided would not differentiate between NRMRL products that had a profound impact on remediation costs and programs and those that met a more limited need.

Tracking the broad range of research and technical support activities undertaken by NRMRL will require a diverse array of performance metrics. To differentiate efforts that are successful in meeting identified needs from those that do not effectively meet needs, performance metrics will need to go beyond simple counting of work products. Some assessment of the impact of the work products will be required. NRMRL should develop mechanisms for assessing the impact, as well as the number, of its work products. Identifying mechanisms for characterizing the impact of research should be a part of the NRMRL's benchmarking activities.

In assessing performance and making comparisons with other institutions, understanding the reasons for failures can be as important as understanding what characterizes success. For that reason, in the self-study questions, the review panel requested that NRMRL identify cases where the Laboratory was not successful in meeting Program Office or Region needs. The two cases that were identified were cases where programs that had achieved success were terminated because of lack of funding. This response was not what the panel had hoped for and the panel encourages NRMRL to examine how to identify programs that are not meeting existing needs. Nevertheless, the response suggests an additional area that the Laboratory should examine—how to bring successful projects to closure. For some projects the process is clear. If the goal is to provide technical guidance to inform regulatory decisions, the project may end when the decision is made. In contrast, if the project involves technology development, it may not be clear when to transfer the work from NRMRL to other technology developers. Also, as the Laboratory's mission and priorities change, it may be necessary to phase out some projects that are successfully meeting needs. As suggested previously, NRMRL should develop a staged-gate project evaluation process for managing projects as they evolve.

3.4 Research Strengths and Challenges

❖ What are NRMRL's unique research capabilities and strengths to accomplish its objectives? The NRMRL core competencies are the same as those identified 3 years ago: source/problem characterization, pollution prevention methods, pollution control methods, remediation/restoration methods, performance and cost verification, and technology transfer. These core competencies are being complemented by increased expertise in the life and social sciences. These new areas of expertise are being developed to accommodate the change in mission of NRMRL, and to better integrate with the other ORD Laboratories and Centers in support of the risk paradigm. NRMRL is commended for maintaining its core competencies in the face of trying to address changes in direction and in seeking to keep up with the shift in its mission.

The current approach to adjusting the balance of expertise is a judicial rather than a prescriptive approach. When a vacancy occurs, it may or may not be filled with an individual with life or social science expertise; Laboratory management makes a judgement based on the current critical need or opportunity. This somewhat ad hoc approach may not be adequate to ensure that the needed balance of disciplines is reached in the timeframe required. Furthermore, there is reluctance on the part of some researchers to shift from human health oriented research to ecosystem research. Thus, the need for increased levels of ecosystem research in NRMRL is particularly dependent on new additions in staff and new programs. The BOSC recommends that NRMRL develop a strategic plan with clearly defined desired results for broadening the skill mix. Based on the missions and strategic plans of ORD and NRMRL, respectively, management needs to determine the most desirable skill mix and develop an action plan that includes accountabilities and a timeline for implementation. This will demonstrate purposefulness and commitment, and in the long run, better position the Laboratory to be successful in achieving its mission and meeting customers' needs.

NRMRL should continue to seek partnerships and engagements with other organizations to grow expertise in its developing areas. It also should seek better ways to transition staff working on existing programs into new areas, particularly those that are identified as being critical for the future. Management will have to be creative in seeking to transition existing programs into these forward-looking programs. Perhaps the RME, or similar framework for evaluating emerging problems can provide mechanisms to help achieve this. The BOSC also recommends that NRMRL proceed with a Resident Scholar program of temporary (2-3 year) positions for senior researchers external to EPA. These positions offer the opportunity to bring energy, new ideas, and expertise to the Laboratory. The people brought into these positions not only should be exemplary researchers, but they also should be widely acknowledged as individuals who are coaches and mentors, and able to build teams. Their presence should be regarded as an opportunity to build human bridges to other organizations. Care should be taken in structuring the program so that conflicts and divisiveness within the Laboratory are minimized.

