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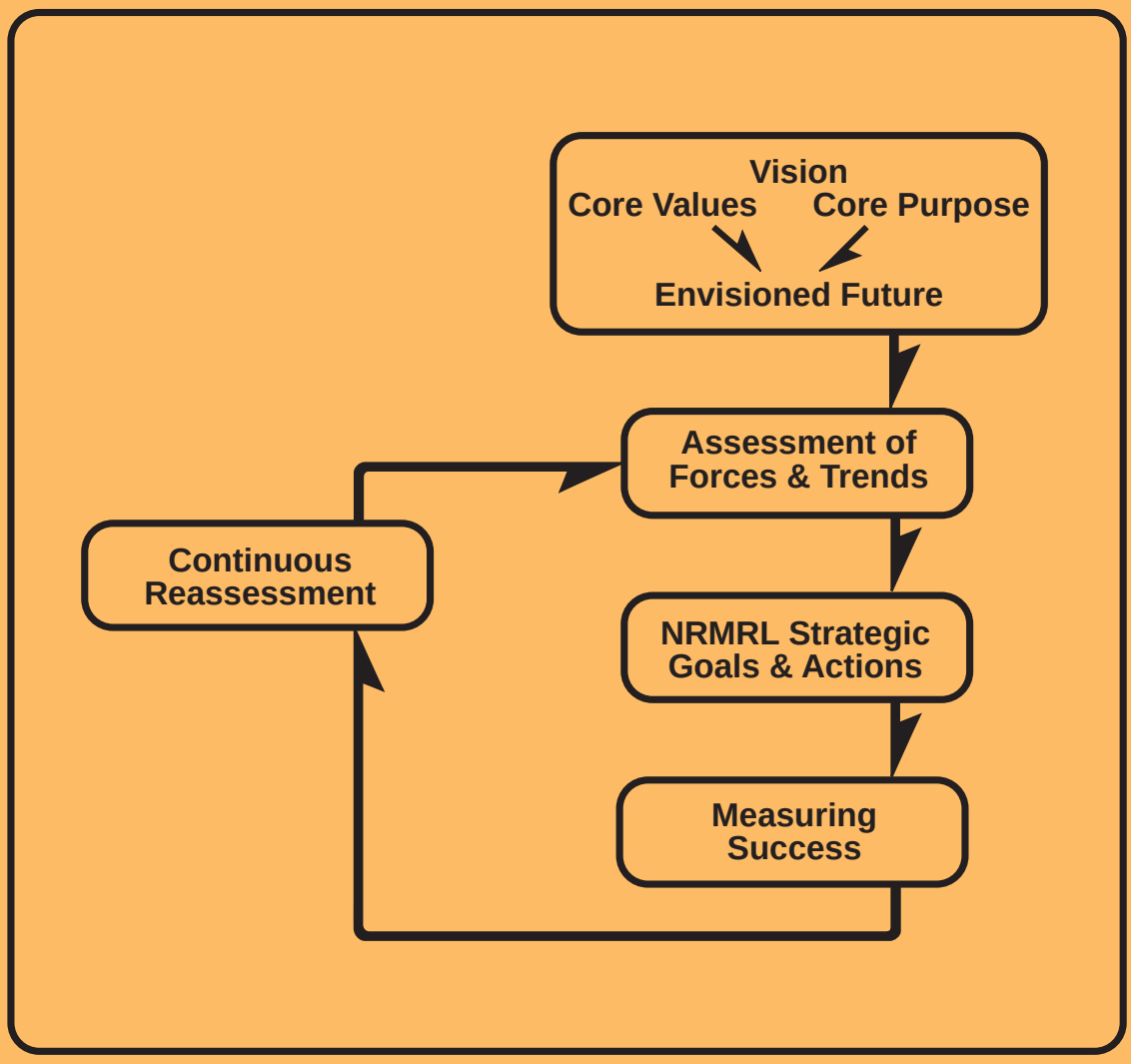
Strategic Plan for the National Risk Management Research Laboratory

Working Draft



SECTION 1

Introduction and Rationale

The goal of this Strategic Plan is to set forth and communicate the strategic direction for NRMRL. Since EPA was formed in 1970, our research programs have adapted to the changing scientific and engineering needs of the Agency in response to new statutes, expanding regulatory and enforcement responsibilities and advances in environmental science that have often raised as many new questions as they have answered.

Over this period, EPA's investment in research has remained relatively constant as the mission and resource base of regulatory and enforcement programs expanded tenfold. While ORD remains an important player in advancing environmental science, we typically represent less than 10% of the Federal investment in any given area of environmental research today.

At the same time, the environmental research missions of other Federal Agencies (DOE, USDA, NOAA, DOD, NIH, DOI) have also expanded tremendously. A similar expansion has occurred in the private sector. There are now 115,000 firms involved in environmental services and technology development. The environmental technology and services sector has grown to $180 billion/year (2-4% of this for R&D). Most major corporations have elevated and expanded the level of personnel and dollar resources directed to environmental compliance and even environmental R&D.

Additionally, organizational changes have increased the focus on in-house research, enhanced peer review and the shift of resources to extramural grants. These present us with both the need and the opportunities to change the way we operate. Also, NRMRL personnel are unsure over which contributions are most valued and important in the new organization: meeting short-term regulatory needs of the Program Offices, cutting edge research, technology development, technology assessment, in-house research, research program management, or technical assistance.

Again, the goal of this Strategic Plan is to set forth and communicate the strategic direction for NRMRL. This includes articulating an envisioned future for our organization, identifying a set of strategic goals to move us toward that vision, developing an array of specific actions to achieve those goals and articulating useful measures to evaluate progress in achieving our goals. The Strategic Plan is organized in a manner that describes each of these steps in the process as described in Figure 1. It is important to note that we envision the process to be continuous, with a periodic reassessment of our effectiveness in achieving our strategic goals as well as an evaluation of forces and trends outside of NRMRL that may impact our goals.

The primary audiences for this strategic plan are the employees of NRMRL and the leadership of the other ORD Laboratories, Centers, and Offices. For NRMRL employees, this strategic plan provides a concise document setting forth the organization's goals, and ways for individuals to understand how they can contribute to achieving these goals. For ORD managers, this strategic plan identifies opportunities for

developing synergy throughout ORD for collaborative research to understand and to solve key environmental problems and meet the needs of the Agency.

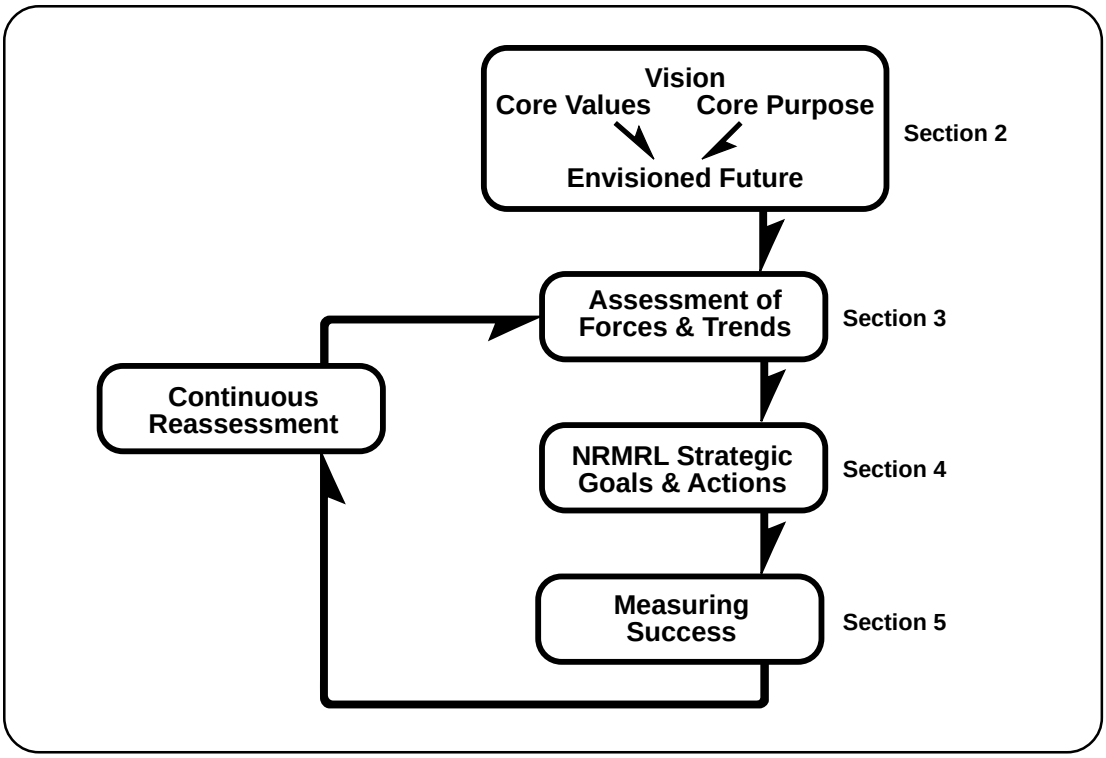


Figure 1. Overview of the NRMRL Strategic Plan.

