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Strategic Plan for the Office of Research and Development

Information Management Component

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Contents

Glossary/List of Acronyms

architecture	In the context of an information management system, architecture means the overall logical and physical definition of the system.
browser	An electronic tool for reviewing information in a database. Also referred to as a "database browser."
catalog	A set of detailed documentation about a number of data sets that helps users determine which data sets may be useful for a particular application. A catalog provides much more detailed information than a directory.
CBEP	EPA's Community-Based Environmental Protection initiative.
CD-ROM	Literally, Compact Disc-Read-Only Memory. A type of compact disc that is used to store software, databases, and reusable information.
CENR	The White House Committee on Environment and Natural Resources.
CIO	Chief Information Officer; the person who has been officially designated as having the overall responsibility and authority for information management activities, policies, and direction in an organization.
client/server	Use of distributed "client" computer systems linked to a central "server" in order to share common software tools/applications and capability.
data set	A logical meaningful grouping or collection of similar or related data.
DCD	directory/catalog/dictionary.
dictionary	A set of basic information about individual components of a single data set. For example, a dictionary for a scientific data set would include format information and a short scientific description of the parameters or variables in the data set.
directory	A set of information about a large number of data and information products that informs users which products are available and generally what they contain.
GIS	Geographic Information System; a collection of computer hardware, software, and geographic data designed to capture, store, update, manipulate, analyze, and display geographically referenced data.
GPRA	The Government Performance and Results Act.
hypertext	A form of electronic document that contains links to other electronic documents. Typically, users activate the links by clicking on highlighted portions of their screen. This instantly displays the screen for the linked document.
IM	Information management.
Internet	International Communications Network.

Intranet	A limited access network that uses the Internet to link computers together. Access is limited to those individuals whose computers are on the Intranet network.
ITMRA	Information Technology Management Reform Act of 1996.
Java	A computer language for general purpose programming. Primarily used to write interactive Internet applications.
LAN	Local Area Network; a set of computers within a particular location (typically a building or part of a building) that have been physically connected together to enable shared communication and resources, such as printing, files, and dial-out capabilities.
LIPs	Laboratory Implementation Plans; detailed planning documents prepared by ORD Laboratories for all research to be conducted in-house or under a contract or cooperative agreement. Each LIP provides detailed information on the tasks to be conducted under a specific research project, the resources needed, and the research products that will be generated.
metadata	Data or information that describe a set of data or information. For example, scientific metadata describe how, when, and where the scientific data were collected.
model	Mathematical or physical representation of data or a system that accounts for all or some of its known properties.
NASA	The National Aeronautics and Space Administration.
NOAA	The National Oceanic and Atmospheric Administration.
object	A data or information product. For example, objects in ORD's ScienceNet may include data sets, databases, projects, analytical products, and documents.
OIRM	EPA's Office of Information Resources Management.
OMIS	ORD Management Information System; an ORD-wide integrated computerized management information system containing several modules for planning, financial management, project tracking, and human resources management.
QAPPs	Quality Assurance Project Plans; research planning documents, developed to ensure that data of the appropriate type and quality will be generated.
ScienceNet	The name ORD has selected for its Internet-based network of publicly available ORD science and engineering data and information. The ORD ScienceNet will be ORD's home page and front door on the Internet. It will contain printed documents, reports, and journal articles, as well as databases, data sets, models, and software applications. ORD hopes that the ORD ScienceNet will catalyze the creation of two larger scientific information networks: an EPA-wide ScienceNet and a broader U.S. ScienceNet developed collaboratively by EPA and other federal research agencies.
server	See "client/server."
STAR	Science To Achieve Results; ORD's external research grants program.
USGS	U.S. Geological Survey.
WAN	Wide Area Network; a group of Local Area Networks that have been connected together independently of the Internet to enable shared communication and resources, such as printing, files, and dial-out capabilities.
WWW	World Wide Web; a hypertext system for finding and accessing Internet resources.

Summary

This document, the *Information Management Component* of the Office of Research and Development's (ORD's) Strategic Plan, describes a consistent, organizationwide approach for efficiently planning for, collecting, documenting, manipulating, exchanging, archiving, and communicating ORD's research data and science information products.

As the science arm of the Agency, the results of ORD research provide the scientific foundation for environmental decision-making at EPA. With increasingly complex and multidisciplinary environmental research problems and programs, a new level of interaction and collaboration is required between different fields, specialties, scientists, and organizations that formerly may have operated independently. ORD's success as a federal-level R&D organization within this changing environment is defined by two factors:

- The scientific quality of our R&D.
- The degree to which our many EPA and external stakeholders and research partners have open access to and can use the information and data we generate.

ORD's IM Strategic Plan is structured around four themes that provide a robust framework for transforming ORD into a state-of-the-art information provider:

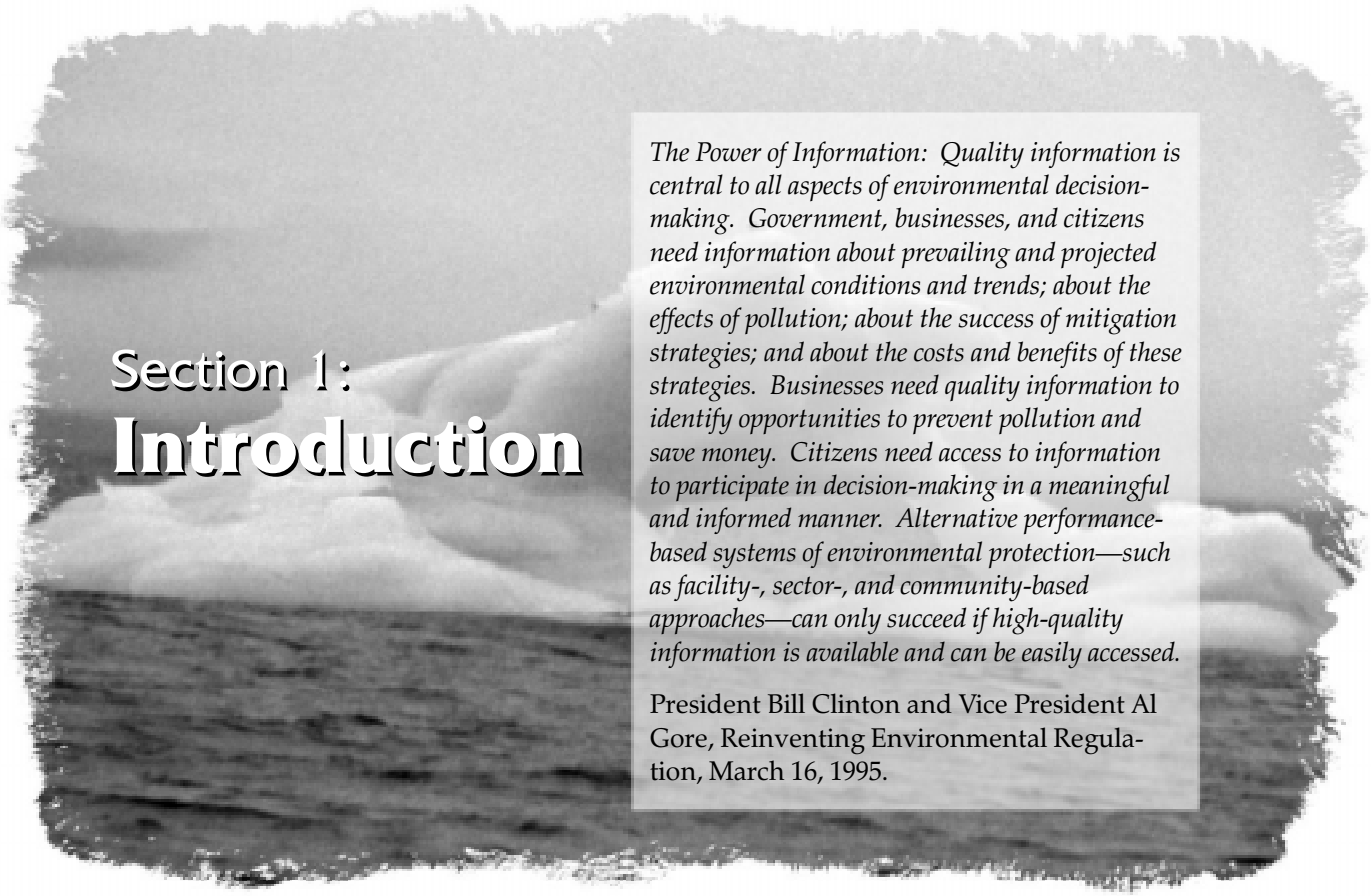
- **Planning** for information management.
- Making potential users **aware** that information exists.
- Making the information **accessible.**
- Making the information **usable.**

The strategic approach is comprehensive, offering a solution to ORD's wide range of information management needs, and addresses both paper and electronic information; interoperability and data management issues; policies and standards; data users and user needs; and electronic information technologies.

Central to this information management framework is the creation of an Internet-based **ORD ScienceNet,** the "front door" to ORD's scientific information. Through ScienceNet, a wide range of users—including researchers and data managers at other federal agencies, extramural scientists at all kinds of non-government laboratories, and the public at large—will be able to search for, access, and download data and information, as well as aggregate, manipulate, and analyze downloaded data sets using a variety of tools available via the World Wide Web. The ability to aggregate data may particularly aid environmental decision-makers, who often must synthesize large amounts of information during the decision-making process. For scientific data, users will be able to access metadata that describe the context and assumptions under which the data were collected. Also, users will be able to link from the ScienceNet website to other information or scientific databases (such as STORET and Envirofacts) via hypertext links.

The newly formed **ORD Science Information Management Coordination Board** will begin developing implementation plans for this strategy in August 1997. The Board will also be recommending an appropriate FY 1998 and 1999 budget to support high-priority ORD science information systems infrastructure.

Successful implementation of this strategy will move ORD from an organization that uses information technology for administration to one that uses it to further its scientific mission.



Section 1: Introduction

The Power of Information: Quality information is central to all aspects of environmental decision-making. Government, businesses, and citizens need information about prevailing and projected environmental conditions and trends; about the effects of pollution; about the success of mitigation strategies; and about the costs and benefits of these strategies. Businesses need quality information to identify opportunities to prevent pollution and save money. Citizens need access to information to participate in decision-making in a meaningful and informed manner. Alternative performance-based systems of environmental protection—such as facility-, sector-, and community-based approaches—can only succeed if high-quality information is available and can be easily accessed.

President Bill Clinton and Vice President Al Gore, Reinventing Environmental Regulation, March 16, 1995.

The Office of Research and Development (ORD) of the U.S. Environmental Protection Agency (EPA) is unique among scientific institutions in this country in combining research, analysis, and integration of scientific and engineering information across the full spectrum of health and ecological issues and across both risk assessment and risk management. ORD is responsible for leadership in science at EPA and for the bulk of EPA's R&D work. The results of ORD research provide the scientific foundation for environmental decision-making at EPA. They also are used by other government agencies, academia, nongovernment organizations, and the private sector for environmental science and management purposes at local, state, regional, national, and international levels.

ORD Success Factors

ORD's success as a federal-level R&D organization is defined by two factors:

- The scientific quality of our R&D.
- The degree to which our many EPA and external stakeholders have open access to and can use the information and data we generate.[1]

The recent explosion of tools and systems for information management and dissemination—relational databases, client/server computing, the Internet and World Wide Web, and compact disks, for example—offer extraordinary opportunities to enhance both the quality and application of ORD science. As never before, effective information management has the potential to:

- Increase ORD's R&D efficiency, quality, and accountability, sharpen the focus and value of our research, and catalyze rich collaborations with leading environmental researchers around the world.
- Vastly enlarge the constituency and potential applications for the data and information generated by ORD research. Recent technological advances make it possible for ORD to provide more usable information and data of documented quality, to more customers in more compelling formats, in a more timely manner, and at a lower cost than ever before.

[1]Throughout this strategy document, the term "ORD information" is used to signify the entire spectrum of ORD's science and administrative data and information.

ORD Information Management Strategy Group

In 1995, ORD instituted dramatic changes to transform itself into a world-class research institution to support risk-based decision-making. Specifically, we restructured our organization and instituted a new research planning process based on the widely utilized risk assessment/risk management paradigm. Our new risk-based planning process is described in our *Strategic Plan for the Office of Research and Development*, published for the first time in May 1996, and updated in April 1997.

To further enhance the quality and value of our work, we now have charted a course for ORD to take strategic advantage of the powerful information management opportunities enabled by recent technological developments. In February 1996, at the request of ORD's Deputy Assistant Administrator for Science, ORD created an Information Management Strategy Group consisting of representatives from all of ORD's Laboratories and Centers, the EPA Administrator's Office, and the EPA Office of Information Resources Management (see inside back cover). This group was charged with developing an innovative and coherent strategic plan for information management in ORD. This document, which is a formal addendum to ORD's Strategic Plan, sets forth that strategy.

Written for ORD staff and our EPA and external stakeholders, this plan provides a clear and practical blueprint for transforming ORD into a state-of-the-art information provider. This strategy is firmly grounded on a set of fundamental economic, technological, and strategic principles to ensure that ORD's approach to information management will be realistic, successful, and take maximum advantage of available resources and opportunities.

The plan begins by defining a vision, mission, and goals for ORD information management (Section 2) and examining the needs of ORD staff and stakeholders (Section 3). Based on these needs, the plan sets forth a four-part strategy for managing information and defines a number of specific actions ORD will take to implement the strategy (Section 4).

Finally, this document will guide detailed implementation planning, which will begin in late summer, 1997. A newly formed ORD Science Information Management Coordination Board, composed of senior information officers from each ORD Laboratory and Center and chaired by a member of ORD's Executive Council, will initially focus on:

- Development of plans for implementation of this strategy; and
- Recommendations for appropriate allocation of resources to be set aside in FY 1998 and 1999 to support high-priority ORD science information systems infrastructure.

Strategic Principles for ORD Information Management

- Build on and coordinate ORD's existing information management capabilities.
- Be ORD-wide and flexible (rather than monolithic or centralized).
- Minimize the cost and disruption to ORD's current operations.
- Be integrated with Agency-wide information management planning.
- Take advantage of rapidly evolving information management tools.
- Leverage resources from other agencies.

External Review

On March 20, 1997, an outside team of experienced information systems managers (drawn from NASA, NOAA, USGS, CENR, and EPA's OIRM) conducted a one-day review of this strategy. The review committee stated that they were very impressed with the quality and commitment within ORD to this effort, and made a number of insightful comments and suggestions for refining our information management planning and implementation. Their recommendations have been incorporated into this strategy.

Coordination of This Strategic Plan[2]

Both ORD and the Agency as a whole already have made significant investments in information management systems. This strategy builds on those efforts by proposing an approach based on organizing and enhancing existing ORD and EPA systems and resources.

The proposed approach is also comprehensive, serving as a unifying plan of action for managing all levels and types of ORD information—from the

[2]It will be important for the new ORD Science Information Management Coordination Board to continue these efforts, by coordinating implementation planning with relevant activities and organizations outside of ORD (Section 3).

scientific data and information resulting from ORD's in-house or extramural research (e.g., raw data collected at field sites, health or ecological risk assessments, aggregated data sets, research plans) to the administrative information needed to manage ORD's research (e.g., resource data, grant award information, Laboratory Implementation Plans).

In addition, this strategy has been coordinated and is consistent with relevant organizations and related activities, such as the Agency Information Resources Management Strategic Plan and the new Office of Planning, Analysis, and Accountability. It is also responsive to the Government Performance and Results Act (GPRA) and the Information Technology Management Reform Act, which was signed into law in February 1996 and requires a fundamental change in the way government agencies perform information management.

The Information Technology Management Reform Act

The Information Technology Management Reform Act (ITMRA) of 1996 establishes a set of information technology acquisition and management requirements for government agencies.

These requirements, summarized in Appendix A, are designed to maximize the value of government investments in information technology while minimizing the risk.

One ITMRA requirement is that EPA establish a Chief Information Officer for the Agency (currently the Acting Assistant Administrator for Administration and Resources Management), responsible for ensuring Agency-wide compliance with ITMRA. Concomitantly, ORD must ensure that its IM activities and systems conform with the ITMRA requirements. Essentially, this means approaching each potential information technology investment as a business case and apply rigorous cost-benefit analyses to it.

In response to ITMRA, EPA already has:

- Initiated an Agency-wide Strategic Information Technology Architecture Plan process.
- Established a Capital Planning and Investment Control Strategic Project Committee to define EPA's process for capital planning and investment control, determine best practices, and implement a new method of evaluating information technology investments, as required by ITMRA.

To keep pace with and help shape these developments, ORD must proceed without delay to participate in these efforts.

Next Steps

The time to act is now. Other EPA programs and offices are currently exploring new information management concepts, such as electronic permitting, reporting and pesticide registration, and "virtual government" pilot projects are being discussed with other federal agencies to develop better interagency connections. At this critical juncture, ORD has the opportunity to lead the Agency in the development of a coordinated information network for science—an "ORD ScienceNet" (described in Section 4)—at a time when the need for defensible and credible environmental research information has never been greater. Given that so much is now possible in electronic networking and publishing, this is an exciting time for ORD to make dramatic progress by "leapfrogging" over obsolete technologies and approaches for information management and into cutting edge systems that hold dramatic promise for enhancing both ORD's and the Agency's stature as a world-class environmental institution.

Section 2: ORD's Vision, Mission, and Goals for Information Management

Many of EPA's scientific data sets are either incomplete, obsolete, or missing altogether, a problem that extends across all media areas. These problems have made it difficult for the Agency to conduct scientifically based risk assessments and to measure the results of environmental programs. The Agency's problems in obtaining quality data are exacerbated by difficulties in managing the data that are available. In particular, EPA's data management systems have been designed to track or manage information about environmental conditions and results for each environmental medium, thus making scientific assessments of risk across media cumbersome and costly.