Recommendation 5: A clear human resources plan is needed to plan, facilitate, and track the Laboratory's continued shift in its skill mix and capabilities; significant needs remain in the social and ecological sciences, and visiting scientist programs should be considered for finding and attracting new talent.

❖ How does NRMRL communicate its results within the Laboratory, within ORD, within EPA, and to the outside world?

Significant progress has been made by NRMRL in the use of information technology to assist in communicating internally and externally. External audiences can view a Website for updated information on research activities and results. Videoconferencing is used and is seen as a key tool in

communicating across the Laboratory among staff at its widely separated locations. Much effort has been made to increase the number of articles published in the peer reviewed literature. NRMRL has made significant progress in this area and it should be commended.

A significant and successful effort has been made to communicate research results to the clients and stakeholders of the Technology Transfer Program. NRMRL has developed two new types of reports to better disseminate the results of the research program: capstone reports and RMEs. NRMRL has made more progress with RME reports than with capstone reports; to date, the Laboratory has four RMEs in preparation.

Communication vehicles appear to be oriented toward making information available rather than seeking to communicate messages. In this, NRMRL has established a number of locations for disseminating information, but these, for the most part, require the target audiences to take action to locate them.

One key mechanism currently used by NRMRL for internal communication is videoconferencing. This mechanism, however, has been only marginally successful due to lack of expertise in using the technology, and the fact that all sites do not have the full technology capabilities. Outreach to the Regions varies by Region. There are ORD liaisons in each Region, and the Regional Science Council has input into setting ORD-NRMRL research priorities. The Regions are taking on more leadership and implementation roles on large strategic issues; roles that once were supported more by ORD and the states. NRMRL needs to ensure that communication lines are open as this new division of responsibilities goes forward, to ensure that the appropriate expertise and technologies are recognized and applied when appropriate.

Currently, it seems that the communication systems and people are working and focusing on certain Laboratory departments and projects while others receive little strategic or practical attention. Technical communications in the technology transfer area and externally directed information products are in place and appear to be functioning well.

It is obvious that there are differences between what management knows and believes compared to what many staff know and believe regarding Laboratory priorities, plans, decisions, and actions. This can lead to an environment of confusion and a lack of trust. Turning this around will take visible emphasis by NRMRL leadership.

A series of actions are recommended to improve internal and external communications. First, NRMRL needs to organizationally define its communication goals and examine and develop a more comprehensive communications strategy and action plan. Particular attention should be given to communications internally. Rotational employees from other parts of EPA should not be used to lead this effort; it should be led by NRMRL.

How and where communications professionals are located should be examined. They should not be sequestered. The BOSC recommends that one person be directly assigned to the Laboratory Director's office and consideration be given as to how to better link communications staff with all Division Directors. Systems need to be in place to ensure that opportunities for internal messages are recognized and not lost. NRMRL should examine whether it currently has the correct mix of communications expertise. There needs to be balance of technical people to support technology, along with other professionals whose emphasis is on the character, content, and effectiveness of messages. The BOSC recommends a more proactive communication program. The NRMRL

should actively communicate its capabilities, work products, and impacts of results. Repositories of information, regardless of how sophisticated, should not be relied upon as primary communications tools. Providing information should not be confused with effectively communicating a message. Outreach programs, vehicles, and tools should be available that aid in disseminating results and information to users and decision-makers.

The BOSC commends NRMRL on its use of workshops to successfully communicate key issues or technologies; for example, the Pollution Prevention Tools Workshop. The BOSC recommends that use of workshops as an effective communications tool be continued and expanded. Also, the use of electronic information bulletins and listservs can be used to inform targeted audiences about new reports and results. Examples of targeted e-mails of this type (for the National Academy of Sciences and the Water Online Newsletter), are presented in Appendix C.

The Subcommittee recommends continued focus on improving the effectiveness of information technology systems, particularly the videoconferencing capabilities. This is seen as essential for the Laboratory to achieve its mission, implement the Strategic Plan, and improve the effectiveness of its communications.

Recommendation 6: Improved internal and external communications expertise and programs are needed to ensure that internal messages are recognized and not lost, and to proactively seek and reach target audiences for NRMRL's products.

