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OFFICE OF THE INSPECTOR GENERAL

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US NUCLEAR

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REGULATORY COMMISSION

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PERFORMANCE CRITERIA AND BETTER  
MANAGEMENT OVERSIGHT NEEDED TO  
ENHANCE NRC'S RESEARCH PROGRAM  
CONTRIBUTIONS

OIG/92A-11

March 8, 1993

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# AUDIT REPORT

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

March 8, 1993

OFFICE OF THE  
INSPECTOR GENERAL

MEMORANDUM FOR: James M. Taylor  
Executive Director for Operations

FROM: Thomas J. Barchi  
Assistant Inspector General for Audits

SUBJECT: PERFORMANCE CRITERIA AND BETTER  
MANAGEMENT OVERSIGHT NEEDED TO  
ENHANCE NRC'S RESEARCH PROGRAM  
CONTRIBUTIONS

Attached is the Office of the Inspector General's audit report "Performance Criteria And Better Management Oversight Needed To Enhance NRC's Research Program Contributions", which assesses the Office Of Nuclear Regulatory Research's (RES) oversight of NRC's research program.

The report focuses on the need for NRC and RES to establish (1) criteria to more accurately measure the performance and contributions of RES's programs, and (2) stronger internal controls to periodically assess research initiatives to ensure they effectively support NRC's mission.

The Deputy Executive Director for Nuclear Reactor Regulation, Regional Operations and Research supports the basic thrust of this report and outlined actions to enhance program management. Because the research program plays an important role in supporting NRC's mission, we are designating this as a high-priority for a follow up audit. Our work will evaluate the effectiveness of NRC's actions to address its research management weaknesses, and whether RES's products meet the needs of those requesting research.

Attachment:  
As stated

203/12

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## INTRODUCTION

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In light of increased emphasis on maximizing the return on limited funds invested in federal programs, the Office of the Inspector General (OIG) reviewed the management oversight of NRC's research program. We focused on whether the Office of Nuclear Regulatory Research (RES) has established and implemented an effective management oversight process for (1) setting research goals, (2) measuring research program performance against those goals, (3) terminating work where warranted, or (4) justifying continued research. In this audit we did not attempt to determine the appropriate level of research, or question the merits of work in broad program areas and their supporting individual projects.

We recognize that the research program plays an important role in NRC's mission. However, we also recognize that in today's era of increased budget austerity, the demand for maximum yield from Federal program investments is great. For example, in attempting to improve efficiency in government programs, the Chief Financial Officers Act of 1990 requires federal agencies to establish performance goals, and systematically measure their effectiveness in achieving them. In an April 1992 report on the Department of Energy's (DOE) technology development program for environmental cleanup, the General Accounting Office (GAO) found that measurable performance goals are key management tools in developing and guiding programs of this nature. More recently, the Administration's budget for Fiscal Year 1993 stated that,

"Taxpayers should not be asked to pay for programs unless they can see results...Federal agencies have not adequately identified measurable goals against which to track and compare performance."

Appendix I contains additional information on our objectives, scope, and methodology.

## BACKGROUND

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RES is one of three NRC offices established by the Energy Reorganization Act of 1974, as amended. Section 205 of the Act directs RES to develop recommendations for research deemed necessary to support the Commission's



licensing and related regulatory functions, and engage in, or contract for, research to support these functions. To carry out this mandate, RES established three program objectives: (1) provide information for making independent and timely regulatory judgements, (2) anticipate potential safety problems, and (3) develop regulations and guides to implement Commission policy or requirements.

RES provides independent expertise and technical information on a wide range of subjects to NRC's various program offices. About 75 percent of RES's work is done to provide information requested in "user-need" letters submitted by various NRC offices, such as the Office of Nuclear Reactor Regulation or the Office of Nuclear Material Safety and Safeguards. RES and other NRC office staff work together in developing these letters. Most "user-need" letters are not prescriptive, but rather outline general topics where additional research information is needed. This approach provides RES the latitude to determine how it will supply the requested information. RES staff normally attempt to complete requested work within 1 to 3 years. The remaining 25 percent of RES's efforts are self-initiated, and directed at anticipating problems of potential safety significance to assist NRC in pursuing its regulatory mission. Since much of this research is speculative, it can require up to 10 years to complete.