Peter F. Guerrero, GAO, May 12, 1995, testimony before the Senate Subcommittee on VA, HUD, and Independent Agencies.

Introduction

The evolution of environmental science in general and ORD's program in particular, is distinguished by several trends that have important implications for information management. First, research problems and programs are becoming increasingly multidisciplinary, requiring collaborations and interaction between different fields and specialties that formerly may have progressed independently. Second, environmental science in the U.S. is benefiting from growing coordination and partnering among multiple federal agencies, each of which is bringing its own resources and research communities to contribute to more integrated federal efforts. Third, ORD's development of a broader extramural component to its research efforts, e.g., through the Science To Achieve Results (STAR) program of research grants, means that the community of scientists who are playing key roles in many research programs now are located at many different institutions in addition to ORD's own laboratories. And finally, there is a growing interest on the part of researchers who are not directly involved in the research programs for which data are initially produced, and on the part of the general public, to have access to EPA data sets. The consequence of all these trends is that ORD's approach to IM must place a priority on making data openly available to a wide range of users, including researchers and data managers at other federal agencies, extramural scientists at all kinds of non-government laboratories, and the public at large.

In its 1996 Strategic Plan, ORD set forth a new organizational vision, mission, and goals to provide the framework for risk-based research planning.

Similarly, ORD has developed a vision, mission, and goals for information management. This framework is designed to ensure that ORD manages information in the way that will best support risk-based research planning and the new trends in environmental decision-making. As described below, the IM framework directly parallels and supports ORD's broader organizational vision and mission.

Vision Statement

ORD's vision for information management is based on the key role that ORD science plays within EPA, and within the broader context of our nation's environmental research agenda. Building upon

ORD's organizational vision statement—*"ORD will provide the scientific foundation to support EPA's mission"*—ORD will likewise support the Agency's mission by conforming to its vision for information management:

ORD's Information Management Vision

ORD will provide timely and reliable scientific data to support EPA's mission, and will exchange environmental information with the public and other stakeholders.

The ORD information management vision statement provides a standard against which the future ORD information management environment can be judged. By living up to this standard, ORD will support the Agency's mission and will also serve as a public resource for reliable scientific, engineering, and risk assessment/risk management information. At the same time, ORD will increase its capacity to exchange environmental information with and integrate the work of ORD's scientific partners, including EPA's Program and Regional Offices, academia, the private sector, and other government agencies.

Mission Statement

As EPA's science arm, ORD has a clear role to identify and provide defensible and credible data and information. Such information is critical to achieving the Agency's mission of protecting human health and the environment. Effective environmental decisions depend on scientific and engineering data that are accurate, reliable, and adequate for their intended use (see "QA Program Interface"). And defensible environmental decisions are backed up by documentation of both the science data and the risk assessment procedures and analytical methods that were used to develop them. ORD plays a leadership role in developing these tools and information and in providing, coordinating, and exchanging information with decision-makers inside and outside the Agency. ORD also supports Agency-wide internal information and data needs for strategic planning, budgeting, and accountability.

The ORD IM mission statement parallels the four-component structure of ORD's overall mission statement, set forth in the Strategic Plan for ORD:

ORD's mission is to perform research and development—

- ORD's IM mission is to make internal and external stakeholders aware of and able to access and use the data and information generated by ORD's research and development.

ORD's mission is to provide technical support—

- ORD's IM mission is to provide research information and supporting electronic communications to customers in a manner that meets world-class standards for quality of content and delivery.

ORD's mission is to integrate scientific research—

- ORD's IM mission is to foster interactive communication, collaboration, and information sharing with scientific partners.

ORD's mission is to provide scientific leadership—

- ORD's IM mission is to provide leadership in the Agency's use of information technology for science.

The parallel structure clearly indicates how ORD will use information management to support its organizational mission and reflects ORD's critical role as an information provider.

Goals

This strategy is structured around four themes that provide a robust framework for effective ORD information management:

- **Planning**—IM planning must be an *integral component of ORD research planning* to ensure that the information generated by all of ORD's research projects can be made available to potential users.
- **Awareness**—Once information is available, stakeholders need to be *aware* that it exists.
- **Accessibility**—Then, they need *access* to the information.
- **Usability**—Finally, the information must be *usable.*

These four themes form the basis for a set of broad, customer-oriented IM goals (Table 2-1) to fulfill ORD's IM mission. Section 4 describes a strategy to achieve these goals.

Table 2-1. ORD's Long-Term Goals for Information Management

Planning	Awareness	Access	Usability
ORD will integrate IM planning into its research planning process to ensure that all of ORD's research information can be made available to potential users in a timely, effective, and efficient manner.	ORD will provide the awareness tools and services needed to make its internal and external stakeholders aware of ORD's information.	ORD will provide the communication paths and equipment that allow internal and external stakeholders access to ORD's information.	ORD will provide the policies and standards, training, user tools, and planning needed to make ORD's information usable to internal and external stakeholders.

Section 3: ORD Information Management Needs, Opportunities, and Benefits

Scientists can now perform environmental research that increases our understanding of the Earth system at all spatial scales, enhances resource management and environmental decision-making, and improves our capabilities for predicting changes in the environment. Over the past decade, in particular, the observational, computational, and communications technologies have enabled the scientific community to understand a broad range of interdisciplinary environmental research and assessment programs.

The National Research Council, Finding the Forest in the Trees.

Needs

ORD currently employs almost 1,900 scientists, engineers, and professional and support staff. These individuals perform or support research in human and ecological health, methods and model development, and risk management. ORD staff also provide technical support to EPA's Program and Regional Office staff as well as external stakeholders.

These activities generate four categories of information, each used primarily by different audiences (Table 3-1):

- Scientific information (risk assessments, research products, the Integrated Risk Information System, and so on)—primarily used by **ORD stakeholders.**
- Integrated scientific, management, and administrative information (e.g., planning, budgeting, and accountability information)—primarily used for making strategic, policy-level decisions by **ORD senior executives.**
- Science management information (i.e., information related to managing and administering ORD research including planning and resource information)—primarily used on a more tactical level by **ORD project managers and administrative personnel.**
- Science data (e.g., monitoring data, analytical data, epidemiological data, and so on)—primarily used in the development of research products by **ORD scientists and engineers.**

As described below, each of these user groups has specific information management needs that, when fulfilled by the strategy presented in Section 4, will greatly enhance their ability to access and utilize information that directly or indirectly contributes to ORD's ability to be a world-class environmental research institution.

ORD User Council

The degree to which our many EPA and external stakeholders use the information and data we generate is listed in Section 1 as one of two ORD success factors. It is critical, therefore, for ORD to

Table 3-1. The Need for ORD Information*

Who needs ORD information?	ORD Stakeholders	ORD Sr. Executives	ORD Project Managers & Administrative Personnel	ORD Scientists & Engineers
What information is needed?	Science Information Products	Integrated Scientific, Management & Administrative Information	Science Management Information	Science Data
Examples:	• Risk assessments • Research publications • Integrated Risk Information System (IRIS)	• Planning information • Budgeting information • Accounting information	• Planning information • Resource information • Laboratory Implementation Plans • Grant award information	• Human health & ecological effects data • Human health & ecological exposure data • Risk management data • Methods & models data • Monitoring & analytical data

* Examples are given only to illustrate that there are several broad categories of ORD information that, for the most part, are needed by different user groups. Some overlap between categories does occur.

have external user communities actively involved with our information management program. These stakeholders must be involved from the outset in ORD's planning, so that they buy into the process and their needs for information are met.

Because of their key role, ORD will establish a "User Council" to ensure that we adequately coordinate with and provide for the information needs of our external user community. The appropriate membership of the User Council and other specifics will be addressed by the ORD Science Information Management Coordination Board during implementation planning.

ORD Stakeholders

EPA Program, PAA, and Regional Offices
ORD is the primary provider of scientific and technical information, as well as technical assistance, to EPA's Program and Regional Offices. ORD staff need ready access to the information and data necessary to meet the information and assistance needs of the Program and Regional Offices. The needs and activities of the Agency's Planning, Analysis, and Accountability Office also will need to be met. In addition, as appropriate, the Program and Regional Offices should have direct access to relevant information and data generated by ORD.

Federal Entities (Agencies, Tribes, Institutions, and Committees)
Federal entities, including agencies, institutions, tribes, and committees, are key ORD partners and stakeholders in several ways:

- Federal research institutions—such as the National Academy of Sciences, the National Science Foundation, the National Aeronautics and Space Administration, and the U.S. Department of Energy—are important research partners of ORD. Often, these agencies help establish standards for best uses of information technology for research purposes.
- ORD represents EPA on federal-level committees, such as those of the National Science and Technology Council, which coordinates the research activities of the federal government.
- ORD also participates in major interagency research initiatives—such as the work of the Federal Geographic Data Committee to build the

National Spatial Data Infrastructure, and the National Biological Services effort to build the National Biological Information Infrastructure.

- Environmental research information forms an important pillar of the National Information Infrastructure and the Global Information Infrastructure.
- Finally, ORD and tribes have collaborated on research.

Current trends in government policy and technology are driving ORD toward greater networking with its federal research partners and customers. This networking is essential to exchange information and coordinate activities so that ORD and other federal institutions can most effectively leverage their increasingly scarce resources. ORD needs to learn from the experiences and efforts of the other research agencies and make its information management program synergistic with theirs.

States and Communities

Increasingly, the Agency is moving toward facilitating regional, state, and local action to identify and solve environmental problems where appropriate and feasible. For example:

- Facilitating and supporting stakeholder partnerships for environmental improvement is one of the key strategic directions cited in EPA's Five-Year Strategic Plan, published in 1994.
- The National Advisory Council for Environmental Policy and Technology (NACEPT), a federal advisory committee, has been providing recommendations to the EPA Administrator on how the Agency can most effectively catalyze community-based environmental protection efforts. NACEPT's 1996 Community-Based Environmental Protection Committee has identified information as one of the primary ways that EPA can catalyze community-based environmental protection (CBEP) efforts.

As ORD works to meet information management needs, it should consider what types of ORD information may be valuable for state and community-led environmental protection efforts and find ways to make this information readily accessible to these stakeholders. Remote sensing and GIS data may be of particular value to these stakeholders.

ORD Senior Executives

ORD's executive leadership provides strategic, policy-level decision-making for ORD. The senior executives define ORD's vision, goals, and objectives, determine how best to ensure the success of ORD's efforts, and define priorities for the content and direction of ORD's research program. They also identify critical gaps in ORD's management or science agenda and take steps to address those gaps.

ORD senior executives need a variety of science, management, and administrative information to support effective decision-making. ORD has a finite set of resources that can be allocated in different ways to support activities critical to EPA's mission. The management challenge for senior executives is to focus ORD research activities on those areas where the greatest benefit can be achieved most efficiently and cost-effectively. With the right kinds of information, this type of decision-making is facilitated and defensible.

To move up to the next generation of strategic research planning and directing, ***ORD senior executives need not only ready access to administrative information, but will need the ability to integrate it with ORD's science information.*** Examples of improved research planning facilitated by using integrated administrative and science information as a strategic resource include:

- Allocation of resources to specific geographic initiatives.
- Knowing what data are available and what projects are ongoing in a specific geographic region may allow improved decisions on where research can be most efficiently conducted.
- Choosing an area already rich in relevant, well-documented data may reduce the resource needs for data collection efforts and significantly shorten the time needed to produce project results.
- Knowledge of ongoing projects within EPA and other organizations.
- Access to information describing projects will significantly reduce the potential for redundant research efforts on the part of ORD. This type of information can be extracted from administrative data describing internal projects, grants, contracts, and interagency and cooperative agreements. Similar information for external entities can be found at their Internet sites.
- Knowledge of existing capability and capacity of EPA and external organizations.
- Access to information about expertise in EPA and other organizations can lead to the development

of strategic partnerships that will allow ORD to more efficiently accomplish its mission.

- Ability to access and evaluate research results in order to direct further activity.
- Access to information on research results will allow ORD to be more effective and timely in responding to Congressional and other inquiries.

ORD Program Managers and Administrative Personnel

As described below, ORD program managers and administrative personnel need tools and services that allow them to effectively:

- Plan and manage ORD research programs.
- Manage the financial and human resources that support the research programs.

Program Planning and Management Needs
To effectively plan and manage ORD research programs, ORD program managers and administrative personnel need:

- Information about ongoing research.
- Information about the needs and operation of the Agency's Planning, Analysis, and Accountability function.
- Reliable and easily obtainable resource information about intramural and extramural research projects.
- Information about publications and other end products of ORD research.
- In some cases, desktop access to scientific and administrative data on the Internet and other sources for use in risk assessment and risk management decision-making.

For example, when proposing or designing an ecological research project, an ORD program manager could access the RaDiUs (Research and Development in the U.S.) dedicated server to determine what research U.S. government agencies are conducting on that particular ecological issue. This information will allow the program manager to determine what funds have been allocated to this area of research and will facilitate networking with other researchers. The ready availability of this type of information will be invaluable for reducing overlap and duplication of effort and will enable ORD laboratories to target their research based on a comprehensive understanding of other similar research efforts.

Resource Management Needs
To effectively manage the financial and human resources that support ORD research programs, ORD program managers and administrative personnel need to:

- Develop effective Laboratory Implementation Plans.
- Link task-based tracking of operating budgets and products.
- Maintain an audit trail of how resources were reallocated.
- Plan and track travel and miscellaneous expenditures.
- Support the research planning process from planning, through budget execution, to results tracking.
- Provide complete records of intramural and extramural research plans, activities, and accomplishments.
- Help ORD keep "in sync" with the Agency's Integrated Financial Management System and the needs and activities of the Planning, Analysis, and Accountability Office.

In 1996, ORD launched the ORD Management Information System (OMIS), which has been designed to meet these needs. OMIS is an ORD-wide integrated computerized system containing several modules for planning, financial management, project tracking, and human resources management. The component modules are:

- The Integrated Resources Management System.
- The in-house accounting module.
- The human resources module.
- The Laboratory Implementation Plan module and other tracking system modules under development.

By the end of FY97, OMIS will hold complete and organizationally consistent information on ORD research projects and tasks; commitments, obligations, and expenditures; grants and contracts; and training plans. OMIS is expected to meet ORD's administrative information management needs and is designed to be consistent with all the Agency's budgeting and accounting requirements.

Concurrently, the Agency's administrative information management systems are being reformed. The

new or updated systems will provide useful tools for meeting ORD resource management needs. For example, under the ARI, or Administrative Reduction Initiative, EPA is adding a variety of new systems capable of electronic routing. These systems will allow ORD managers to electronically receive, review, approve, and act on repetitive processes—such as leave slips, executive correspondence, purchase requests, travel authorizations and travel vouchers, and time and attendance information.

Finally, ORD is piloting "groupware" computer software that will allow ORD program managers and administrative personnel to participate in the many initiatives that will become the standard for EPA administrative processes within the next 18 months to 2 years.

ORD Scientists and Engineers

To play a leadership role in environmental R&D, ORD scientists and engineers need information management capabilities that allow them to:

- Plan and discuss projects.
- Locate and understand data, information, and documents.
- Access data, information, and documents.
- Collect, store, manipulate, and analyze data and information.
- Publish research data and results.

The need for these capabilities is discussed below.

Need To Plan and Discuss Projects
Increasingly, cross-disciplinary teamwork is needed to conceive and conduct research that addresses complex and emerging environmental concerns, which often are multimedia in nature. To work effectively in teams, researchers need the capability to develop plans using an iterative process that incorporates input from multiple sources and encompasses both the strategic and tactical levels. There are three basic stages of IM needs during planning:

- ORD researchers located at different geographic locations need to be able to communicate and interact electronically when developing project concepts.
- Once project concepts are formulated, ORD researchers in different locations need an efficient mechanism to develop, discuss, and review Laboratory Implementation Plans containing milestones, deliverables, and task descriptions.
- Finally, when the research project is underway, ORD scientists and engineers need to consolidate updates from multiple sources to assess impacts and progress toward achieving project objectives on an ongoing basis.

ORD's local and wide area information management environment must support and facilitate planning activities at all three stages.

Need To Locate and Understand Data, Information, and Documents
ORD scientists and engineers need to work with their own data and with secondary data (i.e., data generated by others). To effectively use secondary data, ORD users must be able to locate the data and readily determine whether it is appropriate for their needs.

Increasingly, government agencies, nongovernment organizations, and academia are providing data and information on the Internet that is well-documented and potentially useful to ORD staff. Emerging metadata (information that describes data) standards like those adopted by the Government Information Locator Service (GILS) and the Federal Geographic Data Committee standard for spatial data documentation help ensure that these data and information are appropriately documented and can be readily located.

To stay abreast of the latest scientific developments, ORD scientists and engineers need the capability to:

- Search the Internet for relevant data.
- Perform more traditional literature searches via commercial or government services (such as those supplied by the National Institutes of Health and the U.S. Department of Agriculture).

Need To Access Data, Information, and Documents
Once ORD users have located appropriate data, they must be able to access the data, as well as metadata and documentation, using an appropriate tool set. Examples of access scenarios include:

- Selecting a particular geographic coverage on an Internet server, using an Internet client that supports file transfer protocol to download the selected coverage, and then displaying it using a geographic information system (GIS).
- Using a database browser tool, statistical package, or GIS to examine the content of data in a database management system.

- Using the wide variety of valuable scientific data, information, and documents available on CD-ROM.

Need To Collect, Store, Manipulate, and Analyze Data and Information

Much of ORD's data is originally generated by field and laboratory work that is either conducted or sponsored by ORD. These data need to be managed from their origin in the field or laboratory through the analytical process. To do this effectively, ORD users need access to a wide variety of computer tools, including laboratory information systems, field data recording equipment, and analytical tools. General categories of tools include modeling, scientific visualization, geographic information systems, statistical, spreadsheets, Internet and Intranet servers and browsers, and scientific database management tools.