- ✧ Where does NRMRL need to improve? What are the problems and challenges that NRMRL faces in the next 5 years?

The BOSC acknowledges that there are three key challenges for NRMRL to address in the next 5 years. These are: (1) financial resources, (2) communication strategy and implementation effectiveness, and (3) human resources.

While the costs for personnel, equipment, supplies, and support contracts have increased substantially, the NRMRL budget has stayed relatively constant. Budget constraints have been addressed by reducing funding for new initiatives and programs, for example, ecosystem restoration and watershed management. A number of the programs being cut are those that exemplify and are critical to the transition NRMRL needs to make to better integrate with the rest of ORD and support its risk management mission.

The challenge to recruit, retain, and develop talented and high potential human resources is real and immediate. NRMRL is commended for the Leadership Development Program it planned to implement in the fall of 2001. Its intent is to help the potential future leaders of NRMRL to develop as early as possible the skill sets needed for effective leadership, recognizing that competent researchers are not naturally good leaders of people or managers of programs.

Career and professional development programs exist within NRMRL for staff to develop skills and have opportunities (such as sabbaticals) to broaden and sharpen expertise. NRMRL needs to better inform staff of programs and how to best avail themselves of the opportunities.

It is rare to find an organization that is operating at peak efficiency unless a serious, systematic process to examine how work is done and could be done better has been conducted. These efforts are most effective if true stretch targets are set, there is involvement in idea generation and

implementation from the grassroots level, and the effort has the full and visible endorsement of management. The panel recommends that operational and administrative efficiencies be reviewed with the goal of improving efficiencies (reducing costs) in every division throughout the organization. A cross-organizational, multifunctional, and multidisciplinary team should be established to examine how to implement such a review, given the likelihood of continuing limited resources, until verifiable efforts to increase efficiency and productivity are undertaken.

Recommendation 7: A cross-organizational, multifunctional, and multidisciplinary team should be established to develop a plan for an internal, bottom-up review of opportunities for improving the administrative and operational efficiency of NRMRL.

The BOSC also recommends that a plan be developed for ensuring balance between regulatory driven (current/short term) research with longer-term research that does not have a current regulatory driver. There needs to be a core of basic, strategic research in areas that will position NRMRL for meeting emerging issues and successfully contributing to MYP needs. One example is the issue of indoor air quality. Scientific information needs to be collected and interpreted to be ready for implementation of management solutions when policy and regulatory requirements catch up. NRMRL leadership needs to be vigilant in ensuring that budget constraints are not met by regularly cutting new initiatives and programs.

The BOSC strongly supports the proposed NRMRL Leadership Development Program. Concurrently, the BOSC encourages examination of how the science track career option is communicated to staff. How well are criteria, awards, and compensation understood? It also is suggested that the clarity, frequency, and openness of communications about all development opportunities (including options for support) for staff be examined, e.g., opportunities for sabbaticals and mechanisms to make them possible. The BOSC recommends a review of the mentoring program. For example, a mentoring program should be in place that includes training and defined accountabilities for mentors of post-doctoral fellows to ensure that support is consistent across the Laboratory to help post-docs navigate a new bureaucracy and become productive as quickly as possible.

3.5 Planning and Integration

The management and staff of NRMRL have undertaken significant efforts in strategic and operational planning. This has been realized through the “Strategic Plan for the National Risk Management Research Laboratory,” Working Draft, dated June 1999. This draft, ongoing planning processes, and NRMRL’s responses to the BOSC’s self-study questions, indicate careful attention to the continuing needs of an organization still in transition. Although the draft plan is thoughtful and well-targeted, implementation appears to be lagging in a number of key areas and specific steps are suggested to better facilitate progress.

The NRMRL Self-Study Report responded to the seven questions listed below that relate to planning and integration at the Laboratory.

- ❖ Specifically, how has NRMRL incorporated social and behavioral science into its research program?