SECTION 2

Building the Vision

One important observation from the results of the ORD organizational survey is that many of us, especially scientists and engineers, are unclear as to purpose and goals of ORD. This is due to a lack of a consistent vision. Organizations that enjoy enduring success have identified core values and a core purpose that have remained basically fixed over considerable periods of time, while their organizational strategies and practices continuously adapt to internal and external changes.

Management literature suggests that a well-conceived organizational vision consists of two distinct components: core ideology and envisioned future (1). NRMRL staff have been working during the past year to determine what we think these are for us. The balance of this section describes the consensus we have achieved to date for our vision elements. These elements (Figure 2) serve as the cultural basis for the development of the strategic plan for NRMRL and will provide the strategic basis for individuals, as well as the organization, to make the best research and management decisions for our Laboratory.

Core values and core purpose are the two distinct parts of a core ideology. Core purpose is the organization's fundamental reason for being. NRMRL believes its core purpose is to provide innovative solutions to the most important environmental problems. This includes using our knowledge and expertise to indentify these problems. The critical elements to understand here are: that we are first and foremost "problem solvers"; and that solutions to the most important environmental problems are the outputs and accomplishments we value most, whether they be in the form of new technology, synthesized technology transfer information, improved risk management methodologies, or technical assistance. As problems increase in complexity we also participate in formulating

Core Purpose - To provide innovative solutions to the most important environmental problems

Core Values - We value:
- **our environment**
- **excellence in our research**
- **our people and their professional integrity**
- **the trust, respect and appreciation of the American people**

Challenging Long Term Goals - That NRMRL be:
- **the first place decision-makers come to for solutions**
- **the first place environmental professionals want to work**

Figure 2. NRMRL vision elements.

problems into components that can be more easily solved. Finally, we especially value innovative solutions that go beyond the current state of the art and provide lower costs and a higher degree of risk reduction.

Core values, on the other hand, are the essential and enduring beliefs of an organization. They are a small set of guiding principles that are timeless and have no requirement for external justification. They have intrinsic value and are important to those of us within the organization. Last summer, staff within each of the divisions discussed and revised the initial listing of core values that came from the management retreat in the spring. The following core values emerged for NRMRL:

a) *We value our environment, and our work makes a difference in sustaining it as both a human and ecological habitat.* Most of us came to work for EPA out of a deep sense of commitment to environmental protection and to solving environmental problems.
b) *We value excellence in our research, particularly creativity; innovation; and scientific objectivity, integrity, and quality.* We want our research to always represent the highest quality and to command the respect of the scientific and engineering community and the public.
c) *We value our people and their professional integrity; they are our most valuable resource to accomplish EPA's mission.* The conduct and impact of our research is almost totally dependent upon the intellect, experience, and creativity of our staff.
d) *We value the trust, respect, and appreciation of the American people; as public servants, we seek to uphold those values through the provision of outstanding products for their use and benefit.*

The Vision for NRMRL

The vision we have for our organization is a bold one that builds upon the considerable achievements that we and our predecessor organizations in ORD have accomplished. It is a vision that is beyond our immediate grasp. It will be reached only after long term commitment to hard work and dedication to our core values. The vision is comprised of two difficult and challenging long term goals that we will strive for:

1) NRMRL is the first place environmental decision makers come to for authoritative information and innovative solutions for reducing risks to public health and the environment.
2) NRMRL is the first place environmental professionals choose for pursuing and advancing a career in environmental problem solving research.

NRMRL's Envisioned Future

When we achieve these goals, we think that NRMRL will be so successful as an organization that we will be the place top environmental problem solving professionals will want to work. The technical products, environmental solutions, and expertise of our staff will be the most valued in the world because of our dedication to scientific excellence and personal and organizational integrity. Because we work only at the cutting edge of solutions to the most important environmental problems and we collaborate with the key risk management institutions and researchers across the world, we will be the first place decision makers come for information and advice.

A spirit of teamwork will exist among our staff and with other research collaborators. Ideas will be freely expressed and all individuals will be respected for their personal uniqueness and for their accomplishments. It will be fun to come to work because we enjoy each other's company and are enthusiastic about our accomplishments. The public trust garnered by our success and objectivity will assure that we will have access to the resources, people, and facilities necessary to continue to accomplish our mission. We hire only the best people because NRMRL is the best place to work. We nurture their careers through training, providing new opportunities and challenges, and rewarding their achievements.

SECTION 3

Trends in Environmental Protection and their Implications for NRMRL

The vision and core values that NRMRL has identified provide us with a strategic basis for making the best organizational and programmatic decisions in the face of the changes that are likely to come. While there is always uncertainty associated with predicting the future, we must anticipate what some of the most significant changes may be and determine how they could impact the strategic directions we consider for NRMRL.

Over the last year various NRMRL staff have assessed the futures literature and other information to develop an estimate of trends in environmental protection over the next 20 years. We also evaluated projected trends in a number of key economic sectors (e.g., agriculture, information technology, energy, municipal, and manufacturing) and have considered how they may affect our research program. We have concluded that the following forces and trends are likely to influence the direction of NRMRL and ORD research over the next 20 years.

A. Trends in Regulations and Standards

Public support of environmental protection and enforcement of existing regulations will remain strong. However, there will be a softening in public and political support for new regulations and standards. This will occur as a result of a growing perception that the major (more obvious) environmental problems are solved and the level of investment (currently 2.5% of GDP) is adequate relative to other public priorities. In addition, future regulations will increasingly impinge directly on personal choices rather than corporate balance sheets, enabling a more environmentally informed public to make a direct link between the costs and benefits of proposed actions. As a consequence, the regulatory expansion of the last 25 years will plateau if not decline. There will be fewer regulatory initiatives, and new or revised regulations will face a much more rigorous cost-benefit test.

These changes will mean that environmental science and engineering will play an increasingly important role in driving new regulations and public policy at all levels of government. While it is possible that inflation-adjusted environmental research budgets could increase to accommodate this new emphasis, it is equally likely that EPA and others will simply be asked to do more with less. In the worst case, this will result in increased competition among Federal and non-Federal environmental research institutions for resources in common areas of capability. The formation of a National Institute of the Environment (NIE) will remain a possibility.

In our view, however, it is more likely that EPA Program Offices and Regional Offices will shift their attention to a more critical issue facing environmental protection over the next two decades: the harmonization and integration of the piecemeal regulatory programs that have evolved over the last 25 years. These and other trends such as increasing population, population shifts between urban and rural areas, and greater

use of alternative energy sources will require the integration of environmental information across the risk assessment/risk management paradigm to provide a rigorous, scientifically credible understanding of the complex interactions among environmental stressors, sources, relative risks and risk management alternatives.

While many research institutions, including NRMRL, will be needed to develop the fundamental science and engineering inputs to this process, we and the other Laboratories and Centers in ORD will be in the unique position to also influence and coordinate the work of all the parties through the development and implementation of a consensus on a national environmental research agenda. This opportunity exists because of our location in EPA, our nationally and internationally recognized environmental expertise and our multidisciplinary, cross-media structure. To achieve this, we will need to conduct our research in ways that promote cooperative, multi-organization research to produce integrated products and solutions for decision makers inside and outside of the EPA.

To accomplish this, NRMRL will need to sustain and acquire core competencies that highlight and leverage our expertise throughout ORD. In order to do this, ORD and NRMRL division directors will need to assume a leadership position and become the lin pins of the organization in the identification, development, and use of internal and ORD-wide competencies.

One outcome of regulatory harmonization will include the promotion of more cost-effective, common sense, multi-media approaches and stimulation of voluntary and community-based actions. Risk-based performance requirements will replace technology-based standards. This regulatory reinvention will shift NRMRL's historical emphasis on new technology development toward research to develop more fundamental understanding of how systems of environmental technology can be designed and optimized to achieve risk reduction requirements more cost-effectively. While new technologies will still be needed, technology development will be less the focus of NRMRL's research particularly in light of the large private sector capability that has developed over the last 25 years.

As a consequence of changing mission, priorities, and resources, EPA Regional Offices will experience a declining direct role in regulatory implementation in favor of an oversight role as regulatory responsibilities are devolved to states and localities. This, in particular, will lead them to assume a greater role in direct technical assistance. Recognizing this, NRMRL and ORD will begin to shift their emphasis from providing direct technical assistance to providing scientifically valid data, models, and technical guidance that can be used to build Regional Office capacity to provide more of the needed technical assistance themselves.

International environmental action will become increasingly important as a result of the global economy, international standards, and the increasing importance of trans-boundary pollution impacts. Multinational corporations will push for internationally consistent environmental standards to level the economic playing field. This may shift the power center for environmental action from national environmental regulatory organizations like EPA, to international groups such as the United Nations or new institutions altogether. Because the United States is well positioned to provide other nations with environmental technology, technical assistance and information, NRMRL will need to become increasingly active in collaborative international research, as well as international standards setting organizations (e.g., ISO, ANSI) to position ourselves to understand and implement the most important and policy-relevant research.

