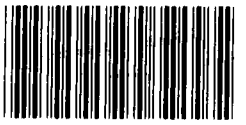
BY THE U.S. GENERAL ACCOUNTING OFFICE

Report To The Honorable Marilyn Lloyd
Chairman, Subcommittee On Energy
Research And Production
Committee On Science And Technology
House Of Representatives

Nuclear Safety Research Responsiveness To Regulatory Needs And Coordination

The Nuclear Regulatory Commission (NRC) spends about half of its budget, or about $210 million, on safety research to support nuclear facility licensing and regulation. The Department of Energy also conducts research and development of nuclear technologies being licensed and regulated by NRC.

GAO found that NRC has not documented that its research has been responsive to its regulatory needs. NRC also recognized this problem and developed and began operating a system to periodically provide NRC management with oversight over its research projects. GAO also found that the coordinating techniques have helped keep DOE and NRC aware of each other's research efforts but that intentional duplication occasionally occurs due to the two agencies' different roles.



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RESOURCES, COMMUNITY,
AND ECONOMIC DEVELOPMENT
DIVISION

B-197263

The Honorable Marilyn Lloyd
Chairman, Subcommittee on Energy
Research and Production
Committee on Science and Technology
House of Representatives

Dear Madam Chairman:

This report responds to your September 2, 1982, request concerning the Nuclear Regulatory Commission's safety research program. The report addresses the relationship of the Nuclear Regulatory Commission program to its regulatory process and discusses the Nuclear Regulatory Commission's and the Department of Energy's roles and coordination efforts associated with their respective nuclear research efforts.

Unless you publicly announce its contents earlier, we plan no further distribution until 3 days from the date of the report. At that time, we will send copies to other interested committees, Members of Congress, the Nuclear Regulatory Commission, and the Department of Energy. Copies will also be made available to others upon request.

Sincerely yours,

Ralph W. Scalone for

J. Dexter Peach
Director

U.S. GENERAL ACCOUNTING OFFICE
OFFICE REPORT TO THE CHAIRMAN,
SUBCOMMITTEE ON ENERGY RESEARCH
AND PRODUCTION, HOUSE COMMITTEE
ON SCIENCE AND TECHNOLOGY

NUCLEAR SAFETY RESEARCH RESPONSIVENESS TO REGULATORY NEEDS AND COORDINATION

D I G E S T

The Nuclear Regulatory Commission's (NRC's) nuclear safety research program, funded at about $210 million in fiscal year 1983, supports that agency's regulation of the nation's nuclear power industry. The Department of Energy (DOE), as part of its nuclear energy program, also conducts research and development directed toward developing nuclear energy technologies. That research and development was funded at about $877 million in fiscal year 1983.

At the request of the Chairman, Subcommittee on Energy Research and Production, House Committee on Science and Technology, GAO evaluated (1) the relationship of NRC's nuclear safety research program to its regulatory process and (2) how NRC and DOE delineate and coordinate their respective research responsibilities to preclude unnecessary duplication. (See p. 1.)

NRC HAS NOT DOCUMENTED THAT NUCLEAR SAFETY RESEARCH IS RESPONSIVE TO REGULATORY NEEDS

To meet its regulatory needs, NRC needs to plan research to address specific regulatory issues or questions; oversee progress of current projects and their appropriate direction; report routinely on completed research so users know about the results; and document the use or nonuse of this research so that management knows how effective the research is. According to NRC, three principal mechanisms--long-range research plans, research review groups, and research information letters--help ensure that research results respond to regulatory needs. (See pp. 7 and 16.)

NRC's long-range research plan is designed to focus its resources on areas important to its regulatory needs. This plan, updated annually, describes research for the next 5 years and identifies regulatory needs for 18 research areas, lists expected results, and ranks each area by importance. Since the plan is only now being implemented, GAO did not evaluate whether it will help ensure the relevance of NRC safety research activities. (See p. 8.)

NRC relies on review groups to help ensure that research results are useful. Review groups are established for specific topics with membership drawn from the research office and from other NRC offices which might use the results. However, the effectiveness of these groups is doubtful. GAO found that NRC does not know how many or which of its approximately 500 ongoing research projects are covered by these groups; groups may meet infrequently and meetings are not always documented or results disseminated to interested parties; and groups often have primary purposes (such as improving communication) other than ensuring that research is meeting defined regulatory needs. (See p. 11.)

To document the results of research, NRC's research office prepares research information letters which briefly describe the work performed and the results. NRC procedures call for such a letter upon completion of "a substantial, coherent, and reasonably complete body of experimental or analytical work." The letter may cover one or more research projects. NRC user offices are to respond to the letters by preparing "research utilization forms" to document how the research was used or why it was not used.

Although these letters and forms can help document the use of research results for NRC's approximately 500 ongoing research projects, only four letters and one utilization form were prepared in fiscal year 1982. NRC lacked records on the status of completed projects and could not provide GAO with specific information on the number of completed projects without research information letters. However, NRC management told GAO that for the vast majority of completed projects, research information letters are not prepared because

they are often perceived as being of limited value. (See p. 14.)

Accordingly, these mechanisms--long-range plans, research review groups, and research information letters--are neither systematically reporting on completed research nor documenting the use or nonuse of research results, and NRC management does not know whether or not the research has been relevant or used. NRC management agreed with GAO's findings and developed a new project tracking system which began operating in July 1983. The system informs management of current research progress and the results of completed projects and documents the use or nonuse of research. Properly implemented, NRC's system should help ensure that research addresses regulatory needs and that its results are appropriately used in the regulatory process. (See p. 16.)

RESEARCH ROLE OVERLAP NECESSITATES COORDINATION

DOE concentrates on developing nuclear technologies while NRC's research focuses on getting information to support regulation of civilian nuclear activities. To accomplish their respective roles, the two agencies' work overlaps. To preclude unnecessary duplication, the agencies must coordinate their work where research and development responsibilities overlap. (See p. 18.)

To accomplish this coordination, the agencies have a memorandum of understanding setting forth management policy on interagency relationships for research programs and related activities and stressing the need for interagency coordination. They also have or are developing interagency agreements for the three nuclear research and development efforts in which their roles overlap: the safety of reactors currently in operation, more advanced reactors, and the storage and disposal of nuclear wastes. These three agreements cover all of NRC's research and over three-fourths of DOE's nuclear energy research and development. Each of the three agreements provides for the use of similar coordinating techniques. Generally, these techniques include the exchange of research documents, joint DOE/NRC meetings, and staff interactions.

To test the effectiveness of the coordinating techniques, GAO examined an NRC-funded project and similar DOE work at one of DOE's contractor-operated facilities. GAO found that NRC and DOE, and their contractors, routinely exchange pertinent documents on their research work and contact each other to informally discuss unusual or significant findings.

Such coordination has resulted in NRC's occasionally eliminating research projects. For example, NRC abandoned its efforts to test possible sites for storing wastes and instead elected to use DOE test results. Hence, these techniques have helped keep DOE, NRC, and their respective contractors aware of the agencies' research and development efforts. GAO concluded that these techniques, if properly adhered to, should help avoid unnecessary duplication of research work.

Although NRC and DOE coordinate and are aware of each other's research efforts, intentional duplication occasionally occurs in order to meet the agencies' respective roles. In view of NRC's responsibility to license and/or regulate nuclear facilities developed or operated by DOE, officials of both agencies believe such duplication is necessary. For example, although GAO found that NRC and DOE have been conducting similar experiments related to the storage and disposal of nuclear wastes, a DOE program official and an NRC project official explained that their approaches differ and that these intentionally duplicative experiments are being done to ensure that NRC's independence is not compromised. (See p. 21.)

GAO agrees that NRC's mission demands continued independence for it to carry out various research, licensing, and other regulatory functions in a way that ensures that the public's health and safety are protected. Clearly, the results of NRC's work must not be compromised. Ensuring independent performance will help prevent conflict of interest and preserve public trust in NRC's ability to fulfill its missions. Thus, GAO agrees, in principle, that NRC needs to conduct some duplicative research lest its independence seem compromised. This review found that the coordinating techniques being implemented

would help ensure that unnecessary duplication does not occur. (See p. 26.)