The draft strategic plan does a good job of identifying needs for NRMRL research efforts in the social and behavioral sciences, including a better understanding of the role of an informed public in

promoting wiser personal and social environmental choices, characterizing the potential effects of voluntary and community-based environmental management, and the contribution of the behavioral sciences as an important component of the Laboratory's new RME efforts. Furthermore, progress has been made in initiating research and in hiring a few social and behavioral scientists to meet these needs. NRMRL's efforts have been principally focused on normative economic assessments by new post-doctoral staff. The Laboratory must ensure that continuity is achieved for the efforts it has made to date to acquire increased capability in the social sciences—by offering permanent positions to those post-docs deemed capable of making effective long-term contributions, and/or selective senior staff appointments. Further hires are needed in the areas of risk perception, communication, information diffusion, and human behavior to effectively address the full scope of social science research issues required. Visiting scientist appointments should be used to attract excellent social scientists who might then consider becoming full-time employees of NRMRL.

- ❖ How has NRMRL achieved/maintained a balance between human health research and ecological research?

NRMRL has recognized the need for a transition in emphasis and skills from one principally focused on human health to one more-balanced between public health and ecological impacts. An example of an opportunity for such a transition is found in NRMRL's strong history of work on microbial pathogens in watersheds and the implications of this for human health through drinking water risk and safety. Similar concerns and approaches could be used to assess the biological factors and processes affecting the ecosystem health of watersheds. In this vein, NRMRL reported a significant new effort on ecosystem restoration at the Ada Division, including the hiring of three new ecologists. NRMRL also described a number of new and beneficial collaborations on ecosystem health with NHEERL Divisions in Rhode Island, Duluth, and Corvallis.

The efforts to identify activities and projects that allow a transition in emphasis from one largely focused on human health to one more-balanced between public health and ecological concerns have been appropriate and should continue. Efforts to build teams across NRMRL divisions and other ORD Laboratories have been especially responsive to this need and should continue.

- ❖ Specifically, how has NRMRL's research management and research program changed since the last BOSC review?
- ❖ How does NRMRL's Strategic Plan articulate with the ORD Strategic Plan and with the EPA Strategic Plan?
- ❖ What are NRMRL's priorities and directions for the next 5 years? Include the Laboratory's research portfolio and multi-year planning efforts.
- ❖ How does NRMRL integrate research across and within the Divisions of its own organization according to the risk paradigm? With other ORD Laboratories and Centers according to the risk paradigm?
- ❖ How does NRMRL integrate research with EPA Regional Offices and Divisions, other federal agencies, and other research centers worldwide?

The BOSC identified a number of planning and integration issues related to these final five self-study questions that are worthy of note and attention. These relate to the role of internal grants in

NRMRL's operations; overall issues related to ORD's post-doctoral scientist program; ongoing staff participation in strategic plan development and implementation; interaction with the STAR program; and the appropriate role of a standing BOSC Subcommittee for providing continued review and advice to the Laboratory.

NRMRL scientists emphasized the importance of the Laboratory's internal grants program for stimulating new and creative work. This program allows scientists to maintain continuity and focus in their professional growth and directions, and allows high-performing scientists to pursue innovative problems and approaches.

Recommendation 8: The internal grants program is an important source of innovative research at NRMRL and should be maintained as a separate and viable component of the Laboratory's activities.

The role and position of post-doctoral researchers were topics of discussion in meetings with both NRMRL scientists and current post-doctoral researchers. Although the current ORD program provides salary support for post-doctoral appointees, there is little substantive financial base beyond this to support their specific research and operational needs. Post-docs who are able to team up with ongoing projects at the Laboratory are generally able to find such support through these projects, and this is an appropriate and beneficial means of ensuring their effective integration in the Laboratory's activities. However, for some post-docs, especially those hired in new (e.g., social science) areas, such projects are less available. Funds are needed to ensure that these individuals are able to initiate and conduct their research in an effective manner (in particular, funds for extramural supplies and purchases, referred to as "e-money" in the Laboratory, are needed to allow post-docs to obtain any specialized materials or supplies). The funds that support post-doctoral salaries in NRMRL (and presumably other ORD Laboratories and Centers) should be extended, or partially reallocated, to provide a fund to support the research activities of post-docs unable to obtain sufficient funds from ongoing Laboratory projects.