RES utilizes this combination of "user-need" letters and self-initiated programs, supplemented by guidance from the Commission, to develop plans for future work. For example, in October 1991, RES published a 5-Year Plan that outlined research needed to support six program elements. Later, to better reflect its current and future work, RES consolidated the program elements into five. Like the previous plan, each program element outlines broad research areas. Much of the previous research will continue under the reorganized work areas, according to RES officials.

NRC contracts with various organizations to conduct specific research. For example, although NRC places most research contracts with the Department of Energy's national laboratories, it also utilizes the research capabilities of universities, foreign governments, and other government agencies. In FY 1992, RES staff managed a \$119 million budget; the majority of this funding supported about 730 research projects.

## FINDINGS

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Our audit found two fundamental management weaknesses exist in NRC's research program. First, neither NRC nor RES has established criteria to measure the performance and contributions of the broad programs and supporting projects that comprise NRC's research effort. Instead, research contributions and direction are primarily guided by the "professional judgement" of RES staff, supplemented by the views and opinions of external technical experts. When reviewing RES programs, the focus is on broad, general program objectives, and not on how effectively the supporting research projects form an integrated research package to answer specific questions. While there has been a recent increase in research program oversight by senior level NRC management, the criteria used in these reviews is based on "professional judgement", not established performance measurements of how effectively research contributes to or serves NRC's mission.

The second weakness -- a lack of strong internal management controls to guide NRC research -- may be an outgrowth of the first. For example, RES does not have a mechanism to determine how many research projects are devoted to (1) solving broad program objectives outlined in the 5-Year Plan or, (2) responding to issues raised in "user-need" letters. This information could improve RES' "professional judgement" decisions, the peer review process, and management oversight effectiveness by better defining the level of effort and resources that NRC is devoting to broad program areas and supporting research projects.

In addition to addressing these management weaknesses, this report also discusses (1) the growing importance of performance goals, (2) how the utility industry's research management is more product-oriented than NRC's, and (3) senior NRC management recognition of the need for better program oversight.

### **NRC HAS NOT ESTABLISHED CRITERIA TO EVALUATE RESEARCH**

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NRC's research program is particularly important because it assists in the protection of public health and safety. However, research by its very nature is often unpredictable and not well-defined. Therefore, an effective management structure is critical to extracting maximum benefit from limited



program resources, and ensuring that NRC's research program achieves intended goals and objectives.

Measurable performance goals are key management tools because they provide a basis for developing strategies, and help guide program direction. These goals also act as benchmarks for measuring program success because they identify desired achievements.

However, we found that neither NRC, RES, nor NRC's external advisory groups have developed criteria to determine when sufficient research has been conducted -- either in broad program areas, or individual research projects that support those areas. Instead, NRC and RES managers and staff review research programs and projects semi-annually to evaluate accomplishments and identify where additional research is needed. This is done using a combination of "professional judgement" and "peer review". We believe the lack of criteria to measure research contributes to the following management weaknesses identified during our review.

#### WEAKNESSES IN ESTABLISHING RESEARCH OBJECTIVES

We interviewed a cross-section of NRC and RES managers and staff, as well as external technical experts who provide advice on NRC research programs, to determine the criteria they use to measure whether NRC is conducting necessary and beneficial research. RES staff told us the primary driving forces behind research are the 5-Year Plan and "user-need" letters. However, since these documents do not outline the research that will be performed to accomplish specific objectives, we found RES staff have considerable discretion in scoping their work.

We also found that program direction and budget decisions are based on fund availability, and staff judgement of how these funds should be allocated among RES's wide range of issues. RES staff generally indicated that the perceived importance of most research programs is often reflected in the level of funding they receive. The staff were not aware of any criteria that guides decisions to allocate funds among programs and projects, and one senior staff member characterized RES's process for allocating funds among projects as "a bit amorphous."