AGENCY COMMENTS

NRC generally agreed with matters presented in this report. NRC also commented that it is further improving its new project tracking system and long-range plan and intends to continue its efforts to resolve noted deficiencies.

DOE agreed with GAO's conclusions. It made editorial comments to clarify the amounts it spends for nuclear energy research and development and to identify the office in which two of the DOE officials interviewed work. GAO made the clarifying changes suggested. The full text of NRC's and DOE's comments are included as appendixes II and III, respectively. (See p. 27.)

Contents

ABBREVIATIONS

DOE	Department of Energy
GAO	General Accounting Office
NRC	Nuclear Regulatory Commission

CHAPTER 1

INTRODUCTION

In her letter of September 2, 1982, the Chairman of the Subcommittee on Energy Research and Production, House Committee on Science and Technology, asked us to examine two major issues: (1) the relationship of the Nuclear Regulatory Commission's (NRC's) nuclear safety research program to its regulatory process and (2) the delineation of research responsibilities between NRC and the Department of Energy (DOE).

Under the Energy Reorganization Act of 1974, as amended (42 U.S.C. 5801), NRC regulates civilian nuclear activities and has responsibility for nuclear safety research needed for licensing and regulation. The act further provides that NRC is to have an independent capability for developing and analyzing technical information related to health and safety issues supporting the licensing and regulatory processes. About $210 million of fiscal year 1983 funding, nearly half of NRC's budget, was for research to provide the technical basis for confirming and/or improving nuclear powerplant safety regulations and for supporting NRC's licensing functions.

Unlike NRC's, DOE's nuclear research is primarily aimed at developing and commercializing nuclear energy technologies. DOE's nuclear energy program was funded at about $877 million in fiscal year 1983, primarily for developing new nuclear reactor technologies and nuclear waste disposal technologies and facilities. As part of this effort, DOE tries to increase basic knowledge of nuclear reactors and their subsystems and disseminate that knowledge so that manufacturers can improve nuclear reactor designs, including increasing the efficiency, economy, and safety of those nuclear reactors.

NRC's SAFETY RESEARCH PROGRAM AND ORGANIZATION

NRC's basic mission is to ensure, by regulation, that civilian nuclear activities are conducted in a manner that will protect public health and safety and maintain national security. This is set out in the Atomic Energy Act of 1954, as amended (42 U.S.C. 2011). NRC is also charged with other important responsibilities. As a federal agency taking major actions which affect the environment, NRC must evaluate the effects on the environment of proposed major commercial nuclear facilities. Furthermore, in the Energy Reorganization Act of 1974 the Congress charged NRC with (1) administering major regulatory research programs, (2) regulating certain DOE nuclear waste storage and/or disposal activities, and (3) increasing emphasis

on safeguarding nuclear materials[1] and facilities against theft, diversion, or sabotage.

NRC came into existence on January 19, 1975, with implementation of the Energy Reorganization Act of 1974. NRC is headed by a five-member Commission appointed by the President and approved by the Senate. The Chairperson of the Commission is selected by the President from among the Commission members and serves at his pleasure. NRC is composed of the Commission, the Commissioners' staffs, the Office of the Executive Director for Operations, fifteen staff offices, five regions, and four program offices, one of which is the Office of Nuclear Regulatory Research.

The Office of Nuclear Regulatory Research conducts NRC's nuclear safety research program to (1) provide the technical basis for rulemaking (which involves issuing regulations) and regulatory decisions, (2) support licensing and inspection, (3) assess feasibility and effectiveness of safety improvements, and (4) increase understanding of events which require analytical treatment for regulatory activities. The program aims at developing a complete information base on fundamental safety issues and an independently verified source of safety, health, and environmental data. When combined with information submitted by utilities and others in support of their license applications, this knowledge is intended to support licensing and regulatory decisions.

NRC's Office of Nuclear Regulatory Research plans and monitors the research projects carried out by contractors. Of the Office's $210 million fiscal year 1983 budget, $19 million is for NRC personnel salaries, benefits, administrative support, and travel, while $191 million is for the research actually performed by private firms and institutions, including DOE laboratories. About 85 percent of the dollar value of NRC's research is performed at DOE laboratories under interagency agreements.[2] Other organizations do the remaining research under contract to NRC.

The principal users of the Office of Nuclear Regulatory Research's results are the three other program offices. These offices rely on the research office to provide the technical basis and scientific verification for their regulatory decisions. These offices and their functions are

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[1]Includes fissionable material such as plutonium-239, uranium-233, and materials mixed with uranium-235.

[2]The primary DOE laboratories used by NRC for research are Idaho National Engineering Laboratory, Idaho; Sandia Laboratory, New Mexico; Oak Ridge National Laboratory, Tennessee; Los Alamos Scientific Laboratory, New Mexico; and Pacific Northwest Laboratory, Washington.

--Office of Nuclear Reactor Regulation which licenses nuclear reactors used for testing, research, and electrical power generation;

--Office of Nuclear Material Safety and Safeguards which makes sure that public health and safety, national security, and environmental factors are considered in the licensing and regulation of nuclear facilities; and

--Office of Inspection and Enforcement which develops policies for inspecting nuclear facilities to determine whether they are constructed and operated in compliance with NRC license requirements and regulations.

DOE's FUNCTIONS AND ORGANIZATION

DOE is to provide the framework for a comprehensive and balanced national energy plan by coordinating and administering the energy functions of the federal government. DOE is responsible for long-term, high-risk research and development of energy technologies; the marketing of federal power; energy conservation; the nuclear weapons program; energy regulatory programs; and a central energy data collection and analysis program. DOE was established by the Department of Energy Organization Act, approved August 4, 1977 (42 U.S.C. 7131), and came into being on October 1, 1977. The Secretary of Energy directs and supervises the administration of DOE, decides major energy policy and planning issues, and acts as the principal energy advisor to the President.

DOE's Assistant Secretary for Nuclear Energy administers DOE's research and development programs associated with fission energy. This includes programs relating to nuclear reactors, both civilian and naval, and the fuel cycle.[3] In addition, the Nuclear Waste Policy Act of 1982 (42 U.S.C. 10101) establishes a new Office of Civilian Radioactive Waste Management with a Director directly responsible to the Secretary of Energy. DOE's role in relation to NRC's research program is discussed in more detail in chapter 3.

OBJECTIVE, SCOPE, AND METHODOLOGY

Our objective was to examine the two issues set forth by the Chairman, Subcommittee on Energy Research and Production, House Committee on Science and Technology, in her September 2, 1982, letter. To assess the adequacy of research utilization in the regulatory process, we identified and evaluated those NRC

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[3]Fuel cycle is the series of steps involved in supplying fuel for nuclear power reactors. It includes mining, refining, and fabricating fuel elements; recovering fissionable material remaining in spent fuel; reenriching and refabricating those fissionable materials into new fuel; and storing and disposing of wastes.

procedures which are intended to enhance incorporation of research results. To determine if NRC's and DOE's roles are adequately delineated, we examined the interaction between NRC and DOE and the techniques used to preclude unnecessary duplication. More specifically, we evaluated each agency's methods for coordinating research and development projects and exchanging technical information on their respective research efforts.

To obtain a perspective on the two issues, we conducted a literature search and a legislative history. We examined relevant documents, reports, and studies, including some which focus on research program management. With respect to the legislative history, we reviewed acts,[4] committee reports, and hearings on congressional legislation and oversight.

At NRC, we interviewed officials and studied agency documents to understand research planning, implementation, and utilization. We interviewed those managers and project monitors within the Office of Nuclear Regulatory Research having responsibility for overseeing the research, and users of research results in the other three program offices: Nuclear Reactor Regulation, Nuclear Material Safety and Safeguards, and Inspection and Enforcement. In addition, we spoke with officials from the Offices of the Executive Director for Operations, Resource Management, and Inspector and Auditor.