Recommendation 9: More careful planning is needed to identify the role of post-doctoral fellows in NRMRL's strategic planning, and to provide the appropriate mentoring and resources.

NRMRL has done a good job in identifying priorities and directions for future years and in multi-year planning, though some additional clarity would be desirable on specific manpower needs. These planning efforts have been well coordinated across NRMRL divisions and with other ORD Laboratories and Centers. The emerging collaborations with NHEERL on issues relating source characteristics and the sampling of pollutants to health effects studies, and on issues of ecological risk management, are exemplary in this regard. Other collaborations were noted with the National Exposure Research Laboratory (providing emissions inputs for ambient and indoor air pollution models), and the National Center for Environmental Assessment (on risk assessment and risk management strategies for Brownfield sites).

Similarly, the draft Strategic Plan developed by NRMRL is very creative and forward thinking in terms of the suite of emerging risk management problems and research approaches for addressing them. Continued efforts are needed to ensure that full staff communication, participation, and buy-in are maintained in the completion, implementation, and any future modifications of the Strategic Plan (see Recommendation 1 of this report).

Although NRMRL has made significant progress in adapting to its new principal role as a conductor of research (in some cases in collaboration with others outside the Laboratory and the EPA) rather than a manager of extramural contract funding, difficulties still remain in identifying the most appropriate and effective modes for interaction with outside researchers. Such difficulties and uncertainty appear to continue to limit the nature and extent of NRMRL researcher interaction with the STAR program and its outside grant recipients. NRMRL scientists are active in relevancy reviews for STAR grant proposals that have passed the initial external peer review for scientific quality, but little systematic interaction and feedback is occurring after STAR grants are awarded. Such interaction is important to ensure that: (1) the STAR grant research efforts are most effectively integrated into the research of ORD and the planning efforts of EPA Program Offices; and (2) NRMRL scientists have the benefit of full exposure and exchange of ideas with outside scientists addressing similar or related issues.

Some notable efforts have occurred at NRMRL to address this problem. The recent Workshop on the Fate, Transport, and Transformation of Mercury in Aquatic and Terrestrial Environment, held May 8-10, 2001, in West Palm Beach, FL, brought together ORD scientists from NRMRL and EPA Region and Program Offices with STAR grant recipients conducting research on this topic, and included joint sponsorship by the U.S. Geological Survey, the Florida Department of Environmental Protection, the Electric Power Research Institute, and the National Wildlife Federation. Such initiatives are needed in other domains to promote the type of ORD-outside scientific interaction needed for an effective, well-integrated national effort. Increased interaction between NRMRL scientists and EPA STAR grant recipients is needed to allow these intramural and extramural efforts to provide the best joint benefit to EPA and the national base of environmental risk management knowledge. Programs such as the May 2001 Mercury Workshop (jointly sponsored by NRMRL, NCER, and others) are an appropriate means to facilitate such interactions, and should be replicated in other problem areas.

Recommendation 10: Further efforts are needed to provide for better interaction and more complementary efforts between NRMRL and NCER's extramural STAR program and its grant recipients; a recent workshop on mercury that included NRMRL and NCER co-sponsorship can serve as a model of one mechanism for achieving this.

During the Subcommittee review and in prior interactions with the BOSC, NRMRL and other Laboratory and Center managers have indicated a desire to maintain ongoing consultation and interaction with the BOSC Subcommittee (or a similar BOSC-led Laboratory review and advisory panel). Such interactions could help NRMRL in its implementation of a number of the recommendations put forth in this report. Consultations (accompanied by written summary reports) could be held several times a year to address issues related to measures of success, promotion evaluation, benchmarking with other organizations, and communications. Advice also could be provided on specific scientific programs, both for the benefit of those programs and to help to evaluate the effectiveness of alternative management strategies. The Subcommittee concurred with the benefits of such more-frequent interactions, but noted that this would require additional support (and a larger Subcommittee) to allow for timely review and response. More frequent interactions and feedback from this, or a related BOSC Subcommittee for NRMRL, should be explored. Once a consistent mode of operation and a set of expectations is established for such standing BOSC subcommittees, proper staffing and support should be provided to ensure effective and timely review and input.