Need To Publish Research Data and Results

ORD's success at meeting its mission will be largely judged on what it publishes. Forms of "publication" include journal articles, databases, data sets, metadata that describe the databases and data sets, models and software applications developed by ORD, and documents. ORD's Science To Achieve Results (STAR) program is currently generating a large body of research data and scientific results that will become part of ORD's information collection in the future.

Electronic publishing is important for internal and external review of draft materials and public access to final materials. To publish electronically for internal purposes, ORD staff need a robust capability that allows them to work in groups to develop, review, and track documents internally. To publish electronically for external purposes, ORD personnel must be able to work on the Internet.

Opportunities and Benefits

Until a few years ago, limitations of information technologies made it difficult, if not often impossible, to set up comprehensive, integrated, and effective IM systems across large organizations such as ORD. During the 1990s, however, information technology and management approaches have made revolutionary progress:

- Key technologies include the Internet and its associated software tools (especially the World Wide Web and Java).
- Emerging management approaches include the concept of creating a Chief Information Officer to oversee information management, as well as a number of other strategic IM approaches that government agencies are now required to implement under the Information Technology Management Reform Act of 1996 (see Appendix A).

These new technologies and approaches provide ORD with important opportunities to achieve the six long-term goals set forth in ORD's 1996 Strategic Plan (Table 3-2) and to meet the information management needs described in this section. In particular, they enable ORD to:

- Integrate its many discrete databases.
- Integrate its information activities with the rest of EPA.
- More readily communicate with and provide information to external partners and stakeholders.

These new opportunities have the potential to bring many benefits both to ORD staff members and to ORD as a whole. For example:

- ORD researchers will be better able to collaborate with research partners, conduct multidisciplinary research, and use GIS and other emerging software tools to readily visualize and make sense of large quantities of data. Sharing of data sets with others will help to correct errors and to clear up misunderstandings in the metadata.
- ORD researchers will have increased awareness of ORD data, and better quality data sets and metadata will lead to better research.
- Better long-term archiving and documentation will protect data sets for future use by ORD and other researchers.
- ORD scientists and engineers will gain substantially increased visibility for and recognition of their work.
- Improved information management has substantial potential to enhance ORD's stature, improve decision-making and accountability, and enhance efficiency and employee satisfaction.

In short, enhanced information management is imperative if ORD is to serve as a world-class provider of environmental data and information in the next century. Section 4 of this document sets forth an ORD IM strategy to effectively meet the many needs of ORD staff and stakeholders described above.

Table 3-2. ORD's Long-Term Goals

- To develop scientifically sound approaches to assessing and characterizing risks to human health and the environment.
- To integrate human health and ecological assessment methods into a comprehensive multimedia assessment methodology.
- To provide common sense and cost-effective approaches for preventing and managing risks.
- To provide credible, state-of-the-art risk assessments, methods, models, and guidance.
- To exchange reliable scientific, engineering, and risk assessment/risk management information among private and public stakeholders.
- To provide leadership and encourage others to participate in identifying emerging environmental issues, characterizing the risks associated with these issues, and developing ways of preventing or reducing these risks.

Benefits to ORD of Enhanced Information Management

- **Improved research**. The potential benefits to ORD research of enhanced IM are exponential:

  - ORD researchers will be able to stay abreast of important scientific developments in a timely and efficient manner.
  - ORD research will be enriched by new opportunities for data exchange and collaboration with internal and external researchers.
  - Enhanced sharing of data sets will stress the importance of adequate metadata and ultimately lead to metadata improvements.
  - Better long-term archiving and documentation will protect data sets for future use.
  - Use of ORD data sets will increase substantially due to improved accessibility, preservation, and metadata quality.

- **Increased stakeholder appreciation of ORD's work**. Using new IM technologies, ORD can now make its products available to stakeholders in the U.S. and around the world more efficiently and effectively than ever before. Both ORD and stakeholders benefit:

  - Many more stakeholders will be able to readily identify, access, and use ORD tools and information for environmental research, decision-making, and improvement.
  - Taxpayers get a better return on their investment through enhanced application of ORD's work.
  - External accessibility to ORD products brings positive recognition and increased support for ORD's work. NASA gained tremendous public visibility and appreciation for its work by placing Hubble telescope images of Jupiter on the Internet and by providing a forum for public interaction on the event. ORD could use the Internet for similar purposes.

- **Greater efficiency and cost-effectiveness**. Improved access to key information will enhance decision-making at all levels of ORD. It also will facilitate effective planning that provides maximum leverage of ORD's resources. This will help ORD conserve resources and become more cost-effective.

- **Enhanced accountability**. Enhanced management of ORD scientific, management, and financial information will provide an essential foundation for transparency and accountability to stakeholders. Also, better documentation of ORD's data holdings will improve the defensibility of ORD and EPA decisions.

- **Enhanced employee understanding and satisfactions**. By publishing the ORD employee handbook and other key resources on-line, ORD can better guide employees through its processes and organization. Also enhanced IM will provide ORD employees with tools and information that offer important opportunities for improving performance and efficiency.

Section 4: Strategy for Managing ORD's Information

EPA must have the ability to collect, process, and analyze the information needed to ensure that it is managing for and achieving real environmental results.

EPA's Five-Year Strategic Plan: The New Generation of Environmental Protection, U.S. EPA, July 1994.

Intoduction

This section describes ORD's four-part strategy for managing its information that is based on several fundamental tenets of successful information management (Figure 4-1):

- **Planning** for information management.
- Making potential users **aware** that information exists.
- Making the information **accessible** to users.
- Making the information **usable.**

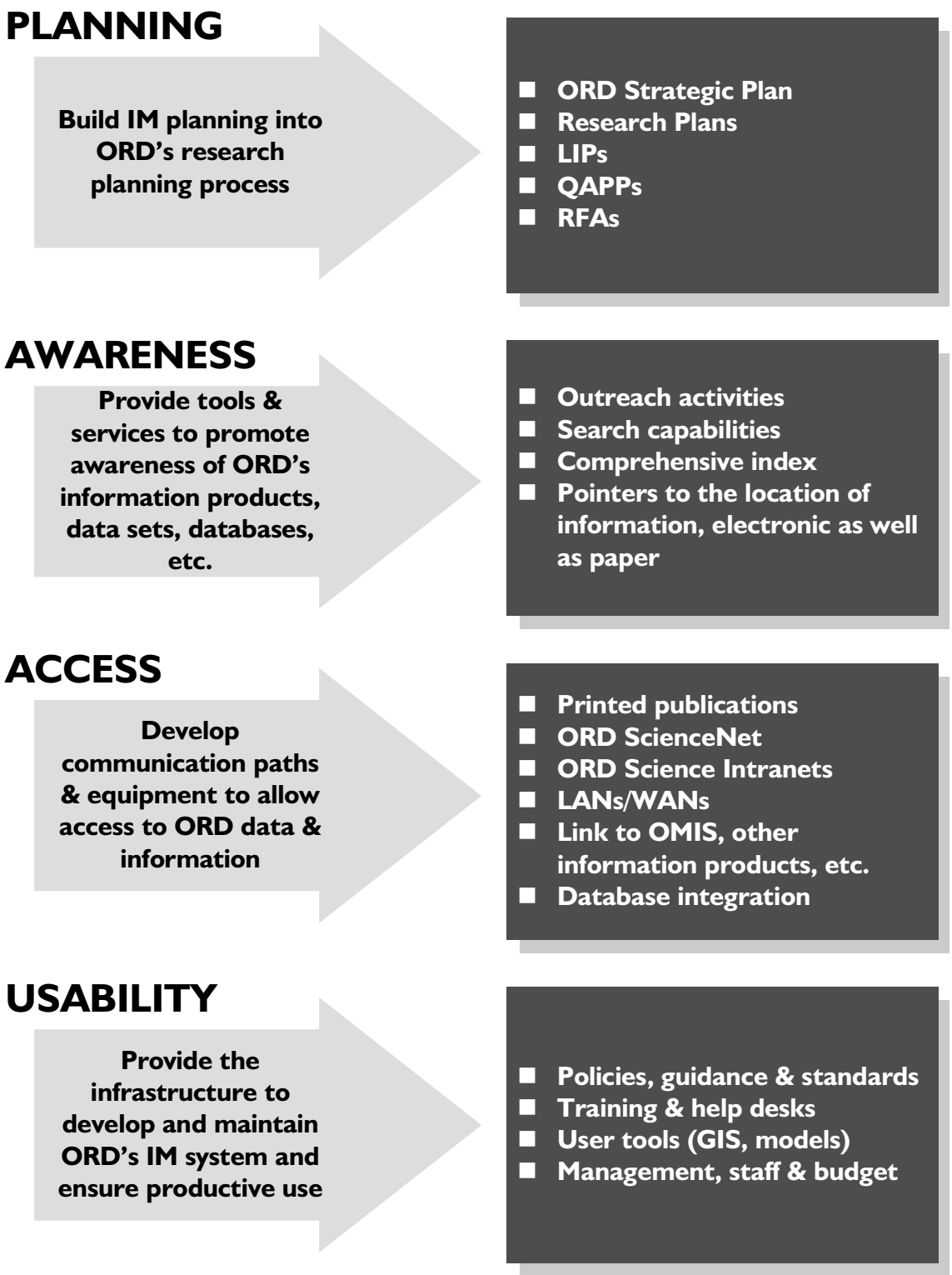
Described in this section is an approach for information management that:

- Will meet ORD's information management needs (described in Section 3) using a comprehensive approach that addresses: both paper and electronic information; research planning; science data management; policies and standards; user needs and support services; and electronic information technologies.
- Takes advantage of the unprecedented information technology opportunities now available.
- Provides a consistent, organizationwide approach to enable ORD to efficiently plan for, collect, document, archive, manipulate, and distribute scientific and management information—including the information generated by both intramural and extramural research.
- Builds on and integrates ORD's existing information capabilities—including tools, services, communication paths, communication equipment, and standards.

Strategic vs. Implementation Plans

ORD's plan for information management is presented in this document at a strategic level, focusing on the *direction* ORD intends to take, not *specifically how* it will be accomplished. Specifics will be left, for the most part, for implementation plans that will be developed and coordinated across the organization by the ORD Science Information Management Coordination Board (Section 1). These implementation plans will spell out exactly how ORD will execute this strategy.

Figure 4-1. Strategic Approach.*



* ORD's information management strategy is not an "Internet plan"—it is a comprehensive approach that addresses "paper-based" and electronically stored information; research planning processes; science data management; administrative information systems; policies and standards; and user needs and support services—as well as information technologies.

However, a few specific implementation items are included in this Strategic Plan, either to provide concrete examples so that the reader has a better understanding of the issue being discussed, or because noteworthy progress has already been made in a certain area.

Planning: Strategy Component 1

As mentioned in Section 1, ORD currently has in place a strategic planning process that determines the highest priorities for intramural and extramural research based on risk assessment and risk management principles. This process was finalized in 1996 and published in the *Strategic Plan for the Office of Research and Development*. The 1997 edition of the Strategic Plan was issued in the spring of this year, and now includes information management considerations.

The vast majority of the data and information that ORD will make available under this IM strategy stems directly from the process and products of ORD research. Therefore, as described below, planning for information management must become an integral part of ORD's research planning process.

ORD's Strategic Planning Process

ORD's risk-based planning process is described in Appendix B. The process involves soliciting stakeholder input, identifying potential research topics, evaluating these topics to select the most appropriate ones for ORD's research agenda, and then defining specific research needs for the selected topics.

Once ORD has identified specific research needs, ORD staff develop a series of planning documents, including Research Plans, Laboratory Implementation Plans, Quality Assurance Project Plans, and Requests for Applications (see the section after next for more detail). Research then is conducted based on these plans. The research products are delivered to stakeholders and provide input into the next strategic planning cycle.

Planning for Information Management

Three considerations are paramount if ORD is to successfully integrate IM planning into the research planning process:

- **Begin IM Planning Upfront—**Information management planning should commence *as soon as ORD has identified its specific research needs.* This is the optimal point for ORD to begin planning for the data and information that will be generated by the specific research projects.
- **Include a Budget for IM—**ORD management and budget decisions must be made *considering the entire research project*, from data collection through long-term archiving of data sets.
- **Consider All Research Types—**Information management planning must, to differing degrees, encompass *all* ORD research projects, including in-house research and extramural research that ORD funds with contracts, cooperative agreements, and grants.

Information included in Appendix B describes the portions of the overall ORD research planning process that should involve planning for information management.

Examples of IM Planning Questions to Consider at All Stages of ORD Research Planning

- What is the purpose or use for which the data were collected?
- What data quality indicators were met supporting the data quality objectives?
- How much data will the program/project generate?
- Who and where are the data users?
- What are the possible long-term archival uses?
- Is there an archive ready to accept and handle the data?
- Who will set standards, delivery requirements, milestones, etc.?
- Who will deliver, document, manage, and distribute the data?
- Are data sets part of deliverables or products for ORD partners or clients?
- What are the requirements for added-value processing? What computing, data management, distribution capabilities are needed? Where do these capabilities reside?
- Who will budget for IM and who will allocate resources among participants?
- How will evolutions in IM technology be accommodated over the life of the project (this question is particularly relevant for long-term projects that extend over many years)?
- Who will set the policy on data access?

When planning for information management, ORD should be guided by the awareness, access, and usability principles (described below) of this IM strategy. In other words, ORD research planners should consider not only what information the research will generate, but also how best to:

- Make potential information users (including clients and stakeholders) aware that the information exists.
- Describe, organize, and display the information so that it will have maximum accessibility and utility to users.

This involves considering who will use the data and how, defining a schedule and resources for IM activities, finding the appropriate "home" for the information, and establishing standards and access policies. The text box on page 19 provides examples of the types of questions ORD managers should address when planning research.

Integrating IM Planning Into ORD Research Planning Documents

During research planning, ORD develops several types of documents that set forth the scientific questions to be addressed and specify schedules, milestones, resources, quality assurance, peer review requirements, and so on. These include:

- *ORD Research Plans*, which provide a broad, overall context and strategic direction for ORD research projects/programs.
- *Laboratory/Center Research Plans*, which are prepared by ORD's National Laboratories and Centers as planning tools to identify, prioritize, and justify their overall research programs.
- *Division and Cross-Division Research Plans,* which define, prioritize, and justify the research program to be conducted by a single division within an ORD Laboratory or Center or by multiple divisions collaborating within or across ORD Laboratories and Centers.
- *Laboratory Implementation Plans*, which provide detailed information on discrete tasks for use by ORD in planning and managing research conducted in-house or under a contract or cooperative agreement.
- *Quality Management and Quality Assurance Project Plans (QMPs & QAPPs),* which include sections on assuring the appropriate type and quality of scientific and engineering data.
- *Requests for Applications (RFAs)*, which invite research grant applications from the external scientific community in areas of special interest to EPA's mission.

Figure 4-2 shows the relationship of these ORD planning documents.

To ensure coordinated information management within ORD, each of these documents should explicitly specify how the data and information to be generated by the research will be managed. Upfront information planning will help ensure that the results of ORD research are captured and disseminated efficiently, rapidly, and as broadly as is appropriate in a way that will be most useful to science data users. Appendix B describes specific recommendations for each type of ORD research planning document.

QA Program Interface

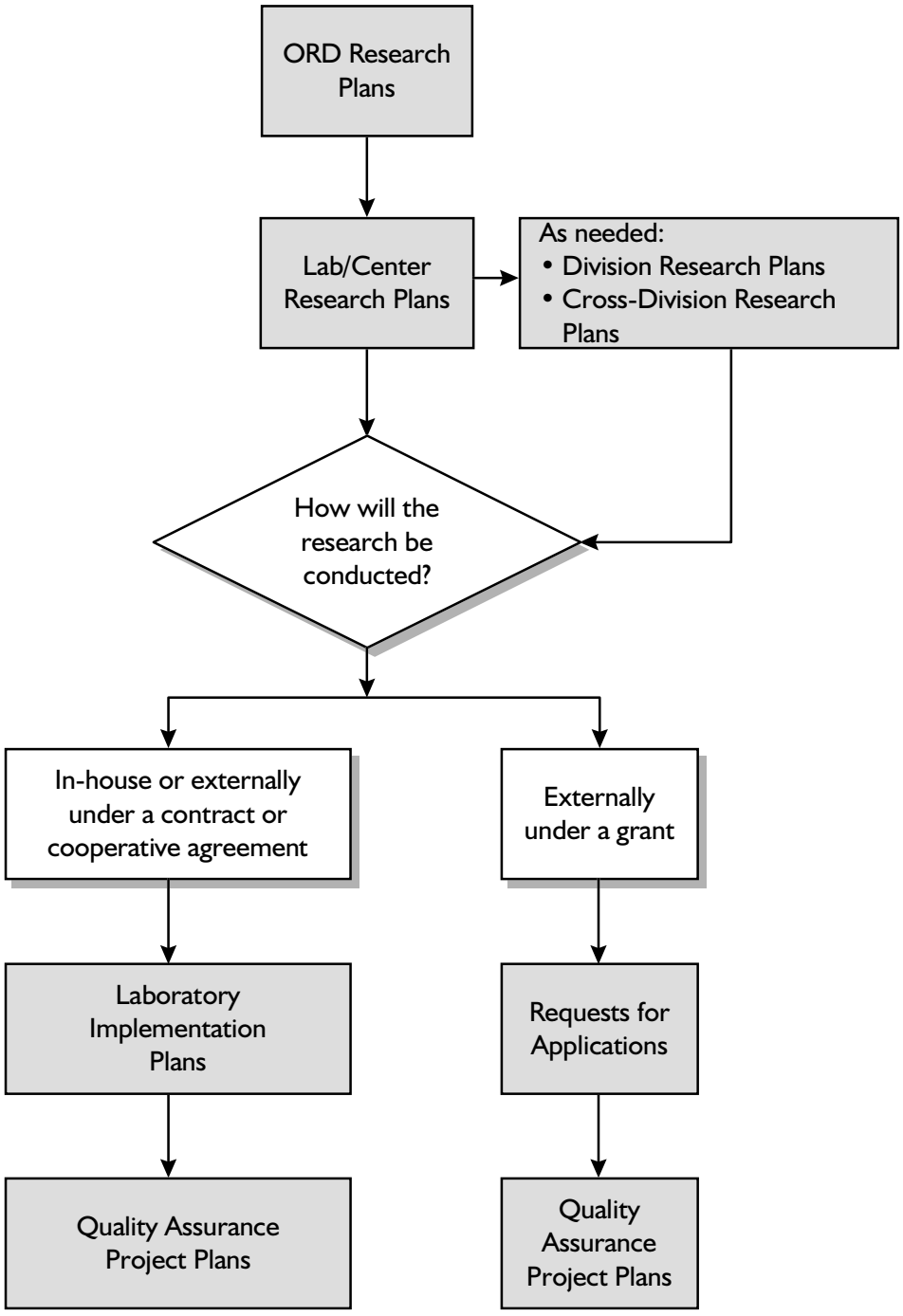
Attention to quality cannot be overstated, particularly in the context of IM planning. The existing EPA Quality System provides a framework and structure by which environmental programs produce results, including environmental data, that are of the type and quality needed and expected for their intended use. This is an Agency-wide, mandatory quality assurance program that includes all EPA intramural and extramural environmental data collection activities.[1]

Under Delegation of Authority-I-41, "Mandatory Quality Assurance Program," ORD is the focal point in the Agency for quality management system policy. The Assistant Administrator for Research and Development (AA/ORD) is designated as the Agency Senior Management Official for Quality Management. The Quality Assurance Division within ORD's NCERQA effects these responsibilities by developing quality assurance (QA) and quality control (QC) requirements and by overseeing Agency-wide implementation of the EPA Quality System.