We examined reports published on specific ongoing and planned research projects and studied NRC's policies, procedures, and regulations pertaining to the research process. More specifically, we examined NRC's procedures for planning and selecting research projects, making critical reviews during and upon completion of the research, and effecting timely user evaluation of research results.

To determine how NRC research projects are selected and implemented, we contacted representatives from internal boards and groups. We discussed the review process for proposed research projects with officials from the Senior Contracts Review Board which reviews all NRC projects over $500,000 and the Waste Management Review Group which reviews research projects for the Office of Nuclear Material Safety and Safeguards. The other two program offices did not have similar groups. We interviewed the chairpersons of 21 active research review groups, selecting those interviewed from a list of 64 review groups with members. Our selection included one or more chairpersons from each of the six NRC research divisions/staff

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[4]Including the Energy Reorganization Act of 1974, as amended (42 U.S.C. 5801); the Nuclear Safety Research, Development and Demonstration Act of 1980 (42 U.S.C. 9701); and the Nuclear Waste Policy Act of 1982 (42 U.S.C. 10101).

offices listed.[5] These interviews were not intended to be a statistically valid sampling of research review groups but were made to explore how research review groups function.

To obtain the views of technical experts on NRC's research activities, we contacted the Advisory Committee on Reactor Safeguards. Created by statute, the Committee advises NRC on the safety of nuclear facilities and the adequacy of safety standards. We reviewed its reports on NRC's research program, budget, and long-range research plan. We also interviewed the Chairman of the Committee's Nuclear Safety Research Program Subcommittee to obtain his views.

In evaluating how NRC and DOE research activities are delineated and coordinated, we interviewed officials and obtained documents at both NRC and DOE. At NRC, several officials gave us their views on coordination with DOE and provided pertinent documentation. We discussed interagency coordination with the DOE Acting Director of the Nuclear Regulation and Safety Division and the Manager of Safety Research and Development, Office of Assistant Secretary for Nuclear Energy, and examined documents they provided, including legislative documents, memorandums of understanding, and program management plans.

To test the effectiveness of techniques used to coordinate research and development between NRC and DOE, we selected for detailed review the largest NRC waste management research project and related work carried out at a DOE-funded center. We interviewed NRC and DOE officials to determine if the provisions of the waste management interagency agreement were being carried out and examined documents they provided. We also contacted Battelle Memorial Institute personnel at the DOE-funded Materials Characterization Center, a government-owned, contractor-operated facility located at Richland, Washington, and the contractor for the NRC project, Battelle Columbus Laboratories, Columbus, Ohio, to ascertain the extent of coordination and information exchange which takes place between DOE and NRC contractors working on related research topics. Since similar techniques are to be used for all DOE and NRC coordination and our test showed that the coordinating techniques can work, we did not test the coordination of additional projects.

Our review was performed during the period from April 1982 through June 1983 and was conducted in accordance with generally accepted government auditing standards.

The following chapters discuss the incorporation of research results in the regulatory process and the coordination and information exchange between DOE and NRC in conducting their

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[5]The list of research review groups categorized the groups according to NRC's organization in effect prior to April 1981 and does not necessarily relate to the current organization of NRC's Office of Nuclear Regulatory Research.

respective research. Appendix I provides a summary of the major research areas covered by NRC.

CHAPTER 2

NRC HAS NOT DOCUMENTED THAT RESEARCH RESULTS ARE RESPONSIVE TO REGULATORY NEEDS

In 1978 and again in 1980, we noted that NRC needed to improve its tracking of research to ensure that the results of that research were used in the regulatory process. On those occasions, NRC said that a tracking system would be too costly to implement and that its existing mechanisms were sufficient. In response to questions by the Subcommittee on Nuclear Regulation, Senate Committee on Environment and Public Works, in April 1981, NRC stated that three principal mechanisms help ensure that its research results respond to regulatory needs. First, an annual long-range research plan sets forth a framework for formulating pertinent research. Second, research review groups, consisting of research program managers and representatives of user offices, review projects during implementation to ensure that projects are focused on producing usable results. Third, research information letters formally transmit research results applicable to the regulatory process to user offices and provide a mechanism for documenting how the research is ultimately used.

In our current review, we found that these mechanisms may be helpful but that NRC has not documented that its research results were responsive to regulatory needs and/or used in the regulatory process:

--Although long-range planning has improved, it is too early to tell whether NRC's latest plan will overcome past problems and be effectively used.

--NRC does not know how many or which projects are covered by review groups; some groups meet too infrequently and do not always document and disseminate their meeting results; groups often have primary purposes other than ensuring that research meets defined regulatory needs.

--Research information letters and associated followup documents are seldom used.

NRC agrees that better assurance is needed and during our review began developing a system to track its research projects. This new system was implemented in July 1983, and NRC is continuing to make improvements to it.

PRIOR GAO REPORTS ON THE NEED FOR A TRACKING SYSTEM

In two prior reports, we recommended that NRC track its research to show how the results of that research were being

incorporated into the regulatory process. In 1978,[1] we recommended that NRC establish a management information system to identify and document the degree to which results of each research project benefited the licensing process. And in 1980,[2] we recommended that NRC track research projects from inception through incorporation into licensing and related regulatory processes to ensure that research results were incorporated to the fullest extent into nuclear regulation.

In both cases, NRC responded that it did not think additional tracking was necessary. In 1978, NRC told us it believed existing mechanisms were sufficient to keep the licensing staff informed of research results and ensure that the research was meeting licensing needs. In 1980, NRC responded that a tracking system was unnecessary and that it was too costly to include each research project in its research tracking system. While we agreed that projects did not need to be covered by an elaborate tracking system, we believed that NRC management needed information on each project, no matter how small. We pointed out that all research projects should be subjected to some managerial control to ensure that NRC's research funds were accounted for and spent for intended purposes and that the results were recognized in the regulatory process.

IMPROVED LONG-RANGE PLANNING TOO NEW TO EVALUATE

NRC's long-range research plans have tried to focus NRC's resources on areas important to current and future regulatory objectives and needs. However, NRC's first and second long-range plans, issued in 1981 and 1982, met with severe criticism. The Advisory Committee on Reactor Safeguards[3] criticized both plans' lack of research priorities and their formats. NRC's current plan, issued in April 1983, is intended to address these criticisms. The current plan (1) identifies regulatory needs for each major research area, (2) lists major research products expected, and (3) ranks the proposed research according to

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[1]Nuclear Powerplant Licensing: Need for Additional Improvements (EMD-78-29, Apr. 27, 1978).

[2]The Nuclear Regulatory Commission: More Aggressive Leadership Needed (EMD-80-17, Jan. 15, 1980).

[3]The Advisory Committee on Reactor Safeguards was created as a statutory committee in a 1957 revision to the Atomic Energy Act to advise NRC on the safety of nuclear facilities and the adequacy of safety standards. Composed of 15 members, mostly scientists and engineers from academia and industry, this Committee reviews safety studies and facility licensing applications referred to it by NRC. A separate subcommittee is established for each nuclear power reactor project and each major subject area.

importance. The effectiveness of this plan in directing research to regulatory needs is unknown due to its newness.

Rationale for long-range planning

NRC devised the long-range plan to coordinate research planning with budget cycles, set priorities, ensure wise use of NRC resources, and establish agreement on research direction. The plan is updated annually, covers 5 years, and outlines research approaches to resolve identified regulatory issues. According to NRC's Director of the Office of Nuclear Regulatory Research, the plan is developed so as to provide NRC user offices' management with an opportunity to review and comment on the broad direction of the research. In April 1981 testimony to the Subcommittee on Nuclear Regulation, Senate Committee on Environment and Public Works, the Director said this approach has led to changes in research program emphasis and he expected that user offices' past reluctance to use specific research results would be eliminated.