B. Science and Technological Trends

While ORD and NRMRL will need to undergo change in response to the evolving scientific and regulatory needs of the EPA, science and

technology will be changing and advancing even more rapidly in the future. The pace and magnitude of these changes will increase with time, presenting new environmental challenges on one hand while providing new tools to understand and solve problems on the other. Some of the likely advances and their implication for NRMRL include:

- Major advances in molecular biology and genetic engineering will provide breakthroughs in our understanding of the causes and risks of human health and ecologic threats. They will also provide new opportunities for managing environmental problems while potentially creating new environmental threats from the use of engineered plants and organisms in manufacturing and agriculture. NRMRL will need to develop research capability in this field to take advantage of the opportunities for enhancing risk management approaches and to anticipate controls for emerging problems.

- Advances in computing and information management will expand our ability to analyze, model, and use environmental data (e.g., virtual ecosystems, GIS, process simulation), as well as expand individual and organizational productivity (voice input word processing, video conferencing, electronic signatures). NRMRL will need to assure we are on the cutting edge in utilizing these technologies in the conduct and management of our research by employing and training high quality staff and acquiring advanced equipment and software as it evolves.

- Successes in reducing uncertainties in chemical-based risks will lead to increased emphases on non-chemical issues, e.g., biologicals, habitat, climate change, physical factors. NRMRL will need to anticipate the staffing and programmatic shifts that will be needed to position our research to address this changing emphasis.

- Advances in electronics and sensors will lead to opportunities for real-time assessment and management of environmental systems. NRMRL research programs and capabilities will need to take advantage of the cost-effectiveness and risk management optimization possibilities that these advances will present for pollution controls, manufacturing processes, and environmental systems such as watersheds.

- Major advances in materials and manufacturing processes will promote quantum increases in materials recycling and re-manufacturing. This will open a wealth of opportunities for application of pollution prevention tools to enhance this change and assure net environmental benefits. NRMRL will need to invigorate its capabilities in this area and be prepared to refocus current research accordingly.

- Energy costs and concern for the impacts of global climate change will drive a quantum technological change in energy production and use away from conventional fossil fuel combustion systems. High performance vehicular power systems (electric, hydrogen fuels, etc.), improvements in solar power and the re-emergence of nuclear power will result in reductions of emissions especially from conventional mobile sources and certain stationary sources.

  Pressures to use cheaper, dirtier energy alternatives (e.g., coal, emulsified fuels) may create a need for more effective risk management technologies. NRMRL will need to adjust its skill mix and research focus to understand and manage the environmental consequences of these new fuels and technologies.

C. Environmental Priorities

As technology advances and the harmonization of regulations progresses, risk management research priorities will also change. Some problems that are just emerging will continue to be important well into the future while mature problem areas will decline in emphasis. If NRMRL is to satisfy its core value of making a difference in environmental protection, we will need to shift our research to address these new problems. While it is difficult to predict exactly where these changes will occur, our current best judgement suggests the following:

- Control of fine particulate matter will continue to be a key issue for the next decade. NRMRL will see an increasing role in evaluating sources, composition, control technologies, control and prevention costs, and risk management strategies for reducing fine particles in the ambient and indoor environment.
- The current focus on global climate change is on assessment and adaptation. As the fruits of current research and global data collection establish its significance and impacts, we will need to move into a phase of risk management technology development to respond to the control needs of developed and developing countries and continue to address adaptation approaches.
- Safe drinking water will continue as a key national and international priority, especially in emerging countries. The research focus will shift to control of emerging pathogen threats, source water protection, assuring the quality of water delivered to consumers (e.g., distribution systems, failing infrastructure), and assuring adequate water quantity (reuse).
- Further improvements in surface water quality and aquatic ecosystem structure and function will require significant advancements in our ability to manage watersheds. This means that we will need to work collaboratively with exposure and effects researchers in ORD to improve our ability to model the design and effectiveness of point and non-point pollution prevention and control approaches. Wet weather flow and ecosystem restoration research will be a key component that will increase in importance into the next decade.
- Concerns for hazardous waste site remediation will decline as the majority of Superfund sites are cleaned up by early in the next decade. While new sites will continue to be added, research and technical assistance needs will decline as remediation technologies are successfully applied to the vast majority of site circumstances to be addressed. NRMRL research will shift to address the significant needs associated with remediation of sites which do not have cost-effective solutions (e.g., heavy metals such as lead and mercury and persistent toxics such as EDC's). EPA will become increasingly involved in mixed and radioactive waste management and remediation as federal facilities receive more attention in the Agency's Regions.
- Sustainable development and understanding the environmental impact of alternative land use and transportation choices will be growing risk management research needs because of the critical link between development and further gains in environmental protection.
- Concern for the human health impacts of indoor exposures to pollutants will increase, driving research to improve our understanding of the relationship between indoor and ambient air quality and develop cost-effective risk management approaches.
- Pollution prevention will be the risk management approach of preference. Research will be needed to develop and

improve technologies and design tools, develop strategies for managing persistent, bioaccumulative and toxic compounds (PBTs), endocrine disrupting compounds (EDCs) and promote the design of green manufacturing processes and recyclable products.

- Controlling the environmental quality of the oceans will become a major international priority and scientific issue. Research needs will include marine ecosystem restoration techniques for near coastal systems and prevention and control methods for persistent transboundary pollutants (Hg, PBTs, EDCs).
- The success of voluntary and community-based environmental management efforts will become increasingly dependent upon understanding and application of social and behavioral sciences and their role in risk perception and regulatory implementation. These factors will become key elements of risk management strategies. NRMRL will need to explore the long range opportunities and needs for research in this area.

The key trends and environmental priorities outlined in this section provide us with information in determining and directing our research efforts in the future. As the key trends outlined in A and B change, this may impact the environmental priorities that we have identified. These can also be affected by the risk assessment process and subsequent change in the risk management assessment.

The key trends outlined in this section are best understood and resolved in the context of multimedia systems and solutions. NRMRL should address these issues from a systems perspective and should increasingly factor in cost and performance. NRMRL should seek understanding of how risk management approaches can be deployed at multiple scales, how optimum solutions can be developed, and how their effectiveness can be simulated.

SECTION 4

NRMRL Strategic Goals and Actions

Strategic Goals

NRMRL has identified four strategic goals that we will need to pursue as a means of achieving our vision in the context of the forces and long term trends discussed previously. These are:

1) To continually strengthen and support the development, success, and recognition of our workforce that will be able to sustain and develop our core competencies.
2) To develop and sustain an outstanding intramural research organization that promotes innovation, collaboration, impact and the highest standards of quality in its research.
3) To fully integrate risk management research across the risk assessment/risk management paradigm and produce synthesized research products and solutions that meet the needs of environmental decision makers.
4) To make a significant and measurable impact in the solution of the most important environmental problems of our time both nationally and internationally.

Strategic Actions to Achieve Our Goals

There are a number of actions that have been identified to enable NRMRL to achieve its strategic goals. These actions are designed to reinforce our core purpose and core values and move our organization toward NRMRL's envisioned future. Actions are arrayed according to the goal they primarily impact. It is recognized, however, that most actions will impact the achievement of more than one strategic goal.

Goal 1 Continually strengthen and support the development, success, and recognition of our workforce.

Because environmental research is a highly complex endeavor that is often characterized by iterative advancement of knowledge based on the success and failure of scientific experimentation, it represents a long-term commitment of acquiring and developing the correct skills, capabilities and technical knowledge and supporting the infrastructure necessary to conduct world-class research. Our staff and their core competencies represent the resource upon which our success solely depends. When they leave at the end of each day, the entire capacity of the organization leaves with them. If we are to achieve our vision, we must: be able to attract and recruit the finest and most talented people possible; build our organization from within, promoting and rewarding people without regard for differences unrelated to performance; and act on the conviction that the women and men of NRMRL will always be our most important asset. The strategic actions that we believe must be implemented to achieve this goal fall into five areas: identify, develop, and acquire core competencies; develop and implement a long-term staffing plan; strengthen our recruitment

Key Areas of Strategic Action for NRMRL

- develop and acquire core competencies
- develop and implement a long-term staffing plan
- strengthen our recruitment efforts
- expand NRMRL investment in career development to meet key staffing and skill needs
- design and implement a development program for the future leaders of our organization

efforts; expand NRMRL investment in career development to meet key staffing and skill needs; and, design and implement a development program for the future leaders of our organization.

a) Develop and Acquire Core Competencies

The core competencies of an organization are the manifestation of its knowhow that can be put into productive use. These are more than a collection of related people, facilities, equipment, knowledge, and skills. They are integrated arrays of capabilities that produce a greater functionality than any of them represented by themselves. In general, core competencies provide high value-added benefits for the client, are generally superior to a similar competency offered by others, and can be extended or leveraged to form other competencies.

Core competencies are essential to NRMRL because we must develop and implement a strategy that delivers the highest value and keeps both short- and long-term goals in context. The combination of our vision, expertise, and technical knowledge will provide for the growth for NRMRL. Core competencies will provide the direction and be the technology basis for implementing the strategy. Each division will have specific competencies which can be leveraged to NRMRL, ORD, and Agency competencies. Identifying and combining our collection of capabilities throughout the Agency will enable NRMRL to solve a wide-array of problems.