Recommendation 11: More frequent review and consultation of the NRMRL efforts to implement this and previous BOSC recommendations by a standing BOSC subcommittee would be beneficial, but may require additional support and subcommittee members to allow for timely and effective evaluation and feedback.

4.0 RECOMMENDATIONS

1. NRMRL should revisit and finalize its Strategic Plan, with an enhanced communication plan to ensure adequate internal support and implementation.
2. Further effort is needed to establish and track measures of performance and success, including the impact of publications, workshops, EPA Program Office and Region consultations, technology support, and overall scientific leadership and innovation.
3. A staged-gate management process should be established to review projects at various stages of development and implementation to ensure continued progress and value, and to enable an appropriate turnover of ideas and initiatives.
4. There are a number of research organizations in the United States and other countries that are appropriate for use by NRMRL for benchmarking its management efforts and scientific programs, and such benchmarking should not be further delayed.
5. A clear human resources plan is needed to plan, facilitate, and track NRMRL's continued shift in its skill mix and capabilities; significant needs remain in the social and ecological sciences, and visiting scientist programs should be considered for finding and attracting new talent.
6. Improved internal and external communications expertise and programs are needed to ensure that internal messages are recognized and not lost, and to proactively seek and reach target audiences for the Laboratory's products.
7. A cross-organizational, multifunctional, and multidisciplinary team should be established to develop a plan for an internal, bottom-up review of opportunities for improving the administrative and operational efficiency of the Laboratory.
8. The internal grants program is an important source of innovative research at NRMRL and should be maintained as a separate and viable component of the Laboratory's activities.
9. More careful planning is needed to identify the role of post-doctoral fellows in NRMRL's strategic planning, and to provide the appropriate mentoring and resources.
10. Further efforts are needed to provide for better interaction and more complementary efforts between NRMRL and NCER's extramural STAR program and its grant recipients; a recent workshop on mercury that included NRMRL and NCER co-sponsorship can serve as a model of one mechanism for achieving this.
11. More frequent review and consultation of the NRMRL efforts to implement this and previous BOSC recommendations by a standing BOSC subcommittee would be beneficial, but may require additional support and subcommittee members to allow for timely and effective evaluation and feedback.

APPENDIX A: Examples of Targeted E-mail Messages That Inform Potential Users of New Reports and Findings

(Note: These are provided as examples of dlist announcements. It is not the BOSC's intent to endorse any particular organization or message.)

From the National Research Council, National Academy of Engineering:

SPOTLIGHT ON ENGINEERING, TECHNOLOGY AND POLICY

 Bringing business and industry leaders the latest information from the National Academy of Engineering (NAE) and the National Research Council

Issue 48 - 3 Topics:

- New Federal Standards Needed for Storing Coal Waste
- The Future of Networked, Embedded Systems
- New Millennium Materials

New Federal Standards Needed for Storing Coal Waste

The storage of liquid waste, or slurry, from coal processing plants, should be subject to rigorous federal regulation and inspection, and alternative storage strategies should be explored, according to a new National Research Council report. Currently, many slurry impoundments are built near old underground mines, creating the potential for slurry to break into a mine and flow into nearby rivers and water supplies. To prevent this, the report recommends that regulatory agencies review the stability of liquid waste storage basins and promulgate a standard minimum distance between basin and mine locations. Coal Waste Impoundments: Risks, Responses, and Alternatives and a press release are available at <http://www.nap.edu/catalog/10212.html?do_se48> and <<http://www4.nationalacademies.org/news.nsf/isbn/8251x?OpenDocument>>, respectively.

The Future of Networked, Embedded Systems

Continued advances in microprocessor miniaturization and networking promise a world in which networked computers are embedded throughout the everyday world. However, current understanding of what such systems would be like is insufficient to bring the promise to reality. A new Research Council report explores the potential of networked systems of embedded computers and the related research challenges, presenting a comprehensive, systems-oriented research agenda along with recommendations to major federal funding agencies. Embedded, Everywhere: A Research Agenda for Networked Systems of Embedded Computers and information about the project from which it came are available respectively at <http://www.nap.edu/catalog/10193.html?do_se48> and <http://www.cstb.org/web/project_embedded>.