Utilizing this Agency-wide system, ORD organizations implement approved quality management plans (QMPs) documenting their quality policy and quality system for applicable environmental programs. Quality systems include roles and responsibilities and processes for handling of documents and records and computer hardware and software.

[1]Environmental data include any information collected or produced from measurements, analyses, or models of environmental processes or conditions, or from experimental systems representing such processes and conditions, including results from laboratory analyses.

Figure 4-2. ORD Research Planning Documents



*Each organization has its own quality assurance system, with its policies, procedures and structure described in its Quality Management Plan.

Approved Quality Assurance Project Plans (QAPPs), or equivalent documents defined by the organization's QMP, are implemented for all applicable projects and tasks involving the collection or use of environmental data. QAPPs define and document the type and quality of data needed for the project and how specific QA and QC activities will be implemented and assessed during a particular project. Data management and handling of documentation and records are also elements defined in a QAPP. EPA QA/R-5, "EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations," specify the QAPP data management requirements, which include:

- Describe the project data management scheme, tracing the path of the data from their generation in the field or laboratory to their final use or storage.
- Describe or reference the standard record-keeping procedures, document control system, and the approach used for data storage and retrieval on electronic media.
- Discuss the control mechanism for detecting and correcting errors and for preventing loss of data during data reduction (i.e., calculations), data reporting, and data entry to forms, reports, and databases.
- Identify and describe all data handling equipment and procedures to process, compile, and analyze data. This includes procedures for addressing data generated as part of the project as well as data from other sources.
- Include any required computer hardware and software and address any specific performance requirements for the hardware/software configuration used. Describe the procedures that will be followed to demonstrate acceptability of the hardware/software configuration required.

The guidance document "Technical Guidance G-5 Data Management Appendix" (EPA QA/G-5) provides additional guidance on the range of scientific and technical operations that involve generating, collecting, manipulating, and archiving environmental data.

Centralized Coordination of Data Management

The new ORD Science Information Management Coordination Board will give more detailed consideration to data collection, quality checking, and archival issues, including the possible role of a centralized data management function for ORD, such as that performed by NASA's National Space Science Data Center and NOAA's National Geophysical Data Center.

Awareness: Strategy Component 2

ORD has long utilized traditional outreach mechanisms (announcements, newsletters, publication lists, etc.) to make potential users aware of its publications. Under the awareness component of this IM strategy, ORD will add to its outreach portfolio electronic outreach via the Internet. Internet outreach will enable ORD to greatly expand:

- The number of people within and outside the Agency who are aware of ORD information resources.
- The information resources they are aware of—since the Internet offers the opportunity to readily create and update comprehensive, searchable directories of available information resources.[2]

Specific electronic outreach activities will include:

- Registering "ScienceNet"—ORD's home page and "front door" on the Internet—with search services that then will direct interested users to ORD's home page. (The "Access" section provides more information on ScienceNet.)
- Listing ScienceNet's Internet address in all printed ORD publications.
- Establishing links *from* ScienceNet to other appropriate Internet sites and working to establish links *to* ScienceNet from these sites.
- Establishing effective search capabilities and links within ScienceNet so that users who access ORD's home page will clearly know what types of ORD information resources they can access and how.

As described in the "Access" section, some information, such as draft reports and peer review documents, will be made available to selected EPA personnel and external partners under the ORD-wide Intranet or a special-purpose Intranet. For these items, ORD will conduct more targeted electronic outreach, via such mechanisms as electronic mail and brochures, to notify the appropriate audiences when the material becomes available.

[2] "Available information resources" can include a wide range of information, such as electronic and hardcopy information, ORD and external information, and data sets, databases and information products.

ORD also will take steps to increase awareness among ORD staff of how to use the Internet as a powerful research tool. Finally, ORD will conduct outreach to publicize to ORD clients and stakeholders the fact that ORD will be strategically managing its information and making it available to them.

Access: Strategy Component 3

ORD will continue to utilize some of the traditional mechanisms for providing access to information—for example, the Air and Radiation Docket, which enables individuals to inspect and make copies of documents—many of which have been in place for some time. Now, the Internet and other state-of-the-art information management technologies make it possible for ORD to:

- Greatly expand who has access to ORD information, how rapidly they can access it, and how much information they have access to.
- Tailor access to specific users or groups as appropriate for certain types of information. This tailoring is achieved by establishing limited access networks, called Intranets, that can be used to facilitate electronic information exchange among targeted groups or individuals both within and outside ORD.

Under this IM strategy, ORD will take full advantage of these possibilities by using the Internet (and specifically the World Wide Web) as the primary vehicle for enabling access to ORD data and information. Specifically, ORD will develop a coordinated information network that provides electronic access to its data and information through three mechanisms:

- An ORD ScienceNet (i.e., ORD's home page) that will be accessible by *all EPA employees and the public* via the Internet.
- A series of Science Intranets that restrict access to *specific users* who may include selected EPA staff, ORD staff, and authorized partners.
- Local and Wide Area Networks (LAN/WANs), which will be established for *specific ORD user groups*.

These components of the ORD information network are illustrated in Table 4-1 and described below.

ORD ScienceNet

As the "front door" to ORD's public scientific information, the ORD ScienceNet will be designed to provide a lively, exciting view of ORD's research. Through ScienceNet, users will have access to the published results of ORD research, which include printed documents, reports, and journal articles, as well as databases, data sets, models, and software applications (Figure 4-3).

Using a variety of tools (see the "Specialized Tools" section) available via the World Wide Web, users will be able to access, search, and download this information, as well as aggregate, manipulate, and analyze downloaded data. The ability to aggregate data may particularly aid environmental decision-makers, who often must synthesize large amounts of information during the decision-making process. For scientific data, users will be able to access metadata that describe the context and assumptions under which the data were collected (see the "Specialized Tools" section). Also, users will be able to link from the ScienceNet website to other information or scientific databases (such as STORET and Envirofacts) via hypertext links.

ScienceNet will supplement and, where appropriate, replace some of the more traditional delivery mechanisms (such as mailing hard copy) that ORD has historically used to disseminate information to the scientific community and the public. This will increase the effectiveness of ORD information dissemination, while lowering the cost.

One goal for ScienceNet is that it serve as a model and catalyst for creating two larger scientific information networks:

- An EPA-wide ScienceNet that would include the ORD ScienceNet.
- A broader U.S. ScienceNet developed collaboratively by EPA and other federal research agencies that would include EPA/ORD ScienceNet as one of many components.

ORD Intranets

ORD will develop a series of Intranets to share its internal scientific, management, and administrative information among EPA and ORD personnel. Intranets use the Internet to network computers together. Access is limited to those individuals whose computers are on the Intranet network. By using the Internet, Intranets circumvent the user incompatibility problems that may occur with

Table 4-1. ORD's Information Management Network

Network Component	What Information Will Be Available?	Who Will Have Access?
ORD ScienceNet	ORD information appropriate for release to the public. For example, users will be able to access published reports, data sets/databases, and grant & fellowship information.	All EPA employees and the public
ORD Intranets		
EPA-Wide Intranet	ORD information appropriate for use within the Agency. For example, EPA programs will have ready access to draft research plans and can comment electronically.	All EPA personnel
ORD-Wide Intranet	ORD information appropriate for distribution within ORD. ORD currently has an Intranet established for use by ORD employees.	ORD staff and authorized EPA and external partners
Special-Purpose Intranets	ORD information relating to specific research projects or groups within ORD.	Specific groups within ORD
ORD LAN/WAN Access	ORD electronic mail and specific administrative functions, such as OMIS.	All ORD staff

LANs—such as incompatibility between PCs and LAN software. The ORD Intranets will have two important purposes:

- First, they will provide access to materials that are either not relevant or appropriate for broader public access. These include:
  - Draft documents not yet cleared for public access.
  - Internal databases.
  - Administrative information in ORD's Management Information System needed for accountability, performance, and results tracking.
- Second, the ORD Intranets will provide a valuable mechanism for facilitating internal ORD processes that require a high degree of coordination—such as developing risk assessments, peer review, project collaboration, and coauthoring or reviewing draft documents. Temporary and permanent ORD Intranets can be established to accommodate these needs.

To fulfill these two purposes, ORD will establish two types of Intranets:

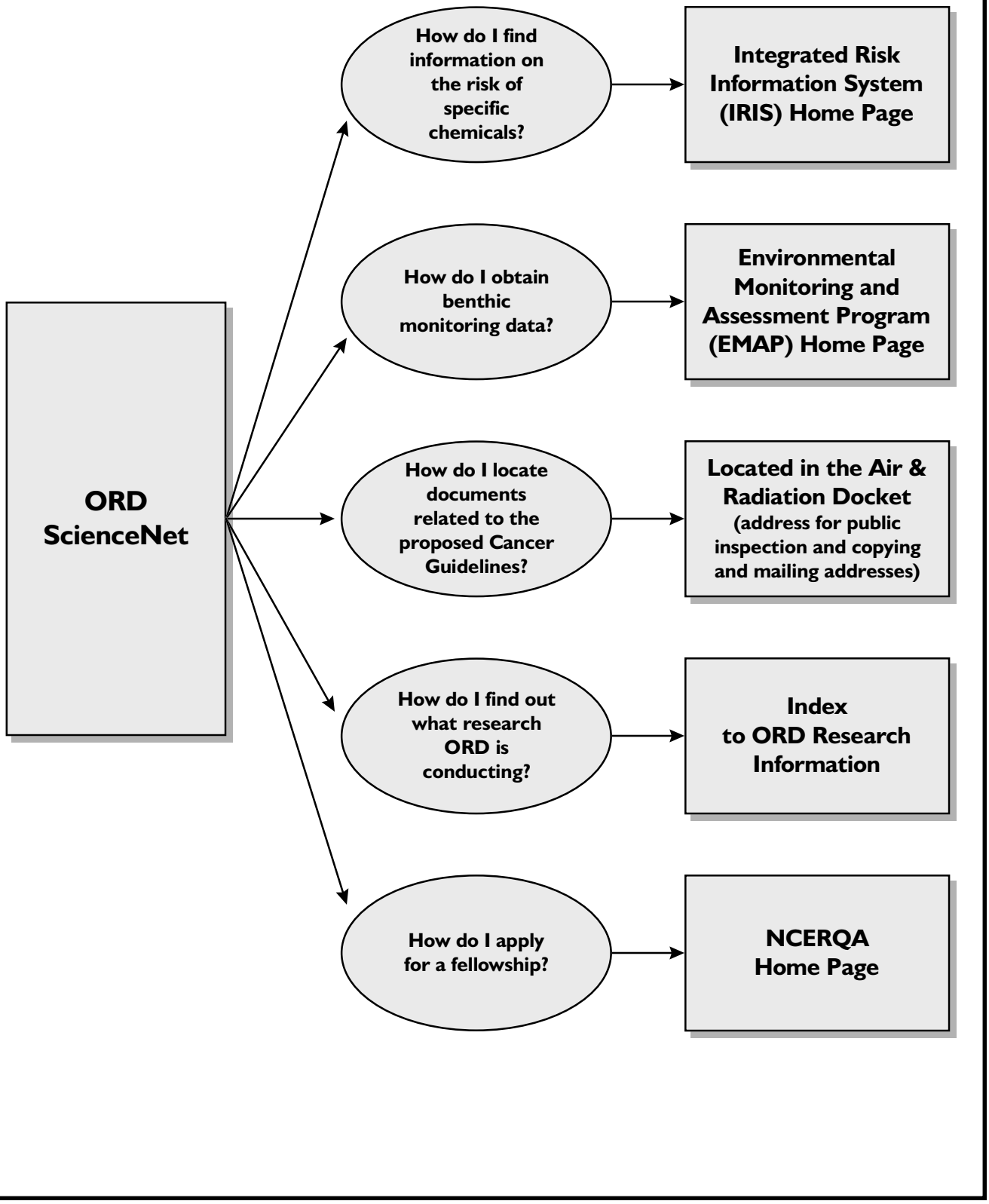
- A permanent ORD-Wide Intranet restricted to ORD staff and authorized EPA and external partners. This Intranet has already been established.
- Special-purpose Intranets to serve the particular communication and coordination needs of specific ORD groups, including established groups (such as a particular ORD Laboratory or Center) and ad hoc groups that exist for limited periods to conduct specific projects. Special-purpose Intranets will be created on an as-needed basis. They may be permanent or temporary.

The Intranets essentially will replace some of the current uses of ORD's LAN/WAN systems. To make the transition to Intranets as efficient, effective, and user-friendly as possible, the Intranet capabilities will build on and integrate the current LAN/WAN systems.

LAN/WAN

In recent years, ORD's LAN/WAN systems have served as the primary venue for internal ORD communication. LAN/WAN information transfer is primarily accomplished by a gateway server that transmits information via dedicated lines to servers

Figure 4-3. The ORD ScienceNet



at various ORD laboratories and/or via the Internet to targeted recipients.

As mentioned above, ORD will shift certain LAN/WAN uses to the Intranet where the latter approach offers important advantages. However, where it does not, ORD will continue to use, and will enhance as appropriate, its existing Local and Wide Area Networks. Future uses envisioned for the LAN/WAN systems include:

- Electronic mail and groupware such as Lotus Notes.
- Various scientific and administrative software applications such as GIS, visualization, and statistical tools that are not yet Internet enabled.
- Certain administrative and management functions, such as OMIS.

Status of Access Components

Internet Operating Plan
Development of ORD's electronic information network is well underway. ORD's National Risk Management Research Laboratory in Cincinnati, Ohio, is finalizing an Internet Operating Plan that defines the resources, policy oversight, and services ORD will need to achieve its electronic information access goals—including development of the ORD ScienceNet and the ORD Intranets. The Internet Operating Plan will form the basis for ensuring that the ORD ScienceNet and Intranets are state-of-the-art information management systems supported by up-to-date telecommunication and other transmission equipment.

Development of ScienceNet
In addition to the operating plan discussed above, ORD will inventory current electronic products already created by ORD staff and determine which should reside on or be linked to on the ORD ScienceNet. Candidates for ScienceNet include ORD-relevant databases (an inventory of these databases is provided as Appendix C) and the home pages that already have been created by many ORD groups.

Status of OMIS Implementation
This action also is well underway. By the end of FY97, OMIS will hold complete and organizationally consistent information on ORD research projects and tasks, commitments, obligations, and expenditures; grants and contracts; and training plans. This information will be updated on an annual basis. Currently, ORD staff access OMIS via the ORD's LAN/WAN system. One action item for OMIS is to decide whether to shift OMIS access to the ORD Intranet. This decision will be made after evaluating the potential benefits of such a change.

LAN/WAN Maintenance
LAN/WAN systems already are well established at ORD. ORD will continue and, where appropriate, enhance their use to support electronic mail, some administrative and management functions (e.g., OMIS), and limited file sharing (O-drive) capabilities.

Incentives for Sharing Data

In addition to expanding access to information through better use of information technologies, ORD will promote an organizational culture of sharing data. Examples of how ORD will more strongly encourage this include:

- Establishing an internal reward system for researchers who publish data sets.
- Developing a policy that affords researchers a certain time period for data collection, analysis, and publication, after which the data will be generally available to others.
- Requiring that milestones for data delivery be included in ORD Research Plans.
- Requiring that an external grant-holder submit data collected during the research project, along with appropriate documentation, for subsequent use by other researchers.

As part of its implementation planning, the ORD Science Information Management Coordination Board will expand on these four examples and fully address how ORD should establish mandates and incentives for individual researchers and programs to make their data and information generally available.