It will be the responsibility of each division to identify these capabilities and develop their own core competencies. Each division's knowledge of the capabilities within NRMRL, ORD, and the Agency will provide the leveraging necessary to address all problems.

b) Strategic Staffing Plan

NRMRL faces the potential of a huge turnover in workforce in the next five years, with over 40% of current staff becoming eligible for full retirement. This presents the prospect of significant loss of competence in virtually all of our areas of research capability. This also represents an opportunity to acquire the necessary skills needed to sustain and develop core competencies. Continued discrepancies between Federal and private-sector salaries will make recruitment and retention of top scientists and engineers a challenge. A concerted effort will be required to develop staffing, recruitment, and hiring strategies that will assure that we can maintain and develop a highly skilled, competent and diverse workforce.

Recently, the Laboratory has developed an initial strategic staffing plan which predicts staff skills (e.g., engineer, secretary) and functions (e.g., principal investigator, manager) that will be needed to successfully conduct our research program over the next five years and beyond. Existing and future staffing have been compared and a projection has been made of positions that will need to be filled between now and 2003. These projections are based upon our assessment of research skills needed to provide the core competencies to enable NRMRL to address the key environmental problems of the future as described in Section 3 and later in Section 4 of this Plan. We also utilized a common set of

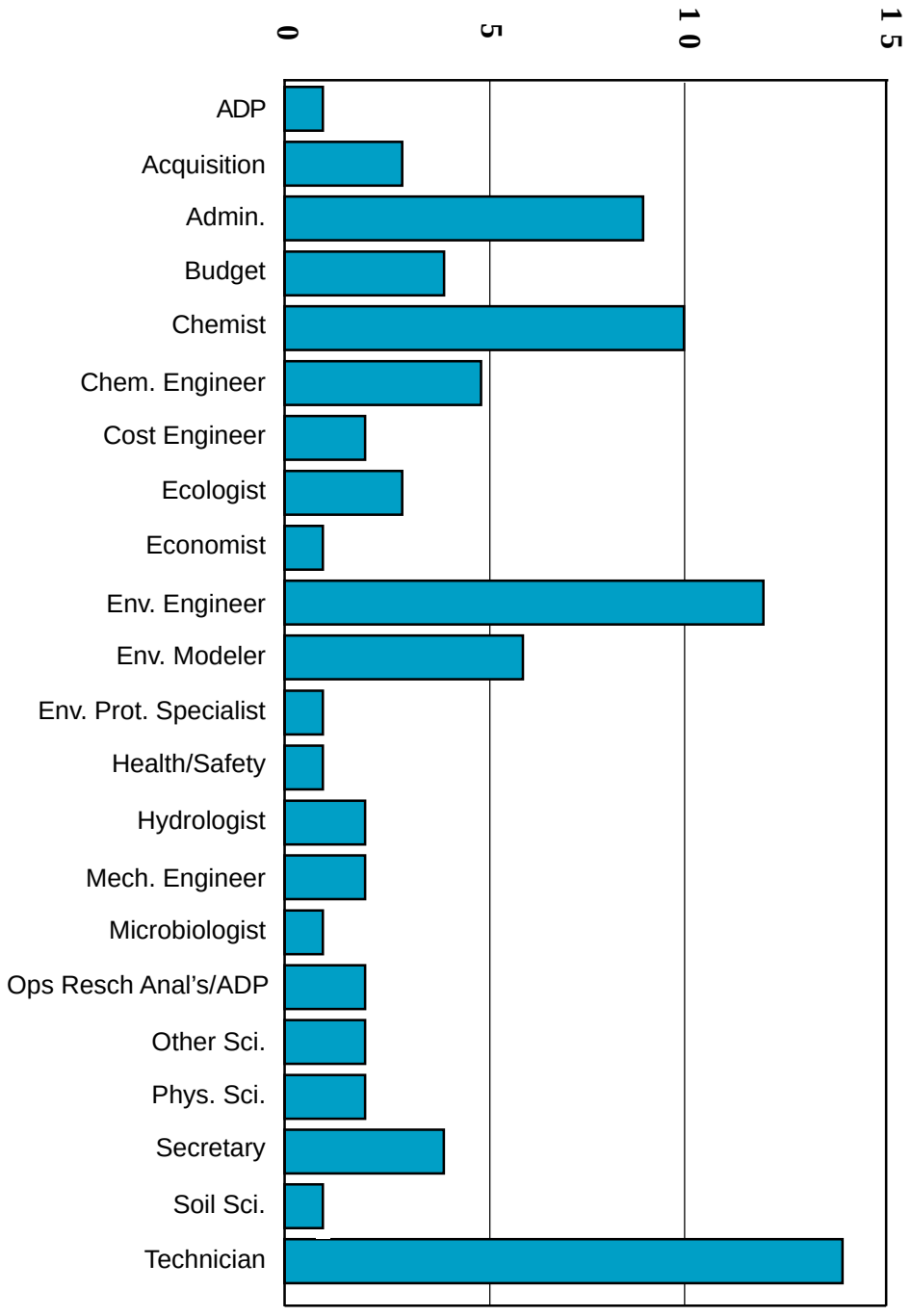


Figure 3. NRMRL projected position opportunities (1998 - 2003. by job function).

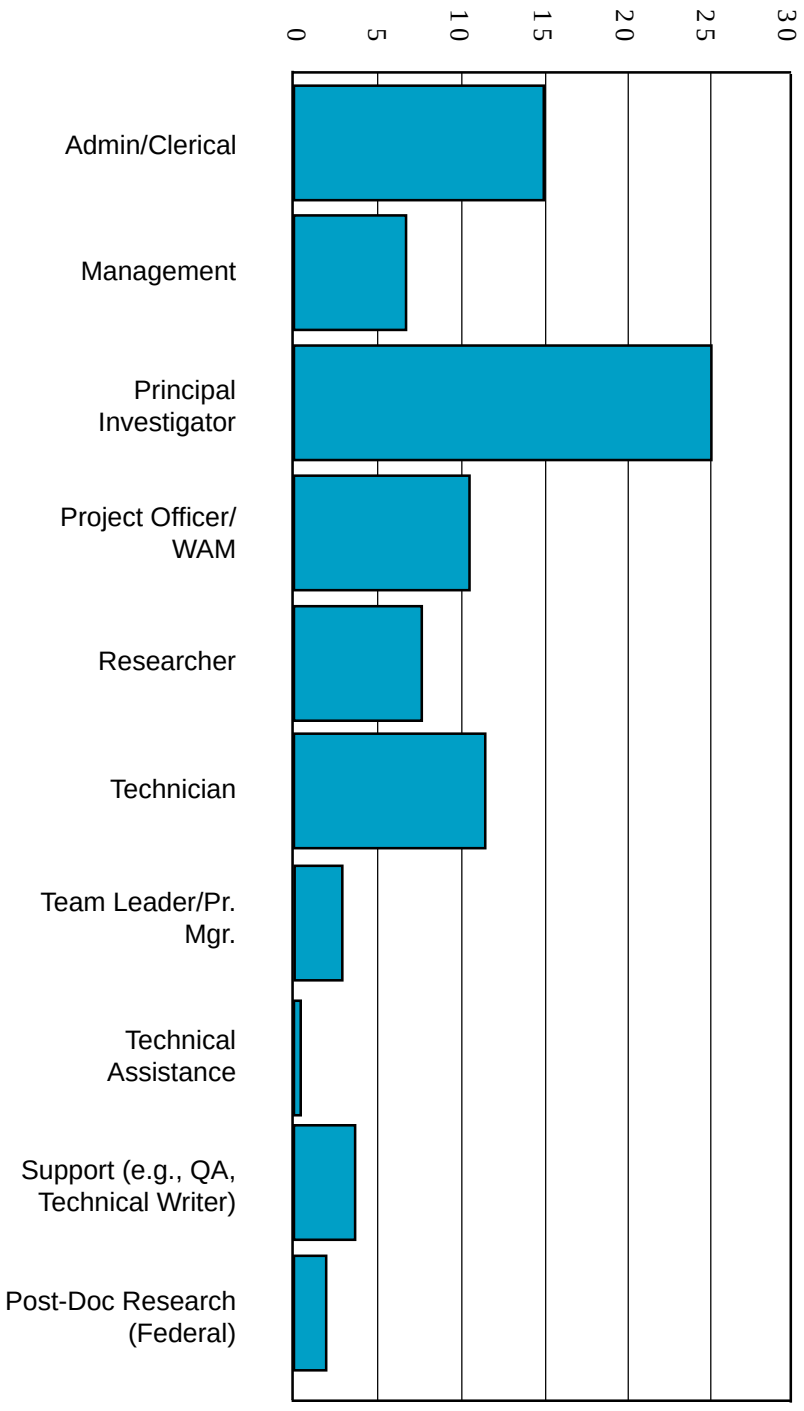


Figure 4. NRMRL projected position opportunities (1998 - 2003, by functional categories).

research implementation models (e.g., teams, individual investigator, extramural project management) to estimate levels of various staffing functions required. These were formulated into divisional staffing plans which also estimated likely retirements by skill and function.