The long-range plan is to be based on programs the research office believes should be initiated, considering needs identified by user offices and guidance provided by the Commissioners. In addition, user offices are to concur in the portions of the plan related to their needs, with yearly updating and reconcurrence. The research budget is to be developed based on the plan. Once the budget is approved, the research office develops detailed projects based on that budget.

Earlier plans were criticized

The Advisory Committee on Reactor Safeguards and the House Committee on Science and Technology were critical of NRC's first two plans issued in March 1981 and August 1982, respectively. According to an April 14, 1981, letter by the Advisory Committee, the first plan improved coordination of research planning with budget cycles but did not present research alternatives or priorities. In addition, the Advisory Committee said the plan merely constituted an extension of current research efforts directed toward current problems as opposed to laying out new, needed research efforts to address anticipated future problem areas. The Advisory Committee further criticized the plan's format, pointing out that potentially useful information was difficult to find. In this regard, it was often difficult to determine how the planned research identified under the various NRC budget categories was related to an identified or potential regulatory issue.

In an April 5, 1982, letter, the Advisory Committee found that NRC had better defined its research objectives in its second plan, but much remained to be done to identify and rank the problem areas warranting research effort. The Advisory Committee faulted the plan for still being merely an extension of efforts designed to address current regulatory questions with little regard for anticipating future regulatory needs.

A September 1982 oversight report by the House Committee on Science and Technology similarly criticized the two plans' lack of research priorities and their formats. The House Committee report concluded that NRC needs to define its specific objectives so that what is known can be compared with what needs to be known. Further, it stated that unless the user offices receive well-defined, understandable research results on a timely basis, they may not be able to make use of those results in revising regulations.

Current plan addresses criticism of earlier plans

NRC's April 1983 plan appears to address the criticisms made of the previous plans. This plan identifies broad regulatory issues and describes programmatic approaches for research to support the resolution of these issues over a 5-year period. These issues address the anticipated future needs of the user offices over the 5-year period. Although prior plans were organized by NRC's budget categories, this plan is organized by research area. Tables in the plan show how the research areas relate to NRC's budget categories. Although the plan defines specific objectives, it is not explicit in describing how the proposed research can be expected to lead to results that are useful for regulatory decisionmaking. For example, the plan does not show how the various research efforts pertaining to a regulatory issue will be integrated to meet specific research objectives.

Covering fiscal years 1984 to 1988, the current plan addresses each of NRC's 18 research areas and sets general priorities based on the relative importance of the safety and other regulatory issues being assessed. For example, the area of severe accident research has highest priority for fiscal year 1984. This research tries to identify the sequence of events that would occur during a severe nuclear powerplant accident, analyze and assess the probability of these events occurring, and develop a sound technical basis for deciding how well the powerplant can safely handle such events. The 18 research areas are described and listed by priority in appendix I.

Eleven of the 18 research areas have subareas. For example, severe accident research has 13 subareas which address key elements such as accident likelihood evaluation, severe accident sequence analysis, accident management, and behavior of damaged fuel. For each subarea, the plan identifies major regulatory needs, describes the research, and lists anticipated major products and projected completion dates. Although the latest plan sets priorities by research areas only, it indicates that NRC will be extending its priority setting to subareas in future plans.

Whether this plan will indeed help better focus the research on supporting regulatory needs will depend on how NRC carries out the research, disseminates research results, and

makes use of those results. The current long-range research plan is still relatively new and it is too early to tell how well the research set out in that plan ultimately will be used in the regulatory process. NRC intends to generate supporting program plans where necessary to deal with the integration of individual projects.

RESEARCH REVIEW GROUPS' EFFECTIVENESS FOR ENSURING RELEVANCY OF RESEARCH DOUBTFUL

Our review indicated that the effectiveness of research review groups as a mechanism for ensuring the relevancy of nuclear safety research is doubtful. Although NRC contends that it relies on such groups for the purpose of helping to ensure that its research results are useful, we found that (1) NRC really does not know how many or which projects are covered by these groups, (2) some groups meet only infrequently and the meeting minutes are not always prepared and disseminated, and (3) groups often have primary purposes other than ensuring that the research meets defined regulatory needs.

NRC guidelines pertaining to research review groups

According to NRC's guidelines for research review groups,[4] the Office of Nuclear Regulatory Research uses these groups to periodically bring together NRC staff on selected research topics. Divisions within the office establish groups for defined technical areas, and group chairpersons report to NRC's research office management. Membership consists of NRC staff from the research office and applicable user office(s). Members are to serve as individual technical specialists in the given area covered by their groups and to be responsible for expressing their own views, as well as their offices' pertinent formal positions. They are expected to report group activities or results to their supervisors and to other interested staff members in their divisions. The research review group guidelines do not cover conditions or circumstances under which such groups are to be established.

According to the guidelines, the research review group chairpersons are to arrange periodic meetings (usually quarterly, but at least twice a year) and special ones, if necessary. The guidelines also require the chairpersons to prepare minutes covering the groups' meetings within 2 weeks following each meeting and to disseminate those minutes to members' supervisors and place copies in NRC's Public Document Room.

The research review groups are to improve communication between the research and user offices and provide a broad base

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[4]Guidelines for RES [Office of Nuclear Regulatory Research] Staff Participation in Research Review Groups (undated).

of technical expertise in their respective research areas. The groups are also to help research management by commenting and recommending, when appropriate, on the

--purpose and expected use of predicted results (before any major planned test),

--validity and applicability of research results,

--possible redirection of projects,

--new projects formulated by NRC's research office to meet defined needs, and

--priorities within their respective technical areas.

Research review groups do not always assure relevancy of research

NRC does not know which of its approximately 500 ongoing research projects are covered by research review groups. In addition, we were told by the Acting Chief, Program and Administrative Services Branch, Office of Nuclear Regulatory Research, that neither the number nor the dollar amount of projects covered by the groups is known. Without knowing which projects are covered, or even the dollar significance of the projects, NRC management lacks assurance that the research review groups adequately ensure that ongoing projects are focused on producing usable results.

Even when projects are covered by research review groups, meetings are often scheduled infrequently and the activities covered are not always documented or disseminated. The following table shows the frequency of meetings held by the chairpersons of the 21 groups we contacted:

Number of periodic meetings each year	Number of groups contacted
0	4[a]
1	6
2	2
4	6
6	2
12	1

[a]Four groups did not have any regularly scheduled meetings, but met on an "as needed" basis as determined by the chairperson.

As indicated in the table, 10 of the 21 groups do not meet regularly (at least twice a year) as set forth in NRC's guidelines. In addition, only 13 chairpersons said that they maintain a written record of activities, although one of these said he

wrote minutes only when there were significant results. Only two chairpersons said that their minutes are distributed to supervisors and staff within their divisions or to NRC's Public Document Room, as called for by research review group guidelines. Without documentation on what transpired during research review group meetings, NRC management may not know whether and how often these groups are meeting, or what important comments and recommendations were made concerning the research projects covered.

Interviews with group chairpersons revealed that the groups lack a clearly understood purpose. According to the research office's deputy director, their main purpose is to ensure that all projects have regulatory relevance. Speaking with chairpersons of 21 research review groups, we encountered a variety of perceived purposes, though most agreed on the goal of improving communication between research and user offices. The purposes cited by the chairpersons of the 21 groups were as follows (some chairpersons cited more than one purpose):

	Groups with chairpersons interviewed	
Cited purpose	Number	Percent of total interviewed
Improve communication	17	81
Provide technical monitoring of research projects	12	57
Provide comments and recommendations on research	9	43
Identify future research needs	5	24
Identify and resolve research problems by redirecting projects	3	14
Review validity and applicability of research	3	14

While the purposes cited are consistent with the purposes set forth in the guidance, the chairpersons' responses indicate that ensuring that research results are responsive to regulatory needs is not a primary purpose of each research review group.

As could be expected from the variety of stated purposes, the extent to which a research review group helps ensure the use of research results varies from group to group. Chairpersons

of 11 of the 21 groups said their groups help ensure the usefulness of research results. Three chairpersons, for example, said that the groups aid research results use by disseminating information to the user office. Two chairpersons noted that use of research results is aided by having user office representatives serve as participants on such groups. They added that these participants are often the same individuals involved in the licensing process.