Usability: Strategy Component 4

Usability—making sure that the access system as well as the data and information provided by the system are usable to internal and external users—is vital to the success of this IM strategy. This is true for ORD's traditional access mechanisms as well as the more recent electronic ones. To optimize usability ORD must:

- Design the information access mechanism/network to meet users needs (described in Section 3) in as complete and efficient as manner as possible.

- Provide the infrastructure and support to enable ORD staff to place important information on the system in a timely manner, manage the information, and effectively utilize the hardware and software components of the system.
- Ensure that adequate documentation can be obtained so that ORD data and information that is located and retrieved is also usable.

Though a robust infrastructure will require investment, the potential returns are substantial. As discussed in Section 3, a well-functioning information management system will greatly enhance ORD's internal functions and external profile.

Usability involves a number of components:

- Security and access control.
- Training.
- Standards.
- User support services.
- Navigational aids.
- Policies.
- Specialized tools.
- Specialized information resources.

These components are discussed below. The following text box on "Cars and Information Systems" provides insight into why they are important.

Security and Access Control

Security measures guard against hackers who seek to tamper with information and damage information systems. *Access controls* ensure that only authorized users can create, read, modify, and delete information. Access control is particularly important for sensitive information, such as personnel and budget data.

A well-managed and adequately staffed security and access control program is essential to safeguard the integrity of the information and data that will be housed in ORD's system. Without these safeguards, ORD would be vulnerable to accidental and deliberate disruptions to its ability to use its information. Such disruptions can be very expensive.

Using guidance from EPA's Office of Information Resources Management, ORD will perform an in-depth security risk assessment that covers all ORD data centers. Based on the outcome of this assessment, ORD will take the required steps to ensure the integrity of its data collection. These steps will include:

Of Cars and Information Systems: Why Usability is Important

Driving a car provides a useful analogy for why usability is vital to a successful information system. Just as drivers need far more than cars to reach their destinations, information consumers need far more than technology (hardware and software) alone to successfully access and use information. In both cases, success depends on a robust infrastructure:

- **Security and access control/permission.** Automobile drivers need "permissions" to drive—insurance, registration, driver's licenses, etc. Computer users need analogous permissions, such as valid software licenses and authorizations to create, read, modify, and delete appropriate categories of information.
- **Training.** Computer users need their own version of "driver's ed": a well-conceived training program that teaches them how to use their information technology efficiently and take advantage of new software applications.
- **Standards and policies.** Standards establishing rules of conduct are crucial for safe and pleasant driving. Likewise, baseline standards and policies for information technology are important to make users' experiences predictable, productive, and even pleasant. For example, ORD users would benefit from clear and concise policies about sharing data and information, security practices, and training.
- **User support services.** Drivers need support services, including service stations and other facilities, to help them when they require assistance. Similarly, computer users need user support services to help them when their computer "breaks down" or when they get "lost" in cyberspace.
- **Navigational aids.** Drivers need navigational systems, including signs, signals, and maps, to help them reach their destination efficiently and safely. Information users need equivalent aids to help them navigate around information resources. These may include, for example, metadata that explain how information was developed and aid understanding of how it can be used and standard mechanisms to help users understand where they are and how to "go home."

- Developing security policies, procedures, and standards that leverage security documentation and tools already used by the Agency.
- Investigating tools that can aid ORD in meeting its security objectives in a client/server and Internet environment.

Training

ORD traditionally has relied on Agency-sponsored training on discrete topics. Training sessions have tended to use conventional formats, such as topic experts training relatively small groups. This approach has limitations. In particular, it tends to create a situation where the educational needs of ORD staff are met sporadically and inconsistently.

For information management, ORD needs a comprehensive, coordinated, and strategic approach to training to ensure that:

- *All* staff receive training in basic skill areas necessary for information use.
- More specialized training in a timely manner is available to those who need it.

To achieve these goals, ORD will expand its portfolio of training approaches to include computer-based training, video conferencing, and outsourcing training. Also, ORD will develop and deliver to ORD staff:

- An ongoing training and certification program for core competencies in the basic ORD information environment.
- As-needed training for higher levels of expertise in key areas such as GIS and risk assessment.

Standards

ORD will search out and adopt appropriate information management standards at the highest level applicable, for example, those developed and promulgated by ISO, ANSI, and NIST. When appropriate standards do not exist, ORD will develop them to ensure that its information is usable. For scientific data, standards will include descriptive information about the data (metadata). For example, ORD staff will be better able to utilize archived scientific data for future research if they have access to metadata they can use to evaluate the quality, relevance, and practical utility of the archived data (see also the "Specialized Tools" section).

Currently, descriptive elements and quality assurance codes established in 1987 under the *EPA Standards for the Electronic Transmission of Laboratory Measurement Results* (EPA Order 2180.2) are the only scientific metadata requirements available. These requirements will be updated, expanded to cover field data, and made consistent with ORD record retention schedules.

The Agency has a number of other standards that address various aspects of information management:

- Uniform Rulemaking Docket Manual.
- Facility Identification Standard.
- EPA Hardware and Software Standards.
- Security Audit Standards for LANs and PCs (i.e., Enterprise Security Manager).

These standards will be updated as needed to respond to the additional needs of ORD's new information management approach.

User Support Services

ORD users will need support services to help them when they have questions or encounter difficulties. Since user needs will vary considerably, ORD will develop a broad spectrum of service response mechanisms as it implements this strategic plan. Examples of the types of support services ORD may provide to its users include:

- *An electronic "HELP" menu* to assist users by topic area—much like the help menu in a software package. The help menu will be included as an integral component of directories, catalogs, and dictionaries (see the "Specialized Tools" section).
- *An electronic mail and/or telephone hotline*, staffed by IM specialists to aid users in locating, accessing, collecting, and analyzing data. When developing the hotline, ORD will research current EPA hotlines to identify appropriate models for the IM hotline.
- *A published (electronic) inventory of ORD IM specialists* and their respective areas of expertise, as well as extramural data processing and analysis mechanisms available to Agency users.

Navigational Aids

ORD information usability will benefit from a navigational framework that includes standard mechanisms to help users understand where they are in information space, how to "go home," how to get "help," and so on. For key information areas,

such as risk assessment, the equivalent of "tour guides" may prove very useful for helping ORD researchers understand how they can apply these information resources in their work.

ORD will integrate into ORD ScienceNet a navigational framework that includes standard web search engines and the ability to easily browse ORD's information (Figure 4-3). The ScienceNet also will contain a "highlights" section that will focus on novel applications of IM technologies in environmental research, many of which will come from ORD's own research programs.

In addition, ORD will develop topic search agents that ORD staff can use to automatically search the Internet and locate information pertinent to their research.

Policies

Appropriate policies are crucial for fostering information use. ORD may want to establish a policy encouraging the sharing and publication of information, based on a reward system for researchers who publish data sets. Another simple example involves "credit and control." Information suppliers want credit for the information they supply, typically in the form of appropriate citations and acknowledgments comparable to the norm in scientific publications. Similarly, they want to feel they have some control over how the information they supply is used. These issues can be addressed by simple policies that promote adequate documentation of:

- Data sources and contacts.
- The purpose for which the data were collected.
- The documented quality of the data.
- The fact that the data were validated as appropriate for the intended use.

The federal government, EPA and ORD currently have a number of policy and guidance materials for using ORD information systems, including:

- IRM Policy Manual (2100).
- IRM Privacy Act Manual (2190).
- System Design and Development Guidance.
- EPA Operation and Maintenance Manual.
- Records Management Manual.
- Enterprise Technology Services Division (OIRM/ETSD) Operational Directives.

While these policies are largely sufficient in their current form, not everyone in ORD is familiar with them, and overlap and conflict among all of these policies undoubtedly exists. ORD will first reconcile differences and fill gaps in the policy and guidance materials and then widely disseminate them among its staff through training programs. It will provide regular oversight and support to ensure that these policies are implemented.

Specialized Tools

Some ORD information users will need specialized tools that synthesize, analyze, and display data and information to generate new information and knowledge. Key tool categories include:

- Geographic Information Systems.
- Statistical tools.
- Computer models of all sorts (including those needed for risk assessment and risk management).
- Visualization systems that help users visualize what data mean.

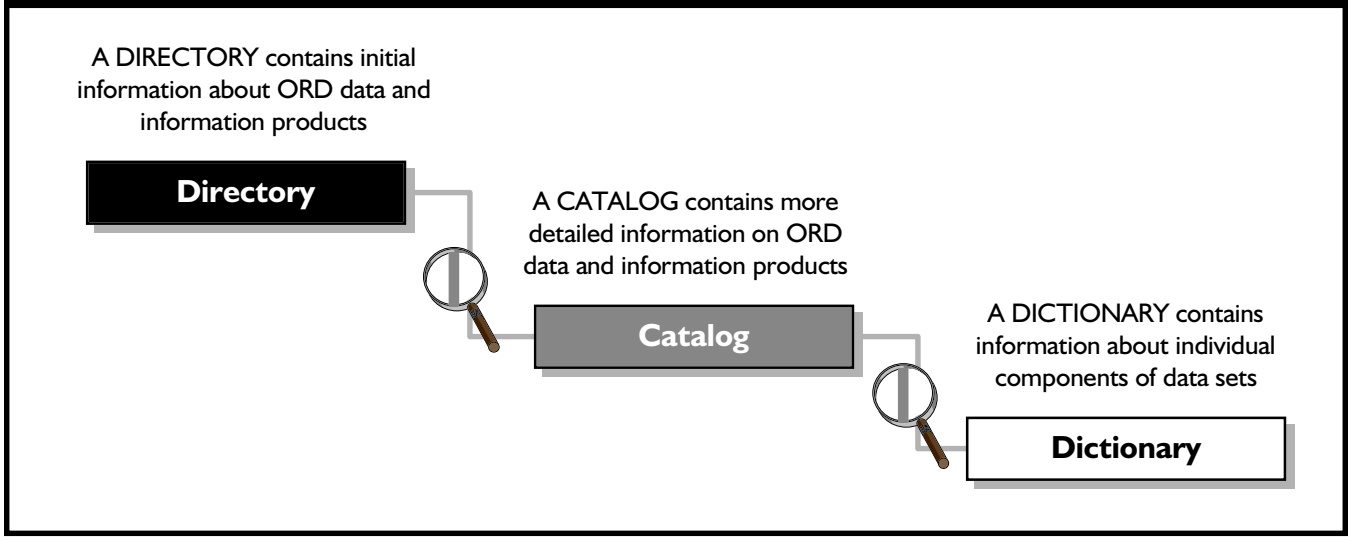
ORD will identify priority needs for these tools and make sure they are available to ORD and external users who need them.

One particularly noteworthy tool that ORD will provide to make its science data more usable is a searchable "directory/catalog/dictionary" database system that will be available on the ORD ScienceNet. From the ScienceNet, this database tool will enable any user to rapidly search ORD's science data collections, identify data relevant to the user's particular need, understand its constraints, and determine whether it is useful for the user's purpose. The directory, catalog, and dictionary components of this system are illustrated in Figure 4-4 and described below.

Directory
The ORD *directory* will consist of a database containing information about the scientific information products produced by or relevant to the ORD mission. Types of information products include data sets, databases, models, projects, analytical products, and documents.

The ORD data directory will provide sufficient information to enable ScienceNet users to determine which of the available ORD science data products (or objects) may be relevant to their needs. For each product (or object), the directory will provide information on:

Figure 4-4. Components of a Searchable Database (the DCD System) that Will Describe the Information Available on ORD ScienceNet



- Why the data were collected.
- Who collected the data.
- Where the data were collected.
- How they were collected.
- When they were collected.
- The format of the data set.
- What fields the data set includes.
- Other information as appropriate.

Catalog
The ORD catalog provides an evaluation mechanism to assist consumers in deciding if a product, such as a model or data set, will be useful in meeting their needs. The ORD catalog will provide detailed information on:

- The general purpose for which the data were collected.
- The originator of the data.
- Sampling and laboratory methods.
- Descriptions of the data and any manipulations or transformations of the data.
- Related quality control/quality assurance measurements.
- Procedures necessary for data access.
- References to publications that use the data set.

The level of detail provided in the ORD catalog will allow most data users to decide whether the data are adequate for the intended use.

Dictionary
A dictionary provides a further level of detail for science data users: descriptive information about *individual fields or attributes* in data sets and databases. This is in contrast to the directory and catalog that relate information to entire data sets (as well as other types of information products).

Status of DCD System Implementation
ORD's National Center for Environmental Assessment currently is assisting EPA Region 10, the Office of Water Surf Your Watershed program, OIRM's Envirofacts, and ORD NERL in developing and implementing a directory, catalog, and dictionary (DCD) system called the Environmental Information Management System (EIMS) to manage environmental data relevant to assessment activities. These systems are currently operational.

The EIMS is being evaluated for use as an Agency-wide metadata management system. The ORD EIMS will be available to users through the World Wide Web and will have the following capabilities:

- The *directory* and catalog have both update and browse capability.
- The *catalog* will provide detailed information on the quality of data sets, the methods employed to create the data sets, and other information consumers can use to determine the appropriateness of the data for their purposes.

- The *dictionary* will provide information for all fields within the ORD data set and database collection. It will be fully integrated and nonredundant with the directory and catalog.

To be successful, ORD's DCD system must be supported by a strong data administration program that establishes:

- What documentation ORD staff should provide to the system.
- How they should provide it.
- Where to provide it.
- When to provide it.
- Who is responsible for providing it.
- Why it should be provided.

ORD will develop data administration policies, standards, and procedures that address these questions and establish consistent ground rules for both contributors and consumers of ORD metadata to follow when populating and using the DCD system.

Specialized Information Resources

Some ORD users will need specialized information resources that come from suppliers outside of ORD and, often, outside of EPA. A good example is remote sensing data. For research themes like ecosystem protection, remote sensing data can provide tremendously improved insights and synergy with other data.

ORD will survey its staff to determine which specialized data resources are needed. Then ORD will work with the providers of these data (such as the National Aeronautics and Space Administration and the National Oceanic and Atmospheric Administration) and use interagency mechanisms (such as the Committee on Environment and Natural Resources and its subcommittees and task forces) to make its needs known. Finally, ORD will prepare a compendium of specialized data resources with information about what they contain and how to access them and distribute the compendium to ORD staff.

ORD Science Information Management Coordination Board

The newly formed ORD Science Information Management Coordination Board, as described in Section 1, will be responsible for developing implementation plans for this strategy and for recommending an appropriate FY 1998 and 1999 budget to support high-priority ORD science information systems infrastructure.

Timing

The need for IM capabilities within ORD is so great that many IM activities or systems already are being implemented by individuals or groups within ORD. This is inherently inefficient because the time and resources to establish these systems independently is far greater than a coordinated effort. Also, the end results often are incompatible with other ORD systems or, at the very least, far less accessible and useful to others than they could be. For example, several large ORD initiatives, such as the Environmental Monitoring and Assessment Program (EMAP), have an urgent need for a coordinated data management system. If ORD does not implement a

Range of IM Needs Among ORD Laboratories and Centers

- The primary mission of ORD's *three Laboratories* is to conduct research. This generally involves collecting and analyzing large amounts of data. The initial users of these data are the ORD and cooperating scientists conducting the research.
- By contrast, the mission of ORD's *National Center for Environmental Assessment (NCEA)* is to provide support for ORD and stakeholder use of risk assessment and conduct risk assessments as a secondary data user. NCEA typically synthesizes data generated by ORD Laboratory research, conducts secondary analysis of this data (e.g., uses it to perform a risk assessment), and disseminates the results to its customers and stakeholders.
- With its grants and fellowship program management, quality assurance, and peer review responsibilities, ORD's *National Center for Environmental Research and Quality Assurance (NCERQA)* has yet another distinct set of information management needs to be able to provide adequate management for ORD's extramural grant and fellowship programs and ensure that the best approaches to environmental data quality and documentation are incorporated throughout ORD.

coordinated IM strategy in the very near future, this program and others likely will be forced to act on their own to stay on schedule with the project goals and milestones.

In general, the more time that passes before an ORD-wide IM system can be created, the greater will be the inefficiencies and the greater will be the cost to integrate existing IM components into a unified system.

External Coordination

Many organizations within and outside EPA are planning for and implementing information management systems for a variety of purposes. The Board will need to be proactive in contacting and communicating with other groups in EPA, with ORD's stakeholders, and with our partners to obtain feedback on this plan before and during implementation and to stay abreast of and coordinate with initiatives, plans, and programs related to our IM efforts. This coordination will be accomplished in part by the outreach activities discussed earlier in this section, which will serve to make ORD's stakeholders and partners within and outside the Agency aware of ORD's IM activities. For example, in the near term, the Board will need to coordinate with EPA's efforts to implement a consolidated planning, budgeting, and accountability system. Also, as described in Section 1, the Board should coordinate with EPA in its efforts to comply with the Information Technology Management Reform Act.

Successful implementation of ORD's IM Strategic Plan will also require substantive input and involvement by all ORD Laboratories, Centers, and Offices. Therefore, during the execution of this plan over the coming years, an effective staffing structure with sufficient management support and resources to operate effectively and responsively will be crucial to ensuring ORD-wide coordination and participation. This is particularly important because ORD is a large organization distributed across the United States (Appendix D), which heightens both the need for and challenges of ORD-wide IM management and coordination.

Each of ORD's five Laboratories and Centers and three Offices currently has its own IM staff (see Table 4-2) responsible for meeting the internal IM needs of its own researchers, managers, and administrative personnel in a way that aligns with its mission. What is currently lacking is a unifying mechanism providing cohesion and overarching coordination among these staff on an organizational level. It is, therefore, recommended that the Board initially look not only at resource needs, but at a staffing structure that will enable ORD's IM staff to more effectively coordinate IM activities across ORD. The challenge for ORD will be to increase coordination, training opportunities, and other support to our scientists and engineers, while avoiding unnecessary bureaucracy.