Figures 3 and 4 illustrate the anticipated shifts and opportunities. This information will become the driver of subsequent actions related to individual career development, recruitment, and leadership development.

c) Recruitment

If we are to meet our objective of attracting the best people, we first need to assure that we are working on the most important problems, are on the cutting edge of risk management research, provide high quality facilities and management systems to promote the success of our researchers, and provide the best working environment for our staff to excel within. Actions to promote these elements of our research program are identified later in this section. In addition to those actions, it is also critical to establish a much more aggressive and effective recruitment effort than currently exists. This entails enhancing personal contacts with universities, other Federal research organizations and the private sector to identify and attract top scientists and engineers to our organization.

NRMRL will develop and implement a Strategic Recruitment Program that will combine project-related travel of key staff with strategic visits and seminars at key institutions around the country. High quality materials describing the Laboratory and its research will be prepared and provided to key staff to utilize in an orchestrated program of annual visits to key institutions to establish a network of contacts that will ensure that NRMRL job opportunities reach a highly qualified, diverse set of potential applicants for permanent as well as post-doctoral positions. The ORD Fellowship Program will also play a potentially important role in filling future vacancies.

d) Career Development

NRMRL must make a significant investment in the development and advancement of current and future staff to anticipate and fill the gaps that will occur. The Strategic Staffing Plan is the driver for individuals and managers to identify and pursue opportunities to build our organization from within. The specific strategic investments we will make are:

- pursue a goal of tripling NRMRL resources allocated to training and career development.
- reinvigorate and expand the Individual Development Plan (IDP) process, assure that meaningful career development discussions are included in performance evaluations and position planning and assure that resources are available for implementation of IDP actions agreed to by supervisors and staff.
- provide staff and manager training on career development, IDPs, and employee mentoring.

e) Leadership Development

Nearly 60% of current managers in NRMRL will be eligible for full retirement by 2003. It is important that we begin a structured process to develop the future leaders of our Laboratory. NRMRL will invest in and develop leaders capable of guiding this research organization. NRMRL will invest in the development of the newly appointed managers since the 1995 reorganization and will provide opportunities for leadership development to others interested in providing scientific and management leadership to the organization. Accordingly, NRMRL will establish a Laboratory Leadership Development Program. Participants will be competitively

selected based on merit and potential using peer panels external to NRMRL.

The Program will be established in calendar year 1999 and will include seminars, common training, a variety of rotational experiences and participation in Laboratory management reviews and quality assurance reviews.

Goal 2 Develop and sustain an outstanding intramural research organization.

We believe that it is essential to the attainment of our vision to develop and sustain the highest quality in-house research capability possible. If we are to be the first place top researchers come to work and decision makers come to for authoritative information on innovative risk management solutions, we must assure that the intellectual leadership for our research resides in our scientists and engineers. We cannot be dependent upon outside organizations for our core competencies.

Achieving this goal presents the greatest challenge of all to NRMRL. We have evolved over the last 25 years to include a mixture of in-house and extramural operations. While emphasis varies across the divisions, resource allocation and general operating policies, including those affecting personnel, funding, office space and facilities, have been developed to a large extent in support of extramural research activities.

Extramural off-site support will continue to be important to the conduct of certain aspects of our research, particularly field studies and collaborations to access unique skills in universities and other Federal research organizations. However, it is clear that our historical level of use of such institutions is well out of balance and contrary to what we now see as a more important strategic direction.

The transition to a flexible, performance-based, more intramural organization, already under way, will involve a significant culture shift affecting all NRMRL staff and managers, and nearly all aspects of the Laboratory operation. The NRMRL research staff is clearly concerned over the transition. Researchers who contributed intellectual ownership to extramural products in the past, and those who are currently project officers (POs) would like to see their products valued for the significance of their contributions. Researchers making the transition to principal investigator (PI) feel that they are often limited by access to facilities, equipment and EPA research support personnel. Some question the long-term viability of using contracts for on site support services due to the inefficiencies in managing this support within acceptable guidelines for avoiding personal services relationships.

A number of steps have already been taken to aid in the transition. These include initiation of the ORD Federal post-doc program, the recent initiative to hire additional Federal research support staff and development of laboratory-wide training grants to offer opportunities for undergraduates to work on research projects in our Laboratories. The divisions and branches now have access to a common set of research models intended to clarify staff confusion over the distinctions between in-house and extramural research, define the relative roles of PIs, POs and other staff, and provide a common set of building blocks upon which we are establishing long range staffing plans. These are all major efforts that are only just beginning to have a measurable impact upon our in-house research.

NRMRL has identified a number of additional strategic actions it needs to take to overcome the barriers and concerns identified above. Many of these actions were drawn from the conclusions and recommendations of the NRMRL Resources and Infrastructure Workgroup in their January 1998 report (3). Others have been identified from responses to the ORD Organizational Survey, skip-level staff meetings and input from NRMRL managers. These actions include:

- Support the use of teams, especially in

collaboration with PIs. Improve the functioning of research teams, including establishment of a clear method for evaluating and rewarding team-based performance and makeing improvements in the identification, allocation and control of resources for team-based research.

- Develop a full cost accounting process for planning and implementation of in-house research. The process needs to account for all of the important elements of in-house research before research is initiated (staff, work years, on-site contract support, laboratory and pilot plant space, equipment, expenses, travel, etc.).
- Implement a revised internal grants program that fosters cutting edge research in high priority areas of risk management.
- Pursue long-term solutions to the laboratory space shortages where they exist.
- Insure availability of adequate resources so that research staff are able to attend and present research results at a minimum of one key national scientific meeting per year.
- Enhance the number and quality of Divisional and Laboratory-wide technical seminars for NRMRL researchers as well as invited speakers.
- Conduct bench marking studies of NRMRL research against high quality external research institutions to identify desirable characteristics and define practical improvements for NRMRL.
- Explore innovative reward systems for highly successful NRMRL researchers including IPAs and establishment of a Research Fellows Program as mentioned in the Resources and Infrastructure Workgroup Report.
- Expand the use of Divisional science reviews by internal and external peer panels (e.g., the Board of Scientific Counselors).
- Strategically invest in the purchase and upgrade of advanced scientific and computer equipment and software to support in-house research efforts.

Goal 3 Synthesis and integration of environmental science and engineering across the Risk Assessment/Risk Management Paradigm.

In our assessment of future trends for environmental protection we concluded that the harmonization and integration of the current piecemeal regulatory structure will be one of the critical issues facing EPA over the next 10 years. In order to accomplish this, EPA will need to develop the capability to integrate environmental information across the risk assessment/risk management paradigm to provide a rigorous, scientifically credible understanding of the complex interactions among environmental stressors, sources, relative risks and risk management alternatives. While many research institutions, including ORD, will be needed to develop the fundamental science and engineering inputs to this process, ORD is uniquely positioned to become the pre-eminent research organization in

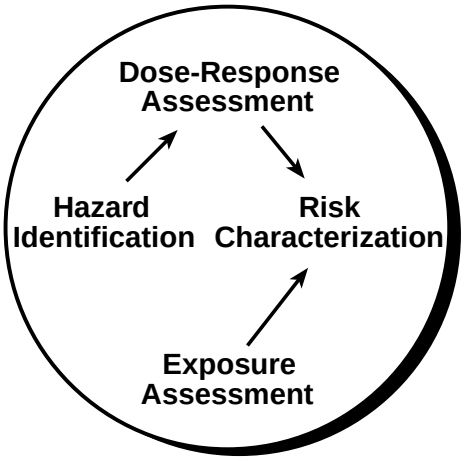


Figure 5. The risk assessment process.

the world to effect the risk assessment/risk management integration that is critical to success.

This is possible because of our highly experienced multi-disciplinary research staff, a multi-media mission within a national regulatory agency and our risk-based organizational focus. NRMRL and its sister Laboratories and Centers in ORD must capitalize on these strengths in order to assure success and a leadership role in setting and accomplishing the national and international environmental research agenda into the future.

The ORD reorganization has provided a rational framework for conducting the EPA science agenda via the risk assessment/risk management paradigm. Unfortunately, while this has clarified who does what research, it has created a "stovepiping" of our programs that is inconsistent with the environmental science integration that will be required to foster regulatory harmonization and further improvements in environmental quality.

This separation is more problematic for risk management research than it is for the risk assessment research efforts of ORD. This is because risk assessment has been used for over two decades to determine the relative importance of environmental problems and the adequacy of solutions in the U.S. The risk assessment process has also been more completely described in a scientific context by the National Research Council (NRC). (See Figure 5) . EPA and ORD have played strong roles in the emergence and maturation of risk assessment as a discipline applied to environmental problems. Risk assessment became the basis for priority-setting and decision-making in EPA, supported by EPA's Science Advisory Board (SAB). Consequently, it became the framework for determining environmental research priorities as well, and much of ORD's research program emphasis has been on improving EPA risk assessments and the risk assessment process. The three components of the risk assessment correspond to three of the five ORD Labs and Centers, effects, exposure and environmental assessment.