In addition, RES staff stated they believe research programs are justified if the Commission or senior NRC management do not direct discontinuation of

their work. For example, staff working on a large multi-year program stated that if they encounter annual budget reductions, they simply stretch out the amount of planned work to meet available funding, instead of reassessing the need to complete all proposed research projects. While they acknowledged this practice generally extends the time required to deliver research products, RES staff defended this strategy by stating it is the product of collegial judgement, and is aimed at delivering an integrated body of research which has received Commission approval in the 5-Year Plan.

We also noted that when research in large program areas has been completed, RES often supports additional work at the "maintenance level" to retain contractor expertise in highly technical areas. RES staff expressed the fear that if they did not continue some work in certain areas, they might not have an adequate body of expertise to support future research initiatives. For this reason, staff stated they believe public interest dictates that NRC conduct research in as many aspects of nuclear operations as possible.

#### **LACK OF PERFORMANCE CRITERIA CAN PRODUCE QUESTIONABLE PROGRAM RESULTS**

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We found that without measurement criteria, it is difficult to determine how effectively RES programs contribute to the regulatory process. For example, in offering advice on one of RES' large multi-year programs, the Advisory Committee on Reactor Safeguards (ACRS) noted the staff responsible for the research "labor under a severe handicap" because it has not been determined how the program results will be used in the regulatory arena. In ACRS's view, this situation places RES "in the position of a traveler with no road maps." In one research area where peer reviewers had identified a large number of significant problems and weaknesses, the ACRS was concerned this condition could exist even though the research had reached the "advanced" stage. The ACRS recommended that (1) RES's work in this program be "used with considerable caution until these deficiencies have been corrected", and (2) a decision be made regarding how this effort will be used in the regulatory process.

We also found that senior RES managers rely on their staff to ensure programs are headed in the right direction. In turn, RES staff generally believe research is justified if they can demonstrate some linkage between their work and the 5-Year Plan or "user-need" letters. However, RES staff noted they are not always able to establish this relationship. For example, in

one program, RES staff stated they could not show a direct linkage between nuclear plant safety and the need for a multi-year research effort. The staff funded this activity based on their engineering expertise and professional judgement. When reviewing the program, however, the ACRS was concerned that RES staff had made no effort to set priorities or assess how this project would enhance nuclear plant safety. As a result, the ACRS questioned whether RES staff was "emphasizing the problem easiest to solve, rather than the most risk-significant." The ACRS also suggested that a "coherent approach to risk management and regulation would assign the NRC's scarce resources and expertise through risk-based criteria," and recommended that the direction of the program be reassessed.

These comments illustrate the need for RES management to establish more effective linkage between its research programs and NRC's mission of protecting public health and safety.

#### **MANAGEMENT CONTROLS NEEDED TO ALIGN RESEARCH OBJECTIVES AND PROGRAMS**

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We attempted to determine how many research projects are devoted to specific issues, such as reactor vessel integrity or analyzing advanced reactor designs. However, this information was not available because RES does not have a management process that reconciles individual research projects with the 5-Year Plan, broad program elements, or "user-need" letters.

We also found that NRC's advisory groups, such as the ACRS and the Nuclear Safety Research Review Committee (NSRRC), primarily offer advice on funding levels and broad program objectives. The advisory groups we interviewed were not aware of the number or effectiveness of research projects in supporting RES' broad program objectives. We also attended RES staff presentations to three groups that provide advice on RES programs. The advisory groups primarily focused on broad program objectives, without discussing how supporting projects work together to form an integrated research package.

Since the information was not available, we developed a data base using September 1992, financial information which RES maintains on each research project to better ascertain the scope of RES's programs. As presented in Appendix II, during the 3-year period included in our analysis, RES was

responsible for managing an inventory of 733 active and planned projects, with a cumulative cost of about \$280 million.

We identified 25 research categories that reflect most of RES's projects, from work on advanced reactor designs, analyses of the Three Mile Island accident, to the disposal of radioactive waste. We also identified two other project categories where RES (1) provides technical assistance to the Office of Nuclear Material Safety and Safeguards on non-reactor initiatives such as evaluating and licensing various aspects of nuclear medicine, and (2) develops engineering standards and transfers nuclear technology. We classified about 80 projects, representing a cumulative 3-year total of about \$19 million, as miscellaneous.