New Millennium Materials

The critical role of materials in advancing technology and enhancing the nation's economy, security, and health was the topic of a recent National Research Council forum. Discussions were focused on the future roles of materials in four areas: information technology, health and biotechnology, national security, and energy and the environment. The proceedings of the forum, entitled Materials in the New Millennium: Responding to Society's Needs, are now available at <http://www.nap.edu/catalog/10187.html?do_se48>.

Visit <http://national-academies.org/events> for a complete list of upcoming Academies meetings. To review all recent NAE/Research Council publications, visit <http://www.nap.edu/>.

It's easy to subscribe or unsubscribe to this newsletter. Sending a blank email to <mailto:engineer-on@LR.ListServe.com> subscribes the sender to Spotlight. A blank email to <mailto:engineer-off@LR.ListServe.com> unsubscribes the sender.

You also may be interested in "Philanthropy Horizons," a broader newsletter that focuses on National Academies activities in education, the environment, agriculture, public health, and economic development. To receive "Philanthropy Horizons," send a blank email to <mailto:Philanthropy-Horizons-on@LR.ListServe.com>.

From the Water Online Newsletter:

=====
Water Online Newsletter -- <http://www.wateronline.com>
Volume 4 Issue 88
Friday, September 14, 2001

***** FEATURED ARTICLES *****

- 1) New Arsenic Study Pressures EPA
- 2) Pollution Control in Taihu Lake to Cost 20 Bil: SEPA (1)
- 3) ACWA Briefing to Focus on Water Supply Challenges, Opportunities

1) New Arsenic Study Pressures EPA
A National Academy of Sciences report shows that the Environmental Protection Agency has greatly underestimated the cancer risks of arsenic in drinking water, according to EPA officials and other environmental experts familiar with the report... <http://www.wateronline.com/read/nl20010914/463682>

2) Pollution Control in Taihu Lake to Cost 20 Bil: SEPA (1)
 China plans to make enormous investment in five-year programs to curb water pollution of the Taihu Lake area, one of the most populous and prosperous regions of the country... <http://www.wateronline.com/read/nl20010914/463678>

3) ACWA Briefing to Focus on Water Supply Challenges, Opportunities
 The link between land use and water supply availability is among the topics to be examined at a briefing September 12 at the Westin Horton Plaza, San Diego... <http://www.wateronline.com/read/nl20010914/463684>

Become a Fully Registered Member of Water Online and enjoy all the benefits that the community has to offer including discussion forums, events listings, download software and much more!
<http://www.wateronline.com/welcome/regnl>

Water Online also offers these additional resources:

Water Online Professional Store - FREE Shipping!
 Visit the Water Online Professional Store to browse and purchase the latest books, software, videos, periodicals and research information available and receive FREE Shipping! (U.S. orders only).
<http://www.wateronline.com/welcome/prostore>

Career Center @ Water Online - For Your Industry Specific Job Search.
<http://wateronline.com/welcome/carbot>

Career Mag.com - For Your General Job Search
<http://wateronline.com/welcome/carmagnews>

If you enjoy reading Water Online's Newsletter, please tell a friend or colleague about it. Anyone can sign up for a free subscription on our Web site at <http://www.wateronline.com>

If you need to update your Water Online e-mail account please visit:
http://www.wateronline.com/content/newsletter/modify_address.asp

=====

If you wish to unsubscribe, please visit the URL below and follow three simple steps: (1) Enter your email address (2) De-select any newsletters that you no longer wish to receive (3) Click "Submit." <http://www.wateronline.com/unsubscribe/ms35@ANDREW.CMU.EDU>

The Water Online Homepage: <http://www.wateronline.com>
(c)Copyright 2001 Vert Tech LLC. All rights reserved. All product names
contained herein are the trademarks of their respective holders.

APPENDIX B: NRMRL Self-Study