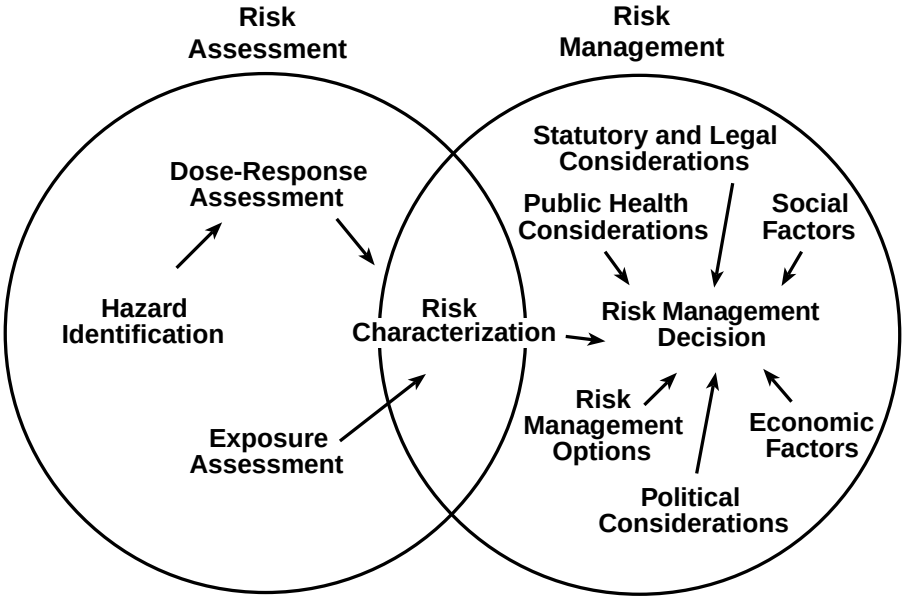


Figure 6. Risk management sequentially following risk assessment.

The NRC process was subsequently modified by others to show a relationship to risk management. This representation (Figure 6) has typically shown risk management as an undefined grouping of actions that follow risk assessment, reflecting the view that risk management decision making has been viewed as independent of, but informed by, risk assessment. Risk management research has also been seen as sequentially following completion of risk characterization. In other words, once problems are determined to be of sufficient risk it then becomes necessary to apply or develop risk management approaches.

These views are changing. A number of domestic and international organizations have developed risk assessment/risk management frameworks to describe and shape the way they address environmental problems. Some important trends have emerged:

- Greater emphasis is being placed on risk management, with risk assessment embedded within the risk management process. Risk characterization is seen as a decision-driven activity directed toward informing choices and solving problems. It becomes linked to risk management in a complex iterative cycle, not merely in the sequential fashion in Figure 6.
- The embedding of risk assessment within risk management forces active consideration of choices in the decision-making process, including decisions to accept risk and implement monitoring strategies, select between control strategies, or abandon a risk-related activity;
- For interested parties, it becomes important to develop a broad understanding of the consequences of risk

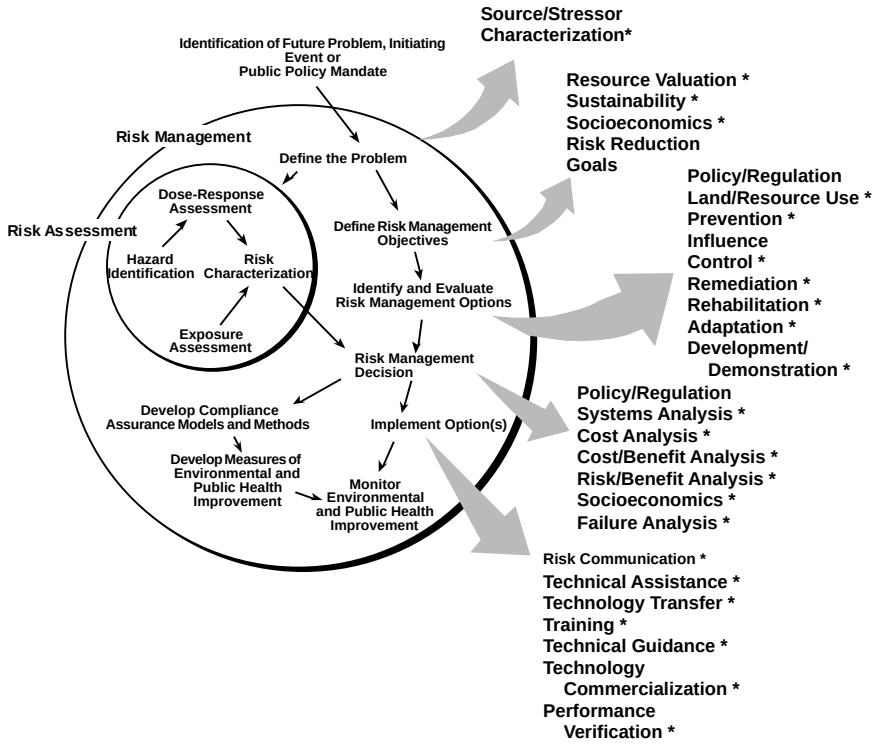


Figure 7. The scientific and technical contributions to risk management.

management options, because acceptability of risk should be determined in conjunction with consideration of alternative courses of action; and,

- Assessment activities must be guided by social concerns as expressed in risk management goals. With more stakeholders having different goals and objectives, decisions must consider social, economic, ethical, and other values in addition to health, safety, and the environment.

What this means to NRMRL is that the risk management process is becoming a more prominent focus of interest in the context of risk assessment. Its scope is also broader and more complex than our historical engineering and control technology role in ORD. To be successful, we must increase our own understanding of these wider risk management issues and define and address the research needs that emerge from them.

ORD's first attempt at doing this was the development of the risk assessment/risk management framework that was first published in the 1995 ORD Strategic Plan. This framework is reproduced as Figure 7 along with additional details on the types of activities that are involved at the different steps of the risk management process. The framework reveals a number of points that are of strategic importance to NRMRL.

- There are many points of interaction between the risk assessment process and risk management, not merely at the completion of risk assessment.
- The range of activities involved in risk management is broader than NRMRL's historical role. A number of these activities are predominantly in the province of the EPA regulatory offices and the Regions. Most, if not all, can and need to be impacted by research designed to reduce uncertainty in the performing and cost of risk management alternatives or through development and verification of new solutions. NRMRL's current set of core competencies will need to be expanded to meet this need.
- The diagram lays out a series of logical sequential steps for conducting risk assessment and the design, implementation and effectiveness evaluation of risk management strategies. However, it does not capture the interactive nature of the risk assessment/ risk management process. In reality, this is not one process but rather a series of processes with a different time frame for various environmental problems of concern.

There are a number of strategic actions that NRMRL must take to reach our goal of achieving greater integration of science and engineering across ORD and the risk assessment/risk management paradigm.

- ORD's initial efforts at defining the risk assessment/risk management paradigm need to be expanded and refined. This means more clearly defining the steps and linkages in Figure 7 and getting external scientific input and consensus. NRMRL and ORD should collaborate with an external scientific body (e.g., the National Academy of Engineering, American Academy of Environmental Engineers) to complete this evaluation. The paradigm also needs to be modified to reflect a process for assessing ecologic as well as human health risks.
- NRMRL must work within ORD to develop a process for true cross-media multi disciplinary research planning and implementation. A reward structure and management system must be put in place to encourage NRMRL scientists and engineers to collaborate with colleagues in other ORD Laboratories and Centers. The objective is to assure that the important scientific linkages are made across the risk

assessment/risk management paradigm in research to characterize and solve key environmental problems.

For risk management research this has several implications: solutions for well defined risks must go beyond pollutant control to evaluate net risk reduction in a comprehensive manner that considers the life cycle impacts of alternatives; NRMRL researchers need to collaborate with effects and assessment researchers to anticipate emerging environmental problems and begin to assess risk management alternatives before risks are fully characterized; and, we along with the ORD Laboratories and Centers need to shift our efforts toward producing research products that synthesize results from our research and research by others in an integrated fashion across the elements of the risk assessment/risk management paradigm. The responsibility for this integration of scientific information should rest in ORD, not in the regulatory and implementation organizations in EPA.

- NRMRL needs to anticipate the risk management implications of emerging environmental problems better. It is important to recognize that the risk assessment/risk management process diagramed in Figure 7 is interactive but not necessarily sequential. This means that for emerging problems such as endocrine disruptors or fine particulate matter (PM), it is important to not only conduct research to reduce uncertainties in the magnitude and nature of the risks but also, in parallel, to be initiating risk management evaluations (RMEs) to identify and reduce the uncertainty of potential risk management options. Early identification of cost-effective options can accelerate the availability of these approaches to reduce risk after risk characterization points to a need for action. In other cases early identification of prevention approaches may even reduce the need for further improvement in risk characterization.

  NRMRL is currently piloting RMEs in a number of problem areas, including: PM, arsenic, pfiesteria and EDCs and beginning an effort in mercury. The approach and content of RMEs needs to be refined over the next five years based upon our experience with the pilot efforts. New RMEs should be initiated for important problems emerging from ongoing effects research in ORD.

- NRMRL must work with the ORD Laboratories and Centers to systematically link health and ecological exposure and effects models with risk management decision models. These linkages will be critical to the success of the Agency in harmonizing environmental regulations and standards. It will also be necessary to provide user friendly versions that are applicable for use by an expanding set of users at the regional, state and local level.