In contrast, chairpersons of 3 of the 10 other groups told us that research review groups do not help ensure the use of research results. Two of them said that the nature of the research and its impact determine whether the research is used. The other explained that the research information letter system is the formal mechanism for ensuring the use of research results, not the research review groups. The chairpersons of the other seven groups noted some other benefits but did not indicate that the groups help ensure that the research results were used in the regulatory process. Thus, management does not have complete assurance that groups are functioning as intended.

RESEARCH INFORMATION LETTERS SELDOM USED

In an April 1981 response to the Senate Subcommittee on Nuclear Regulation, NRC stated that research information letters provide a helpful mechanism for ensuring that research results are used in the regulatory process. However, this contention appears to be overstated. Our review showed that this mechanism is seldom used. Although NRC has about 500 ongoing projects, only four research information letters were prepared in fiscal year 1983. In addition, research utilization forms, which are to be prepared by user offices in response to the letters, are not being filled out in all cases even for those letters that are seldom issued. These forms are intended to provide important documentation showing how or whether the research was used.

According to a March 1981 memorandum by NRC's research director, the research information letter is the basic mechanism for transferring results of research work to user offices. The transfer is to be done in a timely and systematic manner. Under the procedure, a research information letter is to be prepared upon completion of "a substantial, coherent, and reasonably complete body of experimental or analytical work." The letter is to have the following general format:

--introduction: a brief technical description and identification of the user's need.

--results: an executive summary of the principal results of the research and their significance to NRC.

--evaluation: a concise description of the technical evaluation of the results and, where appropriate, the range of applicability of the results.

--attachments: sufficient details to allow technical staff members to evaluate the results independently, including all applicable technical documents or references to them.

The letter may cover one or more research projects. Research office recommendations on the applicability of the research results to the regulatory process are to be brief and concisely stated in the evaluation section.

When research information letters are used, they can help document the use of research results. For example, a December 1981 letter reported the results of research conducted relevant to boiling water reactors.[5] In its March 1982 research utilization form, the user office responded that the research had been used to

--confirm the validity of assumptions used in the development of boiling water reactor emergency procedures,

--confirm the adequacy of the model used to simulate accident conditions, and

--support staff testimony at two NRC licensing hearings.

From 1979 through 1982, 90 research information letters were issued. For 65 of these letters, user offices had provided responses on the research's applicability to the regulatory process. Although NRC consistently has had about 500 ongoing research projects, the table below shows that the number of research information letters and user office responses declined from 1979 through 1982.

Calendar year	Number of research information letters	Number of letters with user office responses[a]
1979	37	31
1980	34	18
1981	15	15
1982	4	1
Total	90	65

[a]Through April 30, 1983.

NRC lacked records on the status of completed projects and could not provide us with specific information on the number of projects without research information letters. However, NRC

[5]A boiling water reactor is a reactor in which water, used as coolant, is allowed to boil in the core. The resulting steam can be used directly to drive a turbine.

management told us that for the vast majority of completed projects, research information letters are not prepared because they are often perceived as being of limited value.

NRC ACTIONS UNDERWAY

The Director of NRC's Office of Nuclear Regulatory Research agreed that NRC lacks assurance that its research is responsive to regulatory needs. While our review was underway, NRC began developing a tracking system for research projects. While not elaborate, the tracking system is to provide data on funding, objectives, and status for each research project, including a user office response on how the research was used. NRC began operating the system in July 1983 and plans to update it every 6 months. In addition, NRC plans to continue improving the system to better serve management needs. This system aims to provide NRC management with information on the progress of ongoing research projects and the results of completed research and document the use or nonuse of the research. Thus, if properly implemented, this system should provide NRC management with a better tool than the mechanisms now used to ensure that research is directed toward regulatory needs and that the results of such research are appropriately used in the regulatory process.

CONCLUSIONS

To ensure that its research is responsive to its regulatory needs, NRC must (1) plan research to meet specific regulatory issues or questions, (2) oversee the progress of ongoing research projects to ensure that they are directed or redirected, as appropriate, and (3) routinely report on the completed research to ensure that users are aware of the results, and document the use or nonuse of the research to provide management with feedback on the effectiveness of the research efforts. Our review showed that the mechanisms NRC used for this purpose were not fully effective. We, therefore, continue to believe that a tracking system is needed to help NRC ensure that nuclear safety research is relevant and that the results are used to the fullest extent in the regulatory process.

Although NRC's current long-range plan tries to more clearly focus planned research on identified regulatory needs, it is still being implemented, and therefore its effectiveness as a mechanism helping to ensure that research results are used in fulfilling NRC's regulatory needs cannot be determined.

The effectiveness of NRC's research review groups as a mechanism for accomplishing this purpose, however, is doubtful. NRC does not know how many or which of its projects are being covered by these groups; some groups meet infrequently; the results of the groups' meetings are not always documented or disseminated to interested parties; and ensuring use of research results is often not among the groups' primary purposes.

Similarly, NRC's research information letters do not appear effective. The letters are seldom written and, even when they are, research utilization forms responding to the issued letters are not being prepared in all cases.

During our review, we brought our concerns to the attention of NRC management. They agreed that weaknesses existed in NRC's mechanisms for ensuring that its research addresses regulatory needs. Thus, a tracking system was developed to provide NRC management with a periodic overview of each research project, including information on how the results of the research were ultimately used. Such a system, if properly implemented, should make it possible for NRC management to better ensure that its nuclear safety research is responsive to regulatory needs. Since this new system has recently begun to operate, we have no recommendations.

CHAPTER 3

DOE AND NRC COORDINATE OVERLAPPING RESEARCH ROLES

Because DOE and NRC nuclear research and development roles overlap, the two agencies strive to coordinate their research efforts to prevent unnecessary duplication. The two agencies' research roles overlap on three primary topics: light-water reactor safety,[1] advanced reactors,[2] and nuclear waste management.[3]

Light-water reactors are the focus of most NRC safety research. So far, DOE has concentrated on planning such research, involving NRC in this effort. DOE is planning to ensure that unnecessary duplication does not occur by using various coordinating techniques, such as memorandums of understanding, interagency agreements, and joint meetings. Nevertheless, since this planned research has not begun, how well the coordinating techniques will work is unknown. DOE and NRC are using similar coordinating techniques for research on advanced reactors and high-level nuclear waste management where they have overlapping research responsibilities. Coordination techniques have already been implemented for nuclear waste management, but to avoid compromising NRC's independence, the two agencies are ensuring that coordination is not too close and, in some instances, intentional duplication does take place.

DESCRIPTION OF DOE's AND NRC's OVERLAPPING ROLES

We examined how DOE's and NRC's respective research roles have been delineated for light-water reactors, advanced reactors, and nuclear waste management. Essentially, DOE's objective is to research and develop the technologies, while NRC's objective is to conduct research on which to base, or as support for, its regulatory decisions. While the objectives are different, the technologies being researched or developed are the same, resulting in overlapping roles. This section discusses

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[1]The principal type of nuclear reactor used in commercial powerplant operations. A light-water reactor is a nuclear reactor which uses ordinary water as a coolant (substance to transfer heat).

[2]Reactors, such as breeder reactors, which produce fissionable fuel as well as consume it, and high temperature gas-cooled reactors, which use gas as the coolant.

[3]Management of equipment and materials (from nuclear operations) which are radioactive and have no further use. High-level wastes have radioactivity concentrations of hundreds to thousands of curies (basic unit of radioactive intensity per gallon or cubic foot).

the roles of DOE and NRC while the subsequent section discusses coordination efforts.

Light-water reactor safety research

The Congress passed the Nuclear Safety Research, Development and Demonstration Act of 1980 (42 U.S.C. 9701) which requires DOE to establish a coordinated light-water reactor safety research and development program to improve nuclear plant design and safety. According to the act, DOE must coordinate with NRC and, to the extent necessary, enter into a new memorandum of understanding or revise existing memorandums to avoid duplication and conflict with NRC's light-water reactor safety research program.