Table 4-2. Current ORD Information Management Staff*

Organization	Site	Computer Specialist/ Engineer/ Assistant	Information Management Specialist/ Assistant	Technical Information Specialist/ Assistant	Computer Graphic/Visual Information Specialist	Management/ Program Analyst	Scientist, Engineer, or Mathematician
HQ	Washington, DC	4				3	
	RTP, NC	1					
NCEA	Washington, DC		6			1	
	Cincinnati, OH	1		1			
	RTP, NC			1			
NCERQA	Washington, DC		1				1
NERL	RTP, NC	6					
	Cincinnati, OH	1					1
	Las Vegas, NV	2	1		1		
	Athens, GA	1	1				
NHEERL	RTP, NC	10	2		1	1	
	Narragansett, RI	1		1		1	
	Corvallis, OR	1	1				
	Duluth, MN	1				1	
	Gulf Breeze, FL						
NRMRL	Cincinnati, OH	7			1		2
	Ada, OK	1					
	RTP, NC	1					

ORGANIZATIONAL ABBREVIATIONS:

HQ - Headquarters
NCEA - National Center for Environmental Assessment
NCERQA - National Center for Environmental Research and Quality Assurance
NERL - National Exposure Research Laboratory
NHEERL - National Health and Environmental Effects Research Laboratory
NRMRL - National Risk Management Research Laboratory

* Many of these individuals perform duties outside the strict definition of information management, such as responding to Freedom of Information Act requests, producing risk assessments and other documents, managing contracts, and handling review and clearance of products.

Appendix A:
The Information Technology Management Reform Act of 1996 (ITMRA)

A fundamental change in the way government agencies perform the work of information management was signed into law in February 1996. The ITMRA repeals large portions of the Brooks Act and establishes a new statutory scheme for information technology management and acquisition. The ITMRA formally establishes the position of Chief Information Officer (CIO). The CIO must put in place a process to meet new requirements for Information Technology Capital Planning and Investment Control.

The CIO will consider mission accomplishment first in approving major systems, overarching policies, agency acquisition strategies and budget. Policy issues will be resolved *before* major system automating efforts begin.

These new requirements raise several challenges for the Agency to meet the goal of the Act, namely to maximize the value of our investments in information technology while minimizing risks:

- Work Process Reengineering as a prerequisite before investing in automation, along with determining whether processes should even be automated or should be performed by entities other than EPA. If we are going to continue to do the work, we must insure that we automate the best approach to the work.
- Return on Investment, including explicit measures of cost and benefits to be realized, as well as cost avoidance, and least costing option. In many cases, the risk on investment will not necessarily be all quantitative but qualitative as well. Investments will be ranked and prioritized that meet Agency thresholds ($25 million/life cycle, $5 million /year). Questions of aggregation of technology and the application of granularity must be answered.
- Risk Management, including explicit criteria for evaluating risk, leading to relative rankings of the associated risks across IT projects considered for investment.
- Performance Measurement, leading to tracking of systems as being on time and on budget plus meeting requirements objectives. The legislation specifies that the Agency must achieve a 5% reduction in costs due to automation.
- Portfolio Management, including dealing with systems in several stages of life cycle, risk, and cost. Major investments must come before an investment board (i.e., EPA's Executive Steering Committee) with an accompanying Business Case Analysis that will summarize the mission benefit as well as the newly introduced Return on Investment and Risk measures.
- We must define investment and thresholds which includes the ongoing costs of operating systems, all life cycle investment, and at the appropriate level of management, rank and prioritize these systems based upon mission accomplishment.

EPA must merge the existing and new processes to the greatest extent possible to create the necessary Capital Planning and Investment Control process.

Action

ORD must approach each information technology investment as a business case and apply rigorous cost benefit analyses. An Agency-wide architectural

process has begun that will drive home the need for a cultural change. The fundamental change required is that no added costs or time delays to systems may be incurred. We must begin now to:

1. Invest human resources in the Strategic Information Technology Architecture Plan (SITAP) process.
2. Participate in the ITMRA Capital Planning and Investment Control Strategic Project Committee to define the Agency process for capital planning and investment control, determine best practices, and implement the new method of determining information technology investments.

Appendix B:
ORD's Strategic Research Planning Process

As described in Section 1, ORD has instituted a strategic planning process to determine research priorities based on risk assessment and risk management principles. This process was finalized in 1996 and published in the *Strategic Plan for the Office of Research and Development*. This strategic plan established the framework by which ORD determines the highest priority research to which intramural and extramural research efforts are directed.

The risk-based research planning process involves soliciting stakeholder input, identifying potential research topics, evaluating these topics to select the most appropriate ones for ORD's research agenda, and then defining specific research needs for the selected topics. Once ORD has identified specific research needs, plans are developed that define long-term directions as well as the immediate research that will be carried out during the next few years. The ORD laboratories then prepare plans that describe how they will implement the intramural component of the research, and complementary solicitations are prepared for extramural research that will be carried out by universities and other research institutions. Research is conducted based on these plans; the research products are delivered to stakeholders and provide input into the next strategic planning cycle. Steps in the research planning process include:

Obtaining EPA and Stakeholder Input. The first step in ORD's research planning process involves seeking input from all parts of EPA (including ORD and the EPA Program and Regional Offices), as well as external stakeholders, to identify the most important and relevant areas for our research efforts. At this stage, we also consider the status and results of our recent research activities. Based on this information, we identify potential research topics.

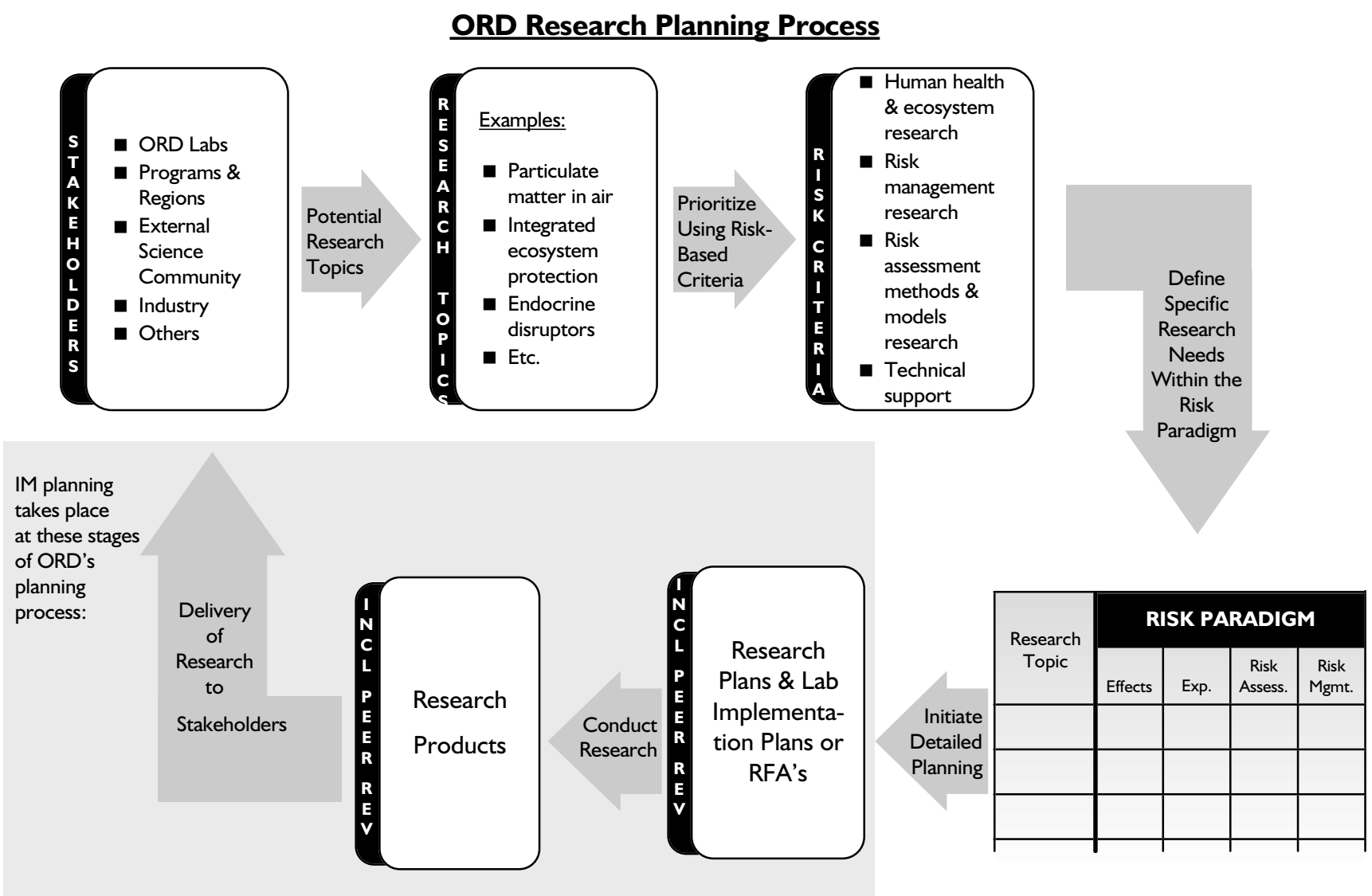
Selecting Research Topics. We narrow the pool of potential research topics by retaining only those that are either within ORD's mission or clearly mandated. To the mission-related topics, we apply a series of human health, ecological health, methods/models, and risk management criteria to compare the topics according to their potential to support effective risk reduction and/or produce broadly applicable results. We then further narrow the pool of topics by retaining only those where ORD can make a *significant* contribution to environmental science. Based on this analysis, we prioritize the research topics.

Determining Specific Research Needs. For each selected topic, we then determine what the specific research needs are within each component of the risk paradigm (effects, exposure, risk assessment, risk management). As appropriate, we may develop strategic plans for broad, overarching topic areas to guide more detailed planning.

Detailed Planning. The next step involves translating these needs into a research program. At this stage, we develop detailed research plans for each project. We also develop operating and laboratory implementation plans for each project to be conducted intramurally or under a contract or cooperative agreement. We develop Requests for Applications for projects to be conducted under grants.

Conducting the Research. Once planning is completed, the research is conducted intramurally or extramurally. The research products and results provide input into future planning efforts.

Relationship of IM Planning to ORD's Research Planning Process



Recommendations for Integrating IM Planning Into the Development of ORD Research Planning Documents

Planning Document	Description	Contents	Current Guidance on IM Planning	Recommendations for IM Planning
ORD Research Plans	Delineate overarching research strategies in the broad topic areas identified for ORD research (e.g., ecosystem protection, drinking water). Used by ORD and its stakeholders, including peer review panels, EPA Program and Regional Offices, and external stakeholders.	**ORD Research Plans describe:** How and why the topic was selected for ORD research (i.e., what criteria were applied, who the research clients are, and how the research will meet their needs). Specific research efforts and major products.	ORD *Guidelines for Research Plans* (October 13, 1995) do not require that Research Plans address IM planning.	ORDs *Guidelines for Research Plans* should formally incorporate a requirement that ORD Research Plans describe a general approach for managing the data and information that will be generated by the research.
Laboratory, Center Research Plans	Prepared by ORD 's National Laboratories and Centers as planning tools to identify, prioritize, and justify their overall programs.	**Lab/Center Research Plans:** Broadly define major research areas. Describe anticipated products or accomplishments and how the research will contribute to addressing /reolving Agency problems. Provide information on the current research program and future directions.	There currently are no formal guidelines for preparing these plans.	These research plans should describe a general approach for managing the data and information that will be generated by the research project.
Divisional Research Plans	Prepared by individual division within an ORD Laboratory or Center, these research plans define, prioritize, and justify the research program to be conducted by the division.	**Divisional Research Plans:** Provide detailed information on specific research areas, disciplines, or themes. Describe the relationship of the research to specific ORD research strategies. Describe the anticipated products/accomplishments and how they will contribute to addressing/resolving identified data gaps.	There currently are no formal guidelines for preparing these plans.	These research plans should describe a general approach for managing the data and information that will be generated by the research project.
Cross-Divisional Research Plans	Prepared by cross-divisional research teams, these plans describe research to be conducted collaboratively across divisions within or across ORD Laboratories and Centers.	**Cross-Divisional Research Plans describe the:** Problem and its importance. Research approaches. Anticipated research products/accomplishments.	There currently are no formal guidelines for preparing these plans.	These research plans should describe a general approach for managing the data and information that will be generated by the research project.
Laboratory Implementation Plans (LIPS)	Prepared by ORD Laboratories for all research to be conducted in-house or under a contract or cooperative agreement. Used by ORD managers and scientists to track and prioritize products (reports, data and metadata, publications) that present the science data and information gathered by the research. All LIP information resides in the LIP module of the ORD Management Information System (OMIS).	**Laboratory Implementation Plans:** Provide detailed descriptions of the specific research projects and tasks to be conducted. Include data on extramural resources and FTEs (full-time equivalents), products to be generated, and the acquisition or assistance mechanism for the research. Show how the resources will be used to implement the research programs and objectives. Divides the research into a set of discrete tasks, each assigned a unique task number. Specify what mechanism will be used to conduct the task (i.e., intramural, contract, cooperative agreement) and what products (i.e., research plans, reports, etc.) will be generated under the task.	There currently are no formal guidelines for preparing these plans.	LIPs should describe the specific tasks and resources needed to effectively manage the data and information that will be generated by the research.

Recommendations for Integrating IM Planning Into the Development of ORD Research Planning Documents

Planning Document	Description	Contents	Current Guidance on IM Planning	Recommendations for IM Planning
Request for Applications (RFAs)	Prepared under ORD's Science to Achieve Results (STAR) Program to solicit investigator-initiated grant applications from universities and other external research institutions in areas of special interest to EPA's mission.	**RFAs specify the requirements and provisions for the research grant. As appropriate, RFAs may also:** Require the investigator to summarize in the proposal the plans for data management. Make these plans one of the selection criteria. Require that the investigator submit data collected during the project, along with appropriate documentation, to an EPA data archive for subsequent distribution and use by other investigators. Require the investigator to describe in the proposal how the data will be preserved and made available to others for future research studies.	There currently are no formal guidelines for preparing RFAs.	When preparing an RFA, ORD should consider the need for IM planning and incorporate requirements for IM planning into RFAs as appropriate on a case-by-case basis. IM plans submitted in the grant proposal would then be peer-reviewed along with the rest of the proposal.
Quality Assurance Project Plans (QAPPs)	Prepared for all applicable projects and tasks involving collection or use of environmental data, to define QA/QC activities and records.	**Quality Assurance Project Plans (QAPPs):** Define and document the type and quality of the data needed to meet the intended use of the project. Describe how specific quality assurance and quality control activities will be implemented, assessed and documented during a particular project.	EPA QA/R-2 and R-5 require that data management and handling of documentation and records be defined in a QAPP.	Particular attention should be focused on documenting requirements of scientific data users, involving them in user acceptance testing and documenting test results as well as recordkeeping for baseline system and software applications and data and subsequent change management.