- NRMRL needs to adjust its skill mix and focus its core competencies to conduct the research needed to impact the expanded elements of risk management decision-making outlined in the risk management paradigm. Many of these needs have already been identified in the NRMRL Staffing Plan as described earlier in this Section.

Goal 4 Make a significant and measurable impact in the solution in the most important environmental problems of our time.

As we worked within NRMRL to identify our core values, the one element that emerged universally was that “making a difference” in solving environmental problems is a key factor that motivates the majority of our staff. Our fourth strategic goal is to assure that we accomplish this. There are four strategic actions that

Goal 4: Making a Difference

Key Actions:

- **identify key customers and needs**
- **focus research on key environmental problems**
- **produce high quality research products**
- **implement a process to measure impact**

NRMRL must take to achieve this goal: identify key customers and initiate research to meet their most important needs; focus research on the most important environmental problems; produce high quality research products; and, implement actions to consistently and continuously measure the impact of our research.

• Identify key customers and needs.

There are two types of customers for NRMRL research products, primary customers and collateral customers. Primary customers are those organizations that drive our research priorities, resources and the timing and nature of outputs. Collateral customers are organizations that may directly or indirectly benefit from our research or may influence our priorities or the form of our products, but do not have a primary role in determining priorities or resources.

The primary customers for NRMRL research are internal to EPA. They are the regulatory offices, regional offices and other ORD Laboratories and Centers. Congress of course, has a critical role in determining resources and priorities for EPA, but these come to NRMRL through EPA and ORD. We have minimal ability to interact with Congress and they are, in most cases, not a direct user of the outputs from our research. Therefore, Congress is not included.

As Figure 8 shows we see the priority for meeting EPA regulatory office needs continuing at current levels. However, as previously discussed, the nature of our support will evolve to meet the changing role of regulatory harmonization relative to regulations development. The regions will become a more important customer as risk management decision-making becomes more community-based, regional (i.e., watersheds, and airsheds) and focused on sustainability metrics. As we move toward integration of

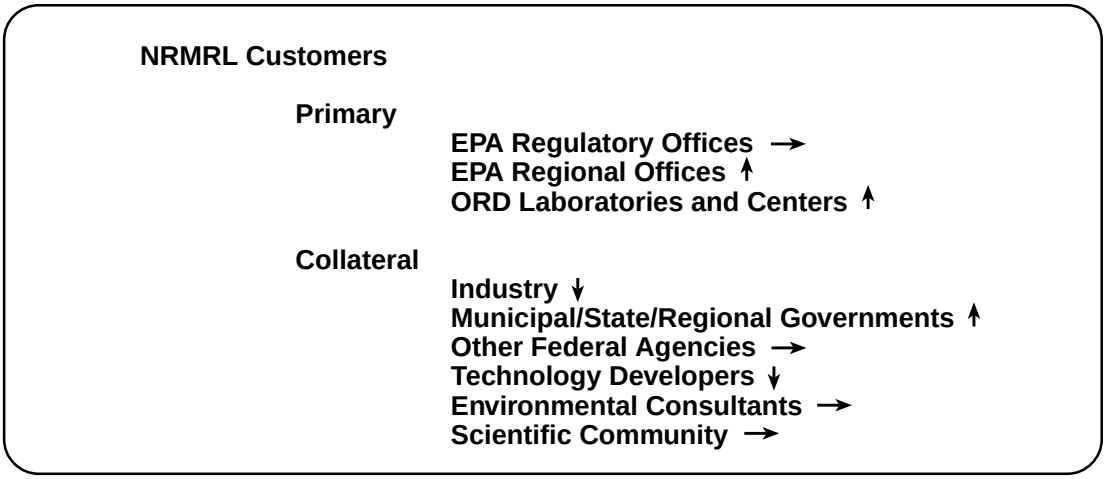


Figure 8. Key customers and emphasis.

research within ORD, the Laboratories and Centers will become more interdependent and, therefore, internal customers of greater importance.

Key actions for NRMRL will be to be more proactive in identifying and meeting regional needs. Regional Offices will especially need to focus more on those problems that are longer-term and multimedia in nature rather than shorter-term, relatively narrow needs that have historically emerged from regional needs assessments. Meetings to identify research requirements and program reviews with individual and groups of regions should become more frequent, especially with the regional science councils. Research products that are integrated and user friendly will become more important. Technology transfer products that build regional capacity for providing direct technical assistance will become more important.

In terms of collateral customers (see panel) there will be a decline in emphasis on industry and on environmental technology developers as customers for NRMRL research. This reflects the established private sector technical capacity and a decline in NRMRL emphasis on technology development. The importance of municipalities, states and regional governmental bodies (river basin commissions, county environmental planning agencies, etc.) will grow for the same reasons that EPA regional offices priority will grow.

- **Focus research on key environmental problems.**

The NRMRL goal to make a difference in solving the key environmental problems is best served by a continuing analysis and assessment of the trends in data that mark the Nation's progress in solving existing problems and in improving both human health and the environment. Trends in EPA's effectiveness can than be combined with trends in emerging problems, the relative magnitudes of recalcitrant residual problems, and plausible alternative futures in order to identify strategic research goals. EPA's Strategic Plan, and the related GPRA Goals identify a number of indicators and measures for our collective progress including, for example, increases in the percentage of the nation's waters that meet water quality standards, completing

Key Environmental Priorities for Risk Management

Increasing Emphasis

fine particulate matter
global climate change
water supply
watershed management/restoration
remediation of sediments/resource extraction
pollution prevention
sustainable development
indoor air quality

Declining Emphasis/Preserve Core Competency

waste management
air pollution control
site remediation
groundwater fate and transport
technology verification

Figure 9. A summary of the key problems identified for NRMRL problem-solving research.

site clean-ups at a specific and accelerated rate or reducing standards violations while increasing compliance with regulations. These GPRA goals are updated annually, are readily available to all staff, and codify ORD's general directions and year-to-year deliverables.

A summary of the key problems identified for NRMRL problem-solving research is described below and listed in Figure 9. These are key problems and account for most, but not all of our future work. A core competency will be maintained at a reduced level of resource investment in a number of other areas. Also included in the descriptions are the key questions that will drive our research.

Particulate Matter - increasing emphasis. What are the sources, composition, control technologies, control and prevention costs, and risk management strategies for reducing fine particles in the ambient and indoor environment?

Global Climate Change - changing emphasis from technology development and greenhouse gas mitigation to technology assessment and adaptation. What is the mix of technologies that can be deployed to achieve national and international goals and likely future commitments for reducing greenhouse gas emissions and what options exist for coping with, and adapting to, climate change impacts on water and air quality?

Safe Drinking Water Supply, Treatment, and Distribution - increasing emphasis on water supply and emerging pathogens. What options exist for sustaining safe drinking water supplies in the face of increasing water shortages, aging infrastructure, and increasing incidences of and concern for outbreaks of pathogen-related illnesses? What risk management options are available for source water protection and for control of contaminants on the contaminant candidate list?

Watershed Management and Restoration to Protect Ecosystems and Improve Human Health - increasing emphasis on urban development, infrastructure replacement, critical habitats and systems analysis. What options exist for the planning, design, operation, and restoration of watersheds and their infrastructure to achieve environmental, human health, and economic development goals?

Contaminated Sediments, Soils and Ground Water - increasing emphasis on sediments, resource extraction contamination and oxygenates in ground water. Maintain core capability to address soils and ground water remediation.

Pollution Control and Prevention for Priority Risks - increasing emphasis on flexibility to address high-risk problems and on systems solutions; EDCs, PBTs, Hg, other Agency priorities. What is the array of control technologies, pollution prevention approaches, and risk management options for known and emerging high priority risks to human health and the environment?

Sustainable Development - What are the risk management benefits of alternative development strategies? What tools will be most useful to local/regional governments?

Indoor Air Quality - Increasing Emphasis - The role of indoor environment in potential human health effects, including asthma, is rapidly gaining widespread recognition in the Program Offices and the research community. The indoor sources of and sinks for pollutants, along with infiltration from ambient air, can result in indoor concentrations of HAPS and fine PM considerably in excess of the same pollutants outside.

The key problems outlined above are best understood and resolved in the context of multimedia systems and solutions. NRMRL will address these issues from a systems perspective and will increasingly consider costs as a factor along with performance. NRMRL will seek greater understanding of how risk management approaches can be deployed at multiple scales and how optimum solutions can be developed.

- **Produce relevant and high quality research outputs.**

Ultimately, the way we impact solutions to environmental problems is through our research products and outputs. These are the vehicles for delivering the results of our research to risk managers and the scientific community. The quality and utility of our outputs are an overall measure of quality and effectiveness of our organization. Table 1 gives examples of research outputs and provides guidance on number of outputs in specific documents and the role of NRMRL staff in developing major outputs. NRMRL will focus its attention on the following outputs:

— Pre-publication products. Posters, presentations at technical meetings, beta-test software, technical seminars, and workshops, are among the usual ways that researchers vet ideas, describe research in progress, and share preliminary findings and data. Feedback from others doing similar research while informing them of ongoing projects within NRMRL are essential items. While informing others of our programs is also useful, the main focus is details of PI- and team-level research and development. Pre-publication products should be of the highest quality possible, directed toward the premier venues within the appropriate disciplines. The PI/team are encouraged to develop presentations, posters, etc. as their respective projects produce results. Expectations for the quantity and venues of such interactions should be planned in advance to the extent possible.