DOE issued its light-water reactor nuclear safety research and development program plan in December 1981 and updated it in March 1983. The updated version identifies, ranks, and recommends research and development activities needed and estimates funding necessary for carrying out such activities. According to DOE estimates, a total of $104 million will be needed over a 5-year period to carry out the plan's recommendations. DOE does not intend to implement the plan itself. Instead, DOE intends to ask NRC and industry to incorporate the recommended research and development activities into their respective research programs. However, in commenting on DOE's plan, NRC stated that because NRC's research budget is projected to decrease, it may not be able to accommodate additional research.

To carry out its mission as delineated by the Energy Reorganization Act of 1974, NRC devotes most of its research efforts to light-water nuclear reactors. Of NRC's $210 million fiscal year 1983 research budget, $169 million is for light-water reactor safety research. NRC's principal responsibility, as implemented through its regulatory program, is to ensure that public health, safety, and the environment are adequately protected. To carry out this responsibility, NRC defines conditions for using nuclear power and conducts technical reviews, audits, and followups to ensure that those conditions are met. NRC's research program provides technical information, independent of the nuclear industry, to aid in discharging these regulatory responsibilities. Confirmatory safety research[4] is done to define with greater precision the safety margins used in regulating nuclear facilities.

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[4]Confirmatory safety research is to provide NRC with a basis for evaluating the adequacy of regulations or to provide a basis for establishing a regulatory requirement or policy, or to provide NRC with the capability to regulate the use of nuclear power and materials.

Advanced reactors

DOE's role is to develop advanced reactors, such as breeders, while NRC's role is to eventually license and regulate these reactors. To accomplish their respective roles, both agencies fund research on these reactor technologies.

In 1970, the Congress authorized the former Atomic Energy Commission to enter into cooperative agreements with private industry to build and operate the Clinch River Breeder Reactor project. The federal government's responsibility for this project has since been transferred to DOE. The purpose of the project was to demonstrate that a liquid metal fast-breeder reactor can be designed, built, and licensed in a utility environment. To ensure that the project can be licensed as part of this project, DOE conducts research and development to ensure that the public health and safety are protected. In addition, DOE is conducting the long-term research and development needed for the private sector to proceed with the large-scale deployment of fast-breeder reactors, emphasizing research on elements that reduce technical uncertainties to levels acceptable to private industry and those that bear on public health and safety. In fiscal year 1983, DOE spent about $578 million on advanced reactor research and development. This amount is primarily for developing specific advanced reactor plants and test facilities. Safety research is integrated into this effort, and the amount spent for such research is not separately identifiable because it is only one of five key elements considered in developing the advanced technologies.

NRC's advanced reactor research is aimed at providing an independent capability for safety assessment and for developing overall licensing standards for advanced reactor technologies. This research also is to support NRC's individual licensing decisions regarding the construction and operation of DOE's advanced reactor demonstrations. In fiscal year 1983, NRC expended about $9 million on this work.

Nuclear waste management

The Nuclear Waste Policy Act of 1982 assigns research and development responsibilities regarding disposal of high-level radioactive waste and spent nuclear fuel to both DOE and NRC. DOE's research and development efforts are focused on developing high-level waste repositories. Under the 1982 act, DOE is to construct, operate, and maintain a nuclear waste test and evaluation facility and develop facilities to demonstrate dry storage of spent nuclear fuel. The 1982 act directs NRC to carry out a continuing analysis of the activities undertaken by DOE and to evaluate and report on the public health and safety implications of these activities.

In fiscal year 1983, NRC spent about $12 million for high-level waste management research and development, and DOE spent about $265 million for its related research efforts. DOE's

ultimate goal is to find safe means for handling and disposing of radioactive wastes. Thus, safety is a consideration in almost all aspects of this effort, but dollar amounts are not separately identified as being for safety research. DOE is currently investigating waste forms (wastes in solidified materials to be stored) and possible sites for repositories. In contrast, NRC's research seeks to obtain technical information and develop standards for regulating DOE's proposed methods and sites for disposing of high-level radioactive wastes.

DOE/NRC COORDINATION TO MINIMIZE DUPLICATION

Since DOE and NRC fund research on the same technologies, coordinating those separate research efforts is important to ensure that unnecessary duplication does not occur. The two agencies have taken a number of actions to help ensure coordination of research and thus help avoid duplication of effort. For example, they negotiated a February 1978 memorandum of understanding covering all research and have negotiated, or are negotiating, interagency agreements for light-water reactor safety research, advanced reactors, and high-level waste management. Similar coordinating techniques, including working groups, meetings, and document exchange, are to be used under each interagency agreement. To test the effectiveness of these techniques, we examined the coordination of waste management research for one NRC-funded project and related work carried out at a DOE-funded center.

The basic document covering all coordination of work between DOE and NRC is a February 24, 1978, memorandum of understanding. It set forth the two agencies' management policy on interagency relationships for research programs and related activities and also set forth certain requirements. The memorandum required interagency agreements to be prepared for major programs, as defined by program offices in each agency, to ensure that DOE/NRC research projects are continually monitored and evaluated. In addition, the memorandum stressed the need for interagency coordinating activities, including independent access to each other's facilities to review and monitor projects' scope, schedule, and funding, and cooperation at various levels within the two agencies to ensure efficient resource management.

Coordinating nuclear reactor research

DOE and NRC are negotiating draft interagency agreements for breeder reactor research and improved light-water reactor safety research. This latter agreement would replace a similar one signed in December 1979 which was never implemented because DOE funding of this type of research was limited. The principal coordinating provisions being proposed are the establishment of a DOE/NRC Joint Coordinating and Review Group and the exchange of information on proposed projects and research results.

To meet the light-water reactor safety planning and coordinating requirements of the 1980 Nuclear Safety Research, Development and Demonstration Act, DOE used working groups, which included NRC participants, to help ensure coordination with NRC of planned light-water reactor research. DOE established 10 working groups to help define programs and plan implementation in the technical areas indicated in the act. The groups identified unresolved issues in their program areas, reviewed current work which addressed these issues, defined a program which would resolve any remaining important items, and helped DOE plan to carry out the program. These groups had representatives from DOE, NRC, and other interested parties such as the Electric Power Research Institute and the Institute of Nuclear Power Operations. The groups met once or twice every 1 or 2 months during the program definition phase, which was completed in 1982. In addition, NRC's research office reviewed drafts of DOE's program plan for light-water reactor safety research and development and gave DOE written comments which were considered in finalizing the plan.

DOE's program plan states that, in implementing program activities, DOE will coordinate with NRC and, to the extent necessary, enter into a new memorandum, or revise existing memorandums for the purpose of eliminating unnecessary duplication and avoiding programmatic conflict with NRC safety research. In this regard, DOE has established technical working groups to assist it in implementing the program. However, since DOE has only been identifying research needed and has not yet funded or implemented the planned research, the effectiveness of the DOE/NRC coordination of light-water reactor safety research cannot be evaluated.

Coordinating waste management research

An interagency agreement between DOE and NRC was signed in April 1981 to provide for coordinating their respective high-level waste management research and development. To exchange pertinent information and avoid unnecessary duplication, the agreement provides for (1) periodic joint meetings on specific waste management topics, such as facility siting, waste package development,[5] and licensing activities, (2) exchange of contract documents, including technical reports, to provide each agency with a detailed understanding of all technical work that is being performed, (3) staff interaction through participation as observers in technical oversight activities, such as budget planning and work progress meetings, at the other agency, and (4) designation of an individual, called the Interface Coordinator, in each agency who is to be responsible for implementing the agreement.

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[5]Waste package development deals with containers to store nuclear waste underground in a form suitable for long-term storage.