Appendix C:
Inventory of ORD-Related Databases

[Compiled by Sidney Draggan, February 27, 1996]

Medium	Name (*denotes Multiagency)	Description [Number of Sites]	Responsible EPA Organization	Contact/ Telephone	World Wide Web/ Internet/Source	Remarks
Air and Radiation	*Clean Air Status and Trends Network (CASTNet)	Deposition network quantifying status and trends of air emissions, depositions and air quality [EPA 51/Total 235].	Office of Research and Development, NERL	Rick Linthurst 919.541.4909 Jay Messer 919.541.1425	EPA/600/A-94/194	
	*GLAD	Deposition of atmospheric trace elements and nutrients in precipitation to the Great Lakes [EPA 7].				
	*IADN	Identify persistent and bioaccumulative toxic pollutants, estimate their total deposition, and determine sources and relative loadings to the Great Lakes [5].				
	*IMPROVE	Establish current background visibility levels; identify chemical species and emissions sources responsible for existing manmade visibility impairment and document long-term spatial and temporal trends [53].				
	*NAMS/SLAMS/SPM	Air quality data for areas with high pollutant concentrations and high population exposure [507].				
	*PAMS	Comprehensive and representative data on ozone pollution non-attainment areas [144].				
	Aerometric Information Retrieval System (AIRS)	National repository for airborne pollution in the United States and various World Health Organization (WHO) member countries.	Office of Air Quality Planning and Standards; Information Transfer and Program Integration Division	1-800-333-7909	http://www.epa.gov/airs/airs.html	
	(AQS) Air Quality Subsystem	Contains measurements of air pollutants and meteorological data from about 10,000 monitoring stations operated by EPA, state and local agencies, and WHO member countries.				
	(AFS) AIRS Facility Subsystem	Contains data for nearly 150,000 air pollution point sources monitored by the U.S. EPA and/or state and local air regulatory agencies.				
	(GCS) Geographic, Common, and Maintenance Subsystem	Contains reference data shared by the AQS, AFS, and AG subsystems.				
	(AG) AIRS Graphics	Integrates data from multiple AIRS subsystems into maps and charts that show patterns, trends, and anomalies in air pollution data.				
	(AE) AIRS Executive	An IBM PC program that contains a select subset of data extracted from the AIRS database.				
	Support Center for Regulatory Air Models (SCRAM)	Provides regulatory air quality model computer code, meteorological data, documentation, and modeling guidance.	Office of Air Quality Planning and Standards			

Medium	Name (*denotes Multiagency)	Description [Number of Sites]	Responsible EPA Organization	Contact/ Telephone	World Wide Web/ Internet/Source	Remarks	
	Clearinghouse for Inventories/Emission Factors (CHIEF)	Contains information on air emission inventories and emission factors, provides access to tools for estimating emissions of air pollutants and performing air emission inventories for both criteria and toxic pollutants.	Office of Air Quality Planning and Standards				
	UV-B Monitoring	Information supporting international program for ground-level measurement of UV-B [7].					
	Southern Oxidants Study (SOS)	Photochemical; oxidants-related ambient and emissions management data collected in the Southeastern U.S.	Office of Research and Development (ORD), NERL-Atmospheric Sciences Modelling Division	Basil Dimitriades 919.541.2706			
	An Operation System for Predicting the Population Health Effects from Disposal of Radioactive Waste by Shallow Trenches (PRESTO-POP)	Designed to calculate the population health effects resulting from the disposal of low-level radioactive waste in shallow trenches; employs simple radionuclide transport and exposure submodels.	Office of Research and Development	Hung, Cheng-Yeng 202.233.9204			Model
	Indoor Air Quality in Large Office Buildings	Contains ORD and OAR data; characterizes the temporal and spatial variability of important physical, environmental, and comfort parameters influencing occupant perceptions of indoor air quality. A standardized investigative protocol was employed to uniformly collect and report indoor air quality data from randomly selected office work environments in randomly selected public and private office buildings.	Office of Air and Radiation	Susan Womble ORIA/OAR 202.233.9057 Ross Highsmith NERL/ORD 919.541.7828	WWW/Internet: Anticipated availability date April 15, 1996.	Selected data summaries and reports to be placed on WWW. Validated data available through OAR, Susan Womble, (202) 233-9057.	
	PerFluorocarbon [?] Tracer Database	Data related to indoor air modeling and exposure assessments; a comprehensive compilation of several survey studies of residential house volumes, air exchange rates, and infiltration rates.	Office of Pollution Prevention and Toxics	Pat Kennedy (OPPT) 202.260.3916		As yet, undergoing quality assurance procedures by U.S. EPA contractor.	
	Source Ranking Database	Data related to indoor air and exposure assessment.	Office of Air and Radiation	Christine Cinelli (OAR) 202.260.3913			
	Temporal Allocation Factors File (TAFF)	Contains national level default temporal allocation factors for use in developing temporally allocated emissions inventories.	Office of Research and Development, NRMRL/APPCD/ECPB	Charles Mann 919.541.4593 mann.chuck@ epamail.epa.gov.	No Internet; ASCII text file; Microsoft Access		
	Solvent Alternatives GuidE (SAGE)	Computer software system using a decision tree format to identify cleaning options for various surfaces.	Office of Research and Development, NRMRL/APPCD/ECPB	Charles H. Darvin 919.541.7633 E-mail: none	ENVIROENE HTTP://WASTENOT. INEL.GOV:80/ ENVIROENE/ TTN (919)541-5742		
	Coating Alternatives GuidE (CAGE)	Computer-based software program, to assist in reducing VOC and air toxic emissions from metal parts and product coating operations.	Office of Research and Development, NRMRL/APPCD/ECPB	Michael Kosusko 919.541.2734 mkosusko@ engineer.aeerl. epa.gov	No Internet		
	Adhesives Alternatives GuidE (AAGE)	Computer-based package on selection and use of adhesives and low-and-no-VOC substitutes for solvent-based adhesives.	Office of Research and Development, NRMRL/APPCD/ECPB	Chester Vogel 919.541.2827 cvogel@engineer. aeerl.epa.gov	No Internet		

Medium	Name (*denotes Multiagency)	Description [Number of Sites]	Responsible EPA Organization	Contact/ Telephone	World Wide Web/ Internet/Source	Remarks	
	Biogenic Emissions Inventory System (BEIS-II) Land Use Database	Contains county land use data for the contiguous 48 states.	Office of Research and Development, NRMRL/APPCD/ECPB	Christopher D. Geron 919.541.4639 cdg@aesn02.aeerl.epa.gov.	TTN BBS.RTPNC.EPA.GOV		
	Global Technology (GloTech)	Contains information on cost, environmental releases, and other technology data which can be compared, summed and ranked.	Office of Research and Development, NRMRL/APPCD/APB	Lee Beck 919.541.0617 lbeck@engineer.aeerl.epa.gov	HTTP://WWW.EPA.GOV/DOCS/CRB/BROCHURE/GWCB/GLOTECH.HTM.	Software only. Beta test 96.	
Water	Ocean Data Evaluation System (ODES)	Effluent, water quality and biological monitoring data from all coastal sewage treatment plants that have or may submit 301(h) reports.	Office of Marine and Estuarine Protection		EPA 503/8 -90-007		
	(NFTDR) National Fish Tissue Data Repository	Collection and storage of fish and shellfish contaminants data, will be part of a larger EPA database and computer systemOcean Data Evaluation System (ODES).	Office of Water		EPA/823/B-93/003 Accession Number: 212076		
	Biological Data Management System (BIOS)	National biological data management system linked to STORETresults from data requirements survey of field biologists.					
	Exposure Analysis Modeling System (EXAMS-II)	An interactive modeling system allowing specification and storage of chemicals properties and ecosystem characteristics for evaluation of probable aquatic fate of synthetic organic chemicals.	Office of Research and Development	Model Coordinator 706.546.3549			
	National Compendium of Freshwater Fish and Water Temperature Data (FISHTEMP)	Historical fish distribution data with accompanying water temperature data from 1930-present for over 300 species of freshwater fish from 250,000 locations in the U.S. Provides a nationwide compendium of freshwater fish populations in relation to water temperature regimes.	Office of Research and Development	John Eaton 218.720.5557			
	Aquatic Toxicity Information Retrieval (AQUIRE)	Information on the toxic effects of chemicals to aquatic organisms and plants; toxicity test results and related testing information for any individual chemical from laboratory and field aquatic toxicity tests; acute, sublethal and bioconcentration effects are recorded for fresh water and marine organisms.	Office of Research and Development	Christine L. Russom 218.720.5709			
	Assessment Tools for the Evaluation of Risk (ASTER)	Assists Regional and State regulators in performing ecological risk assessments; an integration of the AQUIRE toxic effects database and the QSAR system, a structure activity based expert system.	Office of Research and Development	Christine L. Russom 218.720.5709			
	Quantitative Structure Activity Relationships System (QSAR)	Expert system providing information on physical-chemical properties, fate and effects of organic chemicals to the environment.	Office of Research and Development	Christine L. Russom 218.720.5709			
	Food and Gill Exchange of Toxic Substances (FGETS)	Databases and model predicting temporal dynamics of a fish's whole body composition (g chemical/(g live weight fish)) of non-ionic, non-metabolized, organic chemicals that are bioaccumulated from water only, or water and food.	Office of Research and Development, NERL, ERD-Athens	Frank Stancil 706.546.3197	stancil.frank@epamail.epa.gov		Database/Models

Medium	Name (*denotes Multiagency)	Description [Number of Sites]	Responsible EPA Organization	Contact/ Telephone	Worl Wide Web/ Internet / Source	Remarks	
	Lake Analysis Management System (LAMS)	A system of data bases and models, with GIS capability, developed for the Great Lakes and watersheds. Data bases and models, containing Great Lakes data collected since 1971 and Canadian Great Lakes data collected since 1968, assist in environmental decision-making for the Great Lakes.	Office of Research and Development	Russell G. Kreis 313.692.7615			Database/Models
	Green Cross Solar (GCSOLAR)	Computes direct photolysis rates and half-lives of pollutants in the aquatic environment.	Office of Research and Development	Model Coordinator 706.546.3549			Model
	Stream Quality Model (QUAL2E)	Permits simulation of water quality constituents in a branching stream system using a finite difference solution to the one-dimensional advective-dispersive mass transport and reaction equation; conceptual representation is a stream reach divided into a number of subreaches or computational elements equivalent to finite difference elements.	Office of Research and Development	Model Coordinator 706.546.3180			Model
	River Reach Files (RF1, RF2, RF3)	A series of hydrologic databases of the surface waters of the continental United States and Hawaii. The structure and content of these databases were created to establish hydrologic ordering, to perform hydrologic navigation for modeling applications, and to provide a unique identifier for each surface water feature, i.e., the reach code.	Office of Water	Karen Klima klima.karen@ epamail.epa.gov 800.424.9067	http://www.epa.gov/ OWOW/gis/reach. html		
	The Waterbody System (WBS)	Database provides convenient means for storing assessment information organized around water quality resource units called waterbodies. Assessment information is entered on beneficial use status or causes and sources of pollution for each waterbody. The program can generate lists and summary tables for preparation of Section 305(b) reports.	Office of Water	Karen Klima klima.karen@ epamail.epa.gov	http://www.epa.gov/ OWOW/NBSFlash/ NBSFlash.html		
	STOrage and RETrieval System for Water and Biological Monitoring Data (STORET)	Utility maintained for storage and retrieval of parametric data pertaining to the quality of waterways within and contiguous to the US. Has evolved to a comprehensive family of systems, performing range of functions, including data availability summaries; tabular data reports; statistical data analyses; graphics and maps; and data preparation for down-load to other systems.	Office of Water	Phil Lindenstruth	http://www.epa. gov/OWOW/ STORET/ STORET@ epamail.epa.gov		
	*National Estuaries Program (NEP)	Identifies nationally-significant estuaries to protect and improve their water quality and to enhance their living resources [21].					
	*National Water Quality Monitoring Program	US water quality monitoring and assessment guidelines, protocols and programs for Clean Water Act 305(b) reporting.					
	Discharge Monitoring Report-Quality Assurance Studies (DMR-QA)	Annual analysis of inorganic synthetic wastewater samples by 7,000 to 7,500 major National Pollution Discharge Elimination System (NPDES) dischargers; provides basis for evaluating quality of routine monitoring required in NPDES permits.	Office of Research and Development	Paul Britton 513.569.7216			Database
	Water Pollution Laboratory Performance Evaluation Studies (WP)	Semi-annual analyses of synthetic wastewater samples for up to 80 organic and inorganic analytes by routine wastewater analysis laboratories.	Office of Research and Development	Paul Britton 513.569.7216			

Medium	Name (*denotes Multiagency)	Description [Number of Sites]	Responsible EPA Organization	Contact/ Telephone	World Wide Web/ Internet/Source	Remarks
	Water Supply Laboratory Performance Evaluation Studies (WS)	Semi-annual analyses of synthetic drinking water samples for up to 170 organic and inorganic analytes by laboratories seeking U.S. EPA certification to analyze drinking waters.	Office of Research and Development	Paul Britton 513.569.7216		
	Treatability Database	Compendium of peer-reviewed treatability data on a wide range of environmental contaminants, largely in an aqueous medium but with some information on hazardous wastes.	Office of Research and Development, NRMRL/STD	Jerry Waterman 513.569.7834		
	North American Wetlands for Water Quality Treatment	Compilation of information of wetlands used to treat wastewater.	Office of Research and Development, NRMRL/WSWRD/ WQMB	Don Brown 513.569.7630 brown.donald@ epamail.epa.gov		
	EARNS	Notifications of oil and hazardous substance releases to the environment.				
	*HUC Code Digitization	Details USGS HUCs (watershed boundaries) to sub-watershed delineations.				
	PCS	Data on National Pollutant Discharge Elimination System permit-holding facilities.				
Soil	Dougherty Plain Database	Four-year database on leaching of aldicarb, metolachlor and bromide in a 3.9 ha peanut field. Data includes application rates, pesticide/bromide concentration profiles, plant uptake, soil water retention, hydraulic conductivity and daily weather.	Office of Research and Development (ORD), NERL, ERD-Athens	Charllie Smith 706.546.2247 smith.charllie@ epamail.epa.gov		
	Watkinsville Database	Four-year database on runoff of atrazine, cyanazine, diphenamid, propazine, trofluralin, 2,4-D and fertilizer from four small agricultural watersheds (1.32.7 ha) for use in development and testing of runoff transport models. Data include pesticide and fertilizer runoff by rainfall event, application rates, soil characteristics, pesticide and fertilizer concentration profiles, and daily weather records.	Office of Research and Development (ORD), NERL, ERD-Athens	Charllie Smith 706.546.2247 smith.charlie@ epamail.epa.gov		
	Unsaturated Soil Hydraulic Database (UNSODA)	Database provides field and laboratory measured soil hydraulic and physical properties for use in unsaturated zone models. The database includes the Retention Curve (RETC) code for the estimation of hydraulic parameters for use in these models.	Office of Research and Development , NRMRL/SPRD Center for Subsurface Modeling Support (CSMoS).	Joe. R. Williams 405.436.8608	http://www.epa.gov/ ada/kerrlab.html	Database was developed in cooperation with the USDA Soil Salinity Laboratory in Riverside, California. The database is currently being made ready for distribution via the CSMoS WWW Site listed.
Soil and Ground Water	Model Annotation and Retrieval System (MARS)	Database of subsurface computer models containing information on over 500 models for the unsaturated and saturated zone. System allows the user to search for models by specific model application needs.	Office of Research and Development, NRMRL/SPRD Center for Subsurface Modeling Support (CSMoS).	Joe. R. Williams 405.436.8608	Currently not available on the WWW site.	This database was developed under cooperative agreement with the International Ground Water Modeling Center (IGWMC) and is being maintained and marketed by IGWMC. The updated version can be obtained by contacting IGWMC at (303) 273-3103.

Medium	Name (*denotes Multiagency)	Description [Number of Sites]	Responsible EPA Organization	Contact/ Telephone	World Wide Web/ Internet/Source	Remarks
Multi-Media	*Environmental Monitoring and Assessment Program (EMAP)	Interdisciplinary, multiple US ecological resource program to monitor status and trends with known confidence. Embodies a comprehensive information management system.	National Health and Environmental Effects Research Laboratory	Gilman Veith, NHEERL Tom Murphy, NHEERL Robert Shepanek, NCEA	http://epawww.epa.gov/emaphome	
	Agricultural Lands	Status and trends in the condition of the nation's agricultural lands which include land used for crops, pasture, and livestock; adjacent land; and the associated atmosphere, underlying soils, ground water, and drainage networks.	National Health and Environmental Effects Research Laboratory	Charles Lee Campbell 919.515.3311	http://www.epa.gov/emap/html/resrcgrp/agroland/	
	Estuaries	Status and trends in the condition of the nation's estuaries extending inland to the head of tide. This includes to coastal embayments, bays, inland waterways, tidal rivers, coastal wetland areas, and salt-water marshes.	National Health and Environmental Effects Research Laboratory	Kevin Summers 904.934.9244	http://www.epa.gov/emap/html/resrcgrp/estuary/ http://dolphin.gbr.epa.gov	
	Forests	Status and trends in the condition of the nation's forests, including areas formerly covered by trees, but not currently built-up or developed for agricultural use.	National Health and Environmental Effects Research Laboratory	Sam Alexander 919.549.4020 Beth Eastman 919.549.4059	http://www.epa.gov/-emap/html/resrcgrp/f-orests/	
	Great Lakes	Status and trends in the condition of the Great Lakes, the nation's largest and most unique group of surface waters.	National Health and Environmental Effects Research Laboratory	Stephen Lozano 218.720.5594	http://www.epa.gov/-emap/html/resrcgrp/-greatlak/	
	Landscape Ecology	Studies of the structure, function, pattern, and changes in the nation's heterogenous land areas using remote sensing and geographic information systems.	National Health and Environmental Effects Research Laboratory	Bruce Jones 702.798.2671	http://www.epa.gov/-emap/html/resrcgrp/l-andecol/	
	Rangelands	Status and trends in the condition of the nation's deserts, grasslands, and other arid lands.	National Health and Environmental Effects Research Laboratory	Dan Heggem 702.798.2278	http://www.epa.gov/-emap/html/resrcgrp/r-angland/	
	Surface Waters	Status and trends in the condition of the nation's surface waters including lakes, streams and rivers downstream to the head of tide, and inland wetland areas.	National Health and Environmental Effects Research Laboratory	Steve Paulsen 503.754.4428	http://www.epa.gov/emap/html/resrcgrp/surfwatr/	
	Interagency Taxonomic Information System (ITIS)	Provide an electronic, taxonomic reference that promotes scientific excellence and is fully supported by the world taxonomic community.	National Health and Environmental Effects Research Laboratory	Gary Collins 513.569.7174	http://trident.ftc.nrcs.usda.gov:80/itis/dev/	
	Methods	Database on selection and development of appropriate methods for collecting data. Encourages the use of standardized methods within resource groups to ensure comparability of data and helps to develop strategies for standardizing methods across resource groups.	National Health and Environmental Effects Research Laboratory	Gary Collins 513.569.7174	http://www.epa.gov/docs/emap/html/coordgrp/methods/	
	Indicators	Database on basic research concerning the development and selection of biological and other indicators for use in EMAP.	National Health and Environmental Effects Research Laboratory	Kay Austin	http://www.epa.gov/docs/emap/html/coordgrp/indicatr/	
	*Multi-resolution Land Characteristics Consortium (MRLC)	Interagency program to produce a consistent US land cover database; integrates data and information across temporal and spatial scales.	National Health and Environmental Effects Research Laboratory	Denice Shaw 919.541.2698	http://www.epa.gov/docs/grd/mrlc/	