— Peer-reviewed articles. Journal articles, book chapters, proceedings, software, and review articles are among the accepted forms for this category. For our technology development components, patents awarded are parallel in scope and importance. In both cases, quality and quantity are important dimensions. For example, citation records for published material provides additional evidence that the published work is impacting the field of study. Similarly, patents awarded is less meaningful than license agreements issued. In cases where integrated research across organizational units are appropriate, joint publications are envisioned. Recognition via awards (e.g., STAA), peer recognition via elevated professional membership status, selection as journal editors and members of edit and review boards, etc., accrue to PIs almost entirely because of their publication records (both quantity and quality). ORD's promotion criteria are heavily weighted to this measure. PIs and teams should plan these products. Patent awardees are also expected to publish.

— Technical research documents and risk management evaluations. NRMRL's commitment to support the Agency's mission is often best served by analysis, synthesis, and provision of comprehensive "statements" about major problems. Two kinds of products are envisioned: technical resource documents and risk manage-

Table 1. Research outputs.

	Pre-Publication Products	Peer-Reviewed Articles	TRD/RME	Capstone
PI	1-4/yr	1-2/yr	Leadership & input	Leadership & input
Researchers	0-1/yr	0-.5/yr	Input	Input
Research teams	1-8/yr	1-2/yr	Input	Input

ment evaluations. NRMRL may also choose to provide data and analyses as part of regulatory support activities in which another ORD or EPA Office leads the effort. Technical resource documents are in-depth technical analyses of a specific problem and its solutions, complete with problem definition, solutions and their costs, reliability, and performance. Such documents provide clear and current guidance for both research and operational communities. Once peer reviewed and published, these documents provide definitive topical references for 3-5 year periods and become the major collection of NRMRL's products that others use to solve problems and make risk management decisions. Formats include traditional reports and design manuals but also are expected to include computer models, web-based tools, and electronic data sets. These documents will often require cross-divisional team efforts and, in some cases, cross-ORD teams. Technical resource documents must be planned in advanced, properly budgeted and staffed, and should support NRMRL's GPRA commitments.

Risk management evaluations are similar to technical resource documents in scope but are directed toward emerging issues under active consideration for anticipated risk assessments. For example, if ORD is conducting research on a perceived problem with an expectation that a risk assessment decision/document is needed to inform policy development within EPA, then a risk management evaluation should be planned and produced by NRMRL. Such evaluations clarify the dimensions of the problem, identify the potential risk management options, and assess the current knowledge on risk reduction options and their related costs, commercial availability, reliability, and data gaps. In the case of risk management evaluations, it is critical that NRMRL use a cross-ORD approach to assist in defining the scope and perhaps in completing the products. Risk management evaluations will be the major collection of products, developed in parallel with risk assessments, for use to inform risk-management decision-making. Typically, these products are aggregated, synthesis products that build from our ongoing and peer-reviewed products. Nominal expectations are for 2-3 technical resource or risk management assessment documents per yr for NRMRL. The responsibility for these documents would be at the division level.

— **Capstone products.** Capstone (a term chosen because it refers to the topmost part of a structure) products arise from the premise that premier problem-solving organizations will periodically solve policy-relevant problems of national and international significance. Reports that fully document the outcome of major programs and that identify the impact of the outcomes are envisioned. Such capstone reports demonstrate the robustness of the solutions via statistics including user surveys, economic savings, risks reduced, technologies adopted, markets created and operating, etc. Capstone products must be planned, budgeted, and staffed in advance in order to measure impacts. Attention must be paid to building into programs over time the data collection and analysis required to document impacts. Capstone products should be directed to Congress, OMB, the regulated community, and other groups that hold us accountable for serving the public. Where appropriate, such efforts should be developed and implemented jointly with the Program Offices, other components of ORD, and perhaps key stakeholder groups. Nominal expectations are for one capstone product for NRMRL every two years. Capstone products are developed under the guidance of the associate directors.

— **Technical assistance.** NRMRL is requested to provide technical assistance internal and external to the Agency. It is the responsibility of all scientists, engineers, researchers, and managers to respond to requests for technical assistance. In general, technical assistance is conducted by an individual responding to a request directed by management or through direct contact from the requestor. As scientists, engineers, and researchers within NRMRL, it is our responsibility to provide the best possible assistance in a timely manner to each request.

- **Continuously measure the impact of our research.**

Beyond focusing on the right problems for our customers NRMRL needs to build approaches into our research program to continuously and consistently evaluate the impact of our research. There are two specific actions that will be taken. First we must routinely survey our key customers to determine how effectively our research and its products are meeting their risk management needs and to keep abreast of emerging research needs. The NRMRL Assistant Laboratory Directors (ALDs) will be responsible for leading the development and conduct of these surveys.

The second action involves conducting impact analyses of key research programs. This will be a primary responsibility of Division Directors. Resources and a methodology must be identified at the beginning of new research programs to collect the necessary information as a component of the research. This could include information to determine dollars saved, increased reliability, technology commercialization and use, and degree of use by decision-makers or the scientific community. This information will vary by the type of research program and the customer.

SECTION 5

Measuring Success in Achieving our Strategic Goals

Measures

NRMRL has identified four strategic goals to move us toward our envisioned future. A number of specific actions will be taken to enable us to achieve these goals. A critical step in this process is measuring our success in achieving our strategic goals. We have identified a number of success measures that will be examined on an annual basis to evaluate our progress toward each goal at the annual division review. Systems will be put in place to routinely collect and evaluate the necessary data and produce an annual report for NRMRL staff and ORD management on our progress. The measures we will use are identified below, by NRMRL goal.

Goal 1 Continually strengthen and support the development, success and recognition of our work force.

Measures:

- progress toward 2003 staffing projections
- % of staff meeting annual IDP goals
- ratio of positions filled through career development versus new hires
- the number of staff promoted through scientific peer panels
- resources devoted to career development
- the number of and diversity of applications for NRMRL positions
- increased diversity in management and senior science positions
- NRMRL responses to ORD Organizational Survey in career development, diversity, communication and work environment categories
- the number of staff completing the NRMRL leadership development program
- external recognition (e.g., STAA, professional society awards, EPA honor awards).

Goal 2 Develop and sustain an outstanding intramural research organization.

Measures:

- increase in peer reviewed journal articles published, acceptance rate and citation
- increase in the number of PIs and research staff
- results of programmatic and divisional external peer review
- successful research teams (productivity, number, response to ORD Survey)
- external recognition (e.g., STAA, professional society awards, EPA Honor Awards, expert testimony)
- leadership in professional organizations
- leadership in the scientific community (editorial boards, advisory committees)

- ORD Survey responses - working in teams, scientific collaboration, resources
- resources committed to intramural research
- reductions in unnecessary administrative burdens
- quality of facilities and equipment (ORD survey - work climate, divisional peer reviews, % resources to support intramural research).

Goal 3 Synthesis and integration of environmental science and engineering across the risk assessment/risk management paradigm.

Measures:

- development of joint research and publications with ORD Labs and Centers
- external consensus and peer review of a completed risk assessment/risk management paradigm
- completion/impact of cross-Laboratory synthesis products
- development and use of peer reviewed risk assessment/risk management models
- ORD survey responses on scientific collaboration, communication, support for change, and working in teams
- completion and use of risk management evaluations for emerging environmental problems.

Goal 4 Make a significant and measurable impact in the solution of the most important environmental problems of our time.

Measures:

- Examine impact of major research areas and outputs.
- NRMRL outputs (peer publications, capstone reports, customer and synthesis products, technical resource documents)
- customer surveys and organizational benchmarking (usefulness of products, relevance to needs, timeliness)
- meeting GPRA goals
- impact of patents, licenses, CRDAs, MOUs
- impact of technology verifications, technology commercialization and use.

Approach

Collection and evaluation of the information identified above is not a trivial matter. Management systems will be put into place to accumulate critical data electronically in ORD Management Information System throughout the year using existing data collection processes. Some new data collection efforts will also be needed. This will be initiated in a manner that minimizes administrative burden. Measures that are found to be inappropriate or not useful will be dropped from consideration.

ORD and NRMRL customer service plans will be used to direct the annual customer service surveys. Divisional peer reviews will be initiated and conducted on a 3 year phased cycle. The 1998 NRMRL responses to the ORD Survey will be used as the benchmark for evaluating progress in the survey categories as applicable to the four strategic goals.

NRMRL will also periodically initiate a reassessment of our Strategic Plan. The reassessment will examine changes in the outside forces and trends impacting EPA, ORD and NRMRL. It will re-evaluate our assumptions and assess changes in environmental priorities that will occur. We will utilize this information to revise the Strategic Plan as needed and when needed, but at least on a five year cycle. The vision elements will not be considered for revision.