Since the high-level waste management interagency agreement is the only one that has been implemented to date, we examined the effectiveness of DOE/NRC coordination in waste management research and development. As called for in the interagency agreement, Interface Coordinators have been identified at DOE and NRC to ensure implementation of the agreement. Both Interface Coordinators told us that the coordinating techniques are in place. They said that DOE and NRC staff jointly attend meetings, exchange contracting documents, and interact to provide adequate coordination. In addition to the Interface Coordinators, NRC has a representative on DOE's Materials Review Board which reviews and approves test procedures for waste management materials that have been developed by DOE's Materials Characterization Center, and DOE observers attend periodic NRC briefings of the Advisory Committee on Reactor Safeguards on NRC's waste management work.

To test the effectiveness of such coordinating techniques, we examined how one waste management project funded by NRC has been coordinated with DOE's waste management efforts at its Material Characterization Center, operated by Battelle Memorial Institute. We selected a $5 million ($1 million for fiscal year 1983) NRC project, started in April 1982 by Battelle Columbus Laboratories, for the study of high-level waste packaging for long-term waste disposal.

According to NRC, this study is investigating the physical and chemical processes that degrade the ability of high-level waste packages to contain waste. The research objective is to improve NRC's understanding of factors that can affect long term performance of waste packages and to determine uncertainties in performance assessment for licensing actions. Specifically, the project is developing a method to predict the behavior of high-level nuclear waste packages in geologic repositories (stored underground) for a long term (approximately 1,000 years). The study includes experiments and analyses designed to predict how waste forms (radioactive waste solidified to form glass) and waste containers will hold up over time.

Battelle does waste management work for DOE at the Material Characterization Center. This Center is managed by DOE's Material Integration Office, which is responsible for assuring that the Center's activities meet the needs of DOE's nuclear waste management program. According to the Office's plan, DOE's overall objective is to develop, construct, and operate systems that safely isolate radioactive wastes from the environment for the present and future. Hence, in this effort DOE is seeking to provide data suitable for use in ensuring compliance with NRC's and the Environmental Protection Agency's criteria for waste package performance. To ensure that the criteria are met, comprehensive computer models are being developed to study each proposed repository project to identify which parameters are most critical for determining the potential release of radioactivity to the environment. For fiscal year 1983, the Center's DOE funding was about $2.1 million.

Our test revealed that coordination has been taking place on the high-level waste project. First, pertinent information on each agency's work is exchanged. Project managers for NRC and its contractor routinely receive technical reports from DOE which describe the results of the research and development. Similarly, the DOE program manager and the Center's chief receive NRC reports on waste management research results. For example, NRC automatically distributes all waste management research reports to all parties that have expressed an interest in waste management, including DOE waste management program officials. Second, interaction between DOE and NRC staff and contractor personnel occurs at jointly attended meetings. For example, both the NRC contractor's project manager and the DOE manager of the DOE Center cited jointly attended meetings as a chief means of coordinating preliminary or recent research results. Meetings sponsored by DOE, NRC, or technical societies were cited as bringing technical people together for sharing waste management information. Such a meeting was held in December 1982 in Las Vegas, Nevada, on DOE's waste management program. The meeting was attended by NRC representatives, contractor personnel, and others. At this meeting, DOE discussed its waste management efforts, and NRC presented its waste management work in a half-day session. Finally, the NRC contractor's project manager said that he calls DOE contractors to pass on unusual or significant findings on an informal basis. A DOE contractor confirmed that such informal contact has been taking place.

Both the DOE program manager and the chief of the DOE Center said that the two agencies intentionally placed limits on contractor personnel interaction because of the need for NRC to maintain its distance from DOE due to NRC's licensing role. NRC's project officer and its contractor's project manager said that NRC has not been able to obtain preliminary research data while DOE work is underway or access to unpublished DOE technical reports. In addition, DOE has sometimes denied NRC and its contractor personnel access to DOE work sites. The NRC contractor's project manager said that knowing what DOE is considering doing in its high-level waste management program would help ensure that NRC research is relevant to waste facility licensing decisions. However, NRC's project officer said that NRC is concerned that a too close working relationship with DOE could be criticized because the facilities developed by DOE will be licensed and regulated by NRC. DOE's Interface Coordinator agreed that DOE has tried to constrain NRC's access to DOE's waste management work sites and computer models in an effort to avoid the perception that the two agencies are working too closely together. He explained that DOE does not provide tentative results of its development efforts to NRC because DOE will have to apply to NRC for licenses for its waste management facilities.

Since the research objectives are similar, some duplication of research effort between NRC and DOE exists in high-level

waste. According to NRC's project officer, the Director of NRC's Office of Nuclear Material Safety and Safeguards, and DOE's waste management program manager, such duplication may be appropriate in view of NRC's responsibility to confirm DOE's predictions. They explained that some duplication is necessary because DOE must support its facilities licensing applications with its own data and NRC will need some of its own confirmatory data in addition to DOE's data to license the facilities. They pointed out that, even when the research is similar, the approach may be different. For example, a DOE waste management program official and NRC's project officer told us that Battelle Columbus Laboratories is using different approaches to experiments that have objectives which are similar to some of DOE's research. NRC documents also stated that different approaches were used. NRC management maintains that its research does not duplicate DOE's except when there is a need to conduct independent verification so that NRC's independence does not appear to be impaired.

According to DOE and NRC officials, coordination has occasionally helped prevent unnecessary work from being undertaken. The DOE program manager told us that NRC's waste management work has been modified as a result of knowledge of DOE's work. In this regard, an NRC project officer cited two examples of how NRC modified its project scope based on information that DOE had made changes in its work. First, although NRC was originally going to evaluate three types of materials for waste forms, evaluation of one of the materials was eliminated when NRC learned that DOE was no longer considering using that material. Second, NRC later dropped evaluation of still another type of material as a waste form when it found out that DOE had decided to focus its research on only one type of material.

The Chief of NRC's High-Level Waste Technical Development Branch, Office of Nuclear Material Safety and Safeguards, said that in some instances NRC has abandoned work that can be more appropriately performed by DOE and thus significantly reduced budget expenses over the past several years. For example, NRC had trouble initially convincing DOE of the need to conduct in-situ testing[6] and entered a contract to survey the nation to locate abandoned mines in which an NRC test facility could be established. Phase 2 of the project was to construct the facility and conduct tests at a cost of $11.6 million over a 4-year period, but the project never went beyond phase 1 because DOE incorporated in-situ testing in its repository development program and NRC elected to use DOE's test results. Consequently, NRC reduced its research waste management budget requirements for subsequent years.

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[6]In-situ testing is that which is done at potential repository sites as part of siting research.

CONCLUSIONS

DOE and NRC have overlapping research and development responsibilities for light-water reactor safety research, advanced reactors, and nuclear waste management. Their respective research has different purposes, but it involves the same technologies. To ensure that unnecessary duplication of research work does not occur, the agencies must coordinate their work.

Coordination between DOE and NRC has occurred. In developing its program plan for light-water reactor safety research and development, DOE included NRC staff members on the 10 working groups it established to define research needs. DOE and NRC signed a memorandum setting forth management policy on interagency interaction and stressing the need for coordination. DOE and NRC have implemented an interagency agreement with specific coordinating techniques to be used in nuclear waste management and are revising an unimplemented agreement on light-water reactor safety research and negotiating an agreement for breeder reactors.

To test the effectiveness of the coordinating techniques, we examined one NRC-funded waste management project and similar DOE work being carried out at one of DOE's contractor-operated facilities. We found that the coordinating techniques were in place and have helped keep DOE, NRC, and their contractors aware of the two agencies' research efforts. NRC has on occasion changed its waste management research plans due to its knowledge of DOE efforts. Thus, our test disclosed that the coordinating techniques can work if properly implemented.