Medium	Name (*denotes Multiagency)	Description [Number of Sites]	Responsible EPA Organization	Contact/ Telephone	World Wide Web/ Internet/Source	Remarks	
	Exposure Models Library and Integrated Model Evaluation System (IMES)	Selection of over 70 fate and transport models for exposure assessments in various environmental media. Facilitates selection of best fate model for a particular risk assessment problem as well as information on validation of the models.	Office of Research and Development, NCEA-Washington.	Richard Walentowicz 202.260.8922	EPA/600/C-92/200		
	*Developmental and Reproductive Toxicity (DART) Database	On-line, bibliographic information and data on developmental and reproductive toxicity.	Office of Research and Development, NCEA-Washington	Carol Kimmel 202.260.7331			
	ORD Bibliography	Searchable, downloadable, electronic database of ORD publication citations with abstracts (1976-present).	Office of Research and Development, NRMRL/TTSD	Randy Revetta 513.569.7358		Accessible through ORD Bulletin Board (ORDBBS). (513) 569-7610 (513) 569-7700 (513) 569-7272 (voice)	
	*Ecotoxicology Database Retrieval System (ECOTOX)	Computer-based system that provides chemical-specific toxicity values for aquatic life, terrestrial plants, and wildlife; useful in developing consistent ecosystem management decisions within the EPA and other federal, state, local, and international governmental agencies.	Office of Research and Development, NHEERL	Christine L. Russom 218.720.5709 Steve Bradbury 218.720.5527	http://www.epa.gov/docs/ORD/BBS.html	Developed by ORD with funding from the U.S. Department of Defenses Strategic Environmental Research Defense Program.	
	EMMI	Database of ~ 2,600 EPA regulated substances; includes regulatory limits, method detection limits and abstracts.					
	Soil Transport and Fate Database and Model Management System (STF)	Database providing degradation, transformation, toxicity, bioaccumulation, and partitioning information on approximately 400 chemicals (organic and some inorganic) in the soil environment. Includes the RITZ and VIP models.	Office of Research and Development, NRMRL, Center for Subsurface Modelling Support (CSMoS)	David S. Burden 405.436.8606	http://www.epa.gov/ada/kerrlab.html		Database/Models
	Pesticide Assessment Tool for Rating Investigation of Transport (PATRIOT)	Datasets on daily rainfall (10 years) from 200 NOAA weather stations, properties and occurrences of 8000 soils, pesticides properties and cropping practices complement the PATRIOT Model for rapid assessment of groundwater vulnerability to pesticide contamination in the contiguous U.S.	Office of Research and Development, NERL, ERD-Athens	Frank Stancil 706.546.3130 stancil.frank@epamail.epa.gov			Databases/Model
	Pesticide and Industrial Chemical Risk Analysis and Hazard Assessment (PIRANHA) Program	Includes a geographical database for locating biological resources potentially at risk from pesticides; useful in applying chemical, ecotoxicological and environmental sciences to ecological risk assessment.	Office of Research and Development, NERL, ERD-Athens	Lawrence Burns 706.546.3511 burns.lawrence@epamail.epa.gov			Databases/Model
	National Environmental Supercomputing Center (NESC)	Computational resources necessary to carry out scientific modeling efforts; provides computer support for many critical environmental models.	Director, National Environmental Supercomputing Center	517.894.7600 Fax: 894.7676 Cullati.Art@epamail.epa.gov	http://www.epa.gov/accessepa/chapter8/s1-1.html		
	Sparc Provides Automated Reasoning in Chemistry (SPARC)	Expert system for estimating chemical and physical reactivity estimates on a broad scope and inexpensively.	Office of Research and Development (ORD), NERL, ERD-Athens	Mac Long 706.546.3349 long.mac@epamail.epa.gov			Expert System
	Environmental Fate Constants Database (FATE)	Provides interactive retrieval of kinetics and equilibrium constants used in modeling and assessing chemical (300 and growing) fate in the environment.	Office of Research and Development (ORD), NERL, ERD-Athens	Brenda Kitchens 706.546.3198 kitchens.brenda@epamail.epa.gov			

Medium	Name (*denotes Multiagency)	Description [Number of Sites]	Responsible EPA Organization	Contact/ Telephone	World Wide Web/ Internet/Source	Remarks
	Guide to National Environmental Statistics	Tool for locating sources of national-level environmental statistics available from the U.S. Government; a reference to national-level, time-series environmental statistics; not intended to be inclusive; data sources from 23 offices in 7 agencies: USDA, DOI, DOC, DOT, DOE, EPA, DHHS.	Office of Policy, Planning, and Evaluation	Brand Niemann 202.260.3726		
	Integrated Risk Information System (IRIS)	EPA's primary vehicle for communication of chronic non-caner and cancer health hazard information for over 500 substances. IRIS contains substance specific hazard identification and dose-response information.	Office of Research andDevelopment, NCEA-CIN	513.569.7254 Hotline # FAX 513.569.7159	IRIS Hotline 513.569.7254	
	Total Human Exposure Risk database and Advanced Simulation Environment (THERdbASE)	Data and model management system containing such total human exposure information as census data, state activity pattern studies, EPAs National Human Activity Pattern Study, TEAM and NOPES data, inhalation and dermal models, or indoor air models.	Office of Research and Development (ORD), NERL CRD	John Quackenbos 702.798.2442	http://eeyore.lv-hrc.nevada.edu/therdbase.html	
	Quantitative-Structure Toxicity Relationships (QSTR)	Enables computation of a probable value of toxicity for a given chemical structure, for various health endpoints.	Office of Research andDevelopment, NCEA-CIN	R. Bruce 513.569.7569		
	Treatability Data Base (TDB)	Assist users in selecting technologies or estimating the degree of treatment achievable for specific chemicals in all types of waters, wastewaters, soils, sediments, and debris; data extracted from a variety of sources.	Office of Research andDevelopment	Glenn M. Shaul 513.569.7408		
	Government Information Locator Service (GILS)	Virtual card catalog" of government information. The EPA's GILS website offers access to records that describe the agency's information resources.			http://www.epa.gov/gils/	
	ACCESS EPA	Directory provides contact information and description of services for more than 300 of EPA's major information resources, including databases, models and EPA libraries.	Office of Administration and Resources Management		http://www.epa.gov/docs/Contacts/Access/chapter5.txt.html; EPA 220-B-93-008	
Hazardous Waste and Superfund	CERCLIS	Superfund database with information on all identified U.S. hazardous waste sites.				
	Sediment Toxicity Database	Sediment chemistry and toxicity measurements from saltwater and freshwater sites.	Office of Research and Development, NECA-Washington.	Sue Norton 202.260.8922		
	OHMTADS	Chemical properties, regulatory information, toxicity and safety data, and response information on hazardous substances.				
	RODS	Tracks site cleanups under the Superfund program.				
	RCRIS	Tracks events and activities related to facilities that generate, transport, treat, store, or dispose of, hazardous waste.				
	PIN	Pesticide monitoring inventory, environmental fate, and effects data.				
	TRI	Facility and substance identification for toxic chemicals released directly to air, water or land, or that is transported off-site.				

Medium	Name (*denotes Multiagency)	Description [Number of Sites]	Responsible EPA Organization	Contact/ Telephone	World Wide Web/ Internet/Source	Remarks	
	Bioremediation in the Field Search System (BFSS)	Information on over 500 sites where bioremediation is being tested, implemented, or has been completed.	Office of Research and Development, NRMRL/TTSD	Fran Kremer 513.569.7346		Accessible through Alternative Treatment Technology Information Center (ATTIC); (703) 908-2137. Also accessible through ORD Bulletin Board (ORDBBS);(513) 569-7610; (513) 569-7700 (513) 569-7272 (voice).	
	Treatment Technology Database	Provides information on biological, chemical, physical, solidification/stabilization, and thermal treatment processes.	Office of Research and Development, NRMRL/WSWRD	Daniel Sullivan 908.321.6677		Accessible through Alternative Treatment Technology Information Center (ATTIC).Hotline (703) 908-2137	
	Treatability Study Database	Compendium of peer-reviewed treatability data on a wide range of environmental contaminants, largely in an aqueous medium, but with some information on hazardous wastes.	Office of Research and Development, NRMRL/STD	Jerry Waterman 513.569.7834		Accessible through Alternative Treatment Technology Information Center (ATTIC).Hotline (703) 908-2137	
	Underground Storage Tank Database	Information on underground storage tank corrective actions, surface spills, and remedial action. Allows retrieval of information to help select appropriate, cost-effective solutions.	Office of Research and Development, NRMRL/WSWRD/ UWMB	Daniel Sullivan 908.321.6677		Accessible through Alternative Treatment Technology Information Center (ATTIC).Hotline (703) 908-2137	
	Oil/Chemical Spill Database (SPILLS)	Information on the treatment and disposal of spilled oil and chemicals.	Office of Research and Development, NRMRL/WSWRD/UW-MB	Daniel Sullivan 908.321.6677		Accessible through Alternative Treatment Technology Information Center (ATTIC).Hotline 703.908.2137	Database/Model
	Alternative Treatment Technology Information Center (ATTIC)	Provides information on innovative treatment technologies. Includes case studies providing information on such technologies in support of hazardous waste clean-up.	Office of Research and Development (ORD), NRMRL-Edison.	Daniel Sullivan 908.321.6677	http://www.epa.gov/ attic/attic.html		
	Vendor Information System for Innovative Treatment Technologies (VISITT)	Current information on availability, performance and cost of innovative technologies to remediate soil and groundwater contaminated by hazardous and petroleum wastes.	Office of Solid Waste and Emergency Response, Technology Information Office		Available within CLU-IN BBS (301.589.8366; File=visit3.zip)		
Other	Research Tracking System (RTS)	Tracks research technical information: projects, tasksmilestones; publications produced by Mid-continent Ecology Division scientists.	Office of Research and Development	Judy L. Stagner 218.720.5605			
	Criteria Reference Information Bank (CRIB)	Contains bibliographic information identifying sources cited in air quality criteria and other documents produced by the National Center for Environmental Assessment - RTP Office (NCEA-RTP Office).	Office of Research and Development	Douglas B. Fennel 919.541.3789			
	Athens Chemical Inventory System (ACIS)	In-house chemical inventory is maintained for the purpose of chemical hygiene and environmental compliance.	Office of Research and Development	Frank Stancil 706.546.3197			
	Technical Assistance Database (TAD)	Internal system used to maintain a database of technical support provided to the user community, inside and outside of EPA, by the Center for Exposure Assessment Modeling (CEAM).	Office of Research and Development	Robert Ryans 706.546.3306			
	NIST/EPA/NIH/Mass Spectral Database	Library of mass spectra used on-line by mass spectrometers for compound identification.	Office of Research and Development, NERL CRD/ASB/ACR	Ed Heitmar 702.798.2626	N/A	Database is copyrighted by other organizations and licensed to ORD only for use with specific instruments.	

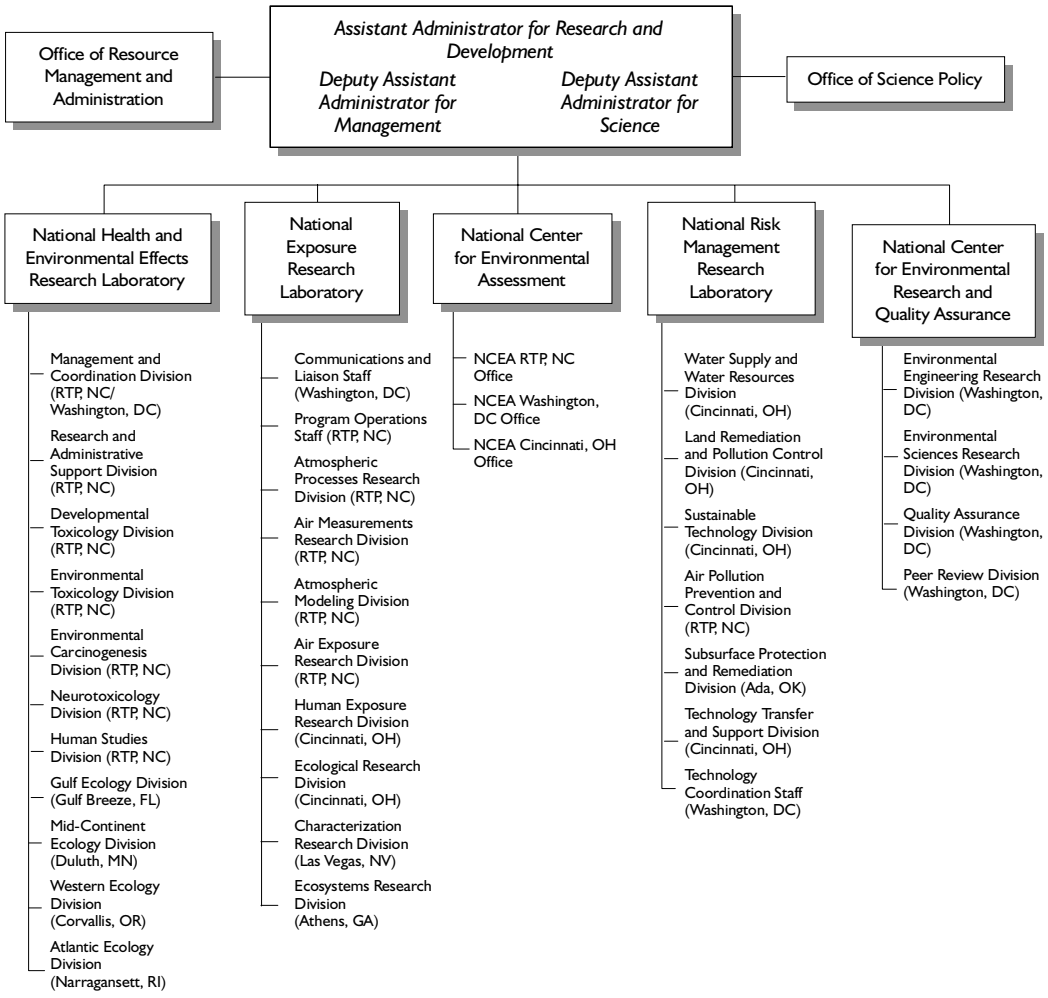
Medium	Name (*denotes Multiagency)	Description [Number of Sites]	Responsible EPA Organization	Contact/ Telephone	World Wide Web/ Internet/Source	Remarks
	Report Locator Data Base	Identifies aerial photographic interpretation projects and reports completed by Environmental Photographic Interpretation Center (EPIC) over the past 20 years.	Office of Research and Development, NERL, CRD			For internal use only. Database currently on VAX; but needs to be converted for use under ORACLE software.
	Pesticide Treatability Database	Compendium of information specific to pesticides, their formulation, and treatment options.	Office of Research and Development, NRMRL/STD/MTB	Dave Ferguson 513.569.7518		
	Enviroene	Hosts an expert architecture known as the Solvent Umbrella, allowing users to access solvent alternative information through a single, easy-to-use command structure.	EPA/DOD/DOE	Idaho National Engineering Laboratory	http://www.epa.gov/I-daho.html	

Please send any comments, additions, modifications or corrections to Sidney Draggan via electronic mail.

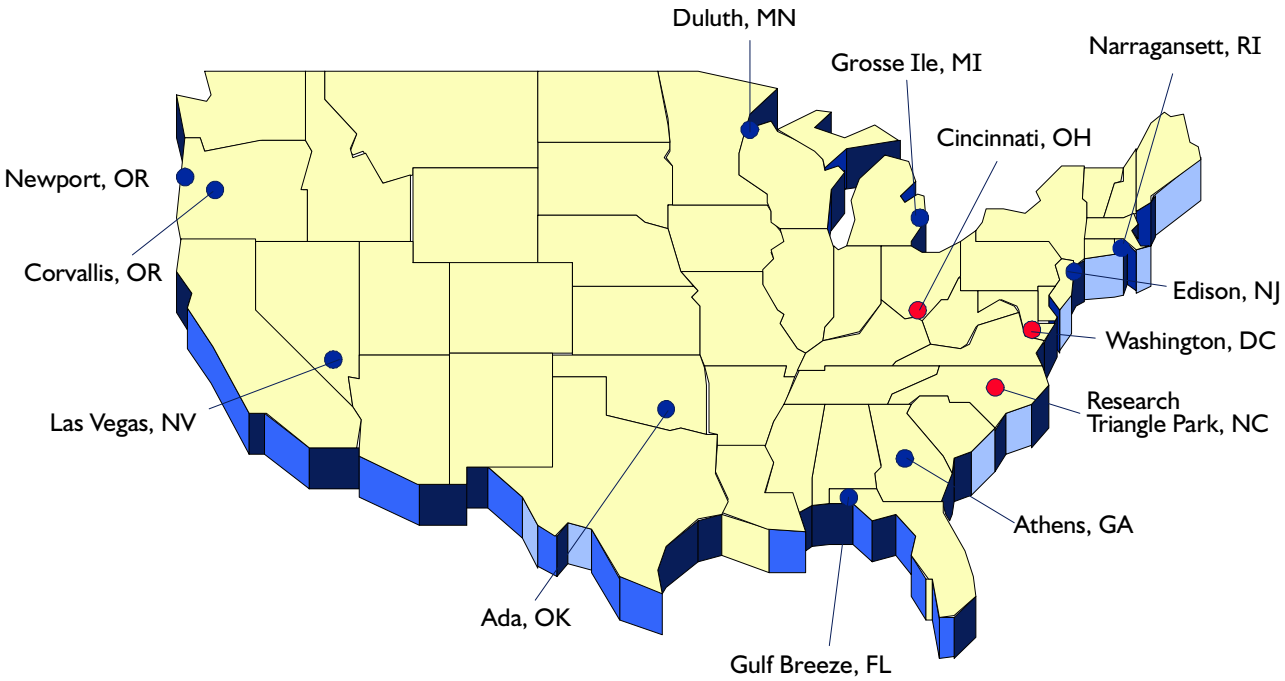
Appendix D:
The Office of Research and Development Organization

ORD's organization, depicted below, mirrors the risk assessment/risk management paradigm. The locations of ORD's National Laboratories, Centers, and Offices are shown on the following page; their functions are described in the ORD Strategic Plan.

ORD's New Risk-Based Organization



Location of ORD's National Laboratories and Centers



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Steve Young, EPA Office of Information Resources Management

United States Environmental Protection Agency
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