Nevertheless, some duplication has intentionally occurred. With respect to NRC's contention that duplicating research performed by DOE offers greater assurance of independence, we agree that this concept is important to carrying out NRC's missions. The public has entrusted NRC to carry out various research, licensing, and other regulatory functions in a manner to ensure that the public's health and safety are protected. It is therefore important that the results of such work not be compromised. This can be done by ensuring that the work is performed independently, thereby avoiding conflict of interest situations. To do otherwise could erode the public's trust and confidence in NRC's ability to successfully fulfill its missions. To illustrate, little public trust would develop in a situation where NRC relied exclusively on DOE's testing of the safe operation of a component in a nuclear waste facility when DOE is responsible for developing that facility. Therefore, we agree, in principle, that NRC needs to conduct some research which duplicates DOE's efforts in order to ensure that its independence is not compromised. During this review, we found the coordinating techniques being implemented would help ensure that unnecessary duplication of research was not taking place.

CHAPTER 4

AGENCY COMMENTS AND OUR EVALUATION

NRC generally agreed with matters presented in this report and DOE agreed with our conclusions. The full text of NRC's and DOE's comments are included as appendixes II and III, respectively.

NRC's comments pointed out further improvements it intends to make to its new project tracking system and its long-range research plan. NRC also stated that the discussion of the DOE/NRC interface is accurate and made no further comment on that topic. We are pleased that NRC generally agrees with our positions, has begun corrective actions, and plans to make further improvements.

DOE said it was in basic agreement with our conclusions and only made editorial comments to improve the report's clarity. It pointed out that most of its nuclear energy program funding of $877 million is for developing new nuclear reactor technologies and waste management technologies and facilities and that only a small portion of its funding is for light-water reactor research and development. DOE also suggested that we identify the DOE office in which two officials we interviewed are located because another DOE office has officials with similar titles. We made changes to clarify this report as DOE suggested.

NRC RESEARCH AREAS AND PRIORITIES

NRC's Long Range Research Plan, issued in April 1983, establishes priorities for 18 research areas, as shown in priority order below. The amounts in parentheses show what NRC plans to spend on these areas in fiscal year 1984.

1. Severe Accidents ($51.8 million). This area will provide technical information to support regulatory decisions in the severe accident area for existing or planned nuclear powerplants. It will develop bases to determine how safe the plants are and where and how their level of safety ought to be improved.

2. Pressurized Thermal Shock ($1.1 million). This research examines the durability of nuclear reactor containment vessels exposed for prolonged periods to nuclear radiation. Abrupt changes in pressure and temperature, a condition called pressurized thermal shock, could create brittle vessels, allowing coolant water to escape.

3. Risk Analysis ($9.4 million). This research is concerned with developing and using systems analysis and engineering techniques, including risk assessment methodology, to assess safety of nuclear power reactors being regulated. It includes developing models, methods, documented procedures, and other analyses to support NRC's reactor safety decisions.

4. Human Factors ($6.2 million). This area is to provide a technical basis to support regulatory needs in applying human factors to the operation of, and emergency preparedness at, nuclear facilities. It includes research on control room design and evaluation, personnel qualifications and staffing, plant procedures, human reliability, and emergency preparedness.

5. Plant Aging ($23.3 million). This area studies problems caused by degradation of reactor components over time. The studies are to provide the basis for NRC's licensing decisions on the ability of nuclear powerplants to meet health and safety requirements.

6. Equipment Qualification ($5.4 million). This research studies methods used for qualifying electrical and mechanical equipment used in nuclear powerplants.

7. External Events ($5.9 million). This area is concerned with the hazards to nuclear reactors caused by natural or human-related phenomena. It provides information on how phenomena such as earthquakes, floods, severe weather, and aircraft accidents could compromise safety.

8. Seismic Analysis ($4.8 million). This research is to better define how nuclear powerplant structures and equipment can withstand seismic events, such as earthquakes, of intensities greater than those which the structures and equipment were designed for.

9. Thermal-Hydraulic Transients ($37.7 million). This research is to provide data and methods for understanding how reactor coolant systems would be affected by abnormal occurrences, such as rupture of coolant pipes. Recently, the emphasis has shifted from loss-of-coolant accident research to applying computer models to analyze the effect of various coolant temperatures and pressures on nuclear reactors.

10. Waste Management ($9.3 million). This research is to provide the technical capability to assess whether nuclear waste management systems comply with regulatory requirements for protecting the public and environment from the hazards of radioactive waste products. Research to prepare for licensing of proposed DOE facilities to store high-level radioactive waste is part of this area.

11. Fire Protection ($0.9 million). Research on fire protection is to provide information to evaluate the adequacy of current fire protection criteria for nuclear powerplants.

12. Instrumentation and Control ($6.2 million). This research is to improve and confirm the methods and systems for minimizing the probability and consequences of an accident.

13. Pipe Rupture Investigations ($0.9 million). This research is to provide information on postulated breaks in safety-related piping which can be used to establish or revise design criteria for nuclear reactors.

14. Radiation Protection and Health Effects ($5.3 million). This research examines the risk of health damage from NRC-licensed activities to make sure that the risk is as low as reasonably achievable.

15. Materials Safety ($2.5 million). This research supports regulation of processing, transportation, storage, and end uses of radioactive materials in facilities other than nuclear powerplants (such as fuel cycle facilities).

16. Decommissioning ($0.8 million). This research is to develop information on technology, safety, and costs needed to establish regulations on decommissioning (shutting down operations) nuclear facilities.

17. Safeguards ($1 million). This research was initiated in fiscal year 1976 and is essentially completed. Future research will stress the interaction of physical protection systems, human factors, and physical security systems and procedures.

18. Advanced Reactors ($9.9 million). This research is to provide data and methods for making licensing and regulatory decisions for advanced types of nuclear power reactors, including fast-breeder reactors and gas-cooled reactors.

APPENDIX II

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

SEP 20 1983

Mr. J. Dexter Peach, Director
Resource, Community and Economic
Development Division
United States General Accounting Office
Washington, DC 20548

Dear Mr. Peach:

We have reviewed the draft of your proposed report, "Nuclear Safety Research -- Accountability and Coordination." The report covers two topics, how the NRC ensures research is responsive to its regulatory needs and the relationship between the NRC and DOE programs. The discussion of the DOE/NRC interface is accurate and we have no comment on this topic.

On the topic of how the NRC ensures that research is responsive to its regulatory needs we have several comments. As noted in the report, we have recently installed a basic research tracking system as a first step in the establishment of an automated information base. As a result of your report, we recognize the need to ensure that senior NRC management is cognizant of how research results are applied. This goes beyond what was our original intention for the tracking system. Further improvements will be necessary since the system, as now designed, will provide only an indexing and tracking function. The format and level of detail of documents used to record how research is incorporated into the regulatory process needs to be carefully defined in order to be more useful than the Research Information Letter (RIL) process which is discussed in the report. Page 15 of the report states, "the plan (Long Range Research Plan) does not show how the various research efforts pertaining to a regulatory issue will be integrated to meet specific research objectives." This problem was identified by the NRC when the Long Range Research Plan (LRRP) was reformatted. The intent was and is to generate supporting program plans where necessary to deal with the integration of individual projects. Supporting plans currently exist in various stages for Severe Accident Research, Seismic Research, and Probabilistic Risk Analysis. Additional plans have been initiated in Plant Aging and Materials. Additionally, a companion report to the LRRP is the Research Utilization Report completed for the first time this summer which, in the future, will be published concurrently with the LRRP.

Overall the audit findings were constructive and we believe we are making progress in resolving those deficiencies that we and the GAO staff have recognized.

Sincerely,

Jack W Roe for

William J. Dircks
Executive Director for Operations

Department of Energy
Washington, D.C. 20585

SEP 19 1983

Mr. J. Dexter Peach
Director, Resources, Community and
Economic Development Division
U.S. General Accounting Office
Washington, D.C. 20548

Dear Mr. Peach:

The Department of Energy (DOE) has reviewed the General Accounting Office draft report entitled, "Nuclear Safety Research--Accountability and Coordination." DOE is in basic agreement with the conclusion of the study and has only a few editorial comments to offer. Please see the enclosure for our comments.

Sincerely,

Martha O. Hesse
Assistant Secretary for
Management and Administration

Enclosure

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