A wide-range of research projects supported each of our categories, from a low of 3 projects devoted to "Assessing the Effect of Utility Organizational Structures on Nuclear Plant Performance," to a high of 63 projects for "Research to Support the Storage of High-Level and Low-Level Radioactive Waste." On average, about 27 research projects support each category.

Our analysis showed there has been a recent gradual annual increase in research project funding, from about \$88 million in FY 1990 to about \$100 million in FY 1992. Also, there has been a shift in research emphasis during the period. Fourteen research categories experienced funding increases, 8 categories had decreased funding, and funding remained fairly constant in 5 categories. There was a gradual decline in the funding of the miscellaneous projects.

The Chairman of the NSRRC reviewed our analysis and stated it appears to accurately reflect RES' broad programs and supporting projects. He also noted that (1) a significant number of projects are underway or planned in areas where he thought research was being terminated or reduced, and (2) it appears RES is supporting too many projects in some program areas. The Chairman also said NSRRC plans to become more involved with NRC operations, and provide better technical advice and oversight, by reorganizing into small subcommittees that focus on specific research programs.

#### **THE IMPORTANCE OF PERFORMANCE GOALS GAINING PROMINENCE**

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There has been a growing awareness of the importance of having

performance goals to effectively manage large programs. For example, in April 1992, GAO reported<sup>1</sup> on its review of DOE's technology development program for environmental cleanup. This program is somewhat analogous to NRC's research program in that it is based on a 5-year plan, represents a significant federal investment in new technology, and can affect public health and safety.

GAO found that research and development experts recognize the importance of establishing measurable performance goals, coupled with clear decision points for effective management oversight. In their view, the objectives of research projects should be well-defined and have quantitative parameters. GAO concluded that without these measurements, it will be difficult to discern (1) what should be achieved, (2) how to best achieve it, (3) which projects are performing poorly and should be eliminated, and (4) when the research objective has been attained. DOE officials agreed with GAO, and have taken measures to improve the program's management structure.

#### **INDUSTRY RESEARCH MANAGEMENT IS MORE PRODUCT-ORIENTED**

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We met with officials of the Electric Power Research Institute, (EPRI) the research arm of the electric utility industry, to discuss the criteria used to measure research programs which serve EPRI's approximately 700 member utilities.

In comparing NRC and EPRI research programs, EPRI officials said their research is more "product-oriented" because it is aimed at solving specific operational problems identified and funded by EPRI's member utilities. For example, EPRI's research program generally follows a 5-step process to (1) identify the problem, (2) find the solution, (3) demonstrate the solution, (4) transfer the new technology to the utility industry, and (5) help utilities implement solutions and new technology at their plants.

EPRI officials also said their research evaluations include some measure of "professional judgement" and advice from external sources. Their judgements, however, are supplemented by input from quarterly meetings with parties requesting the research. These sessions help ensure EPRI's work is meeting

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<sup>1</sup>CLEANUP TECHNOLOGY: Better Management for DOE's Technology Development Program, April 10, 1992, (GAO/RCED-92-145)



utility needs. Research is usually terminated when EPRI and utilities determine the work has produced acceptable solutions to identified problems. In their view, the product-oriented nature of EPRI's research program and this structured approach helps focus their judgements.

#### **SENIOR NRC MANAGEMENT RECOGNIZES THE NEED FOR BETTER PROGRAM OVERSIGHT**

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In August 1991 the Deputy Executive Director for Nuclear Reactor Regulation, Regional Operations and Research (DEDO) personally initiated a series of research program reviews to become more familiar with RES's broad research programs and supporting projects, and ensure that RES's products are useful. The DEDO told us this was the first time senior NRC management has conducted a detailed project-by-project review. The DEDO suggested that senior NRC managers should periodically conduct similar reviews because they provide an excellent perspective of how RES's work will be integrated into the regulatory process, and enhance the working relationship between staff and managers.

We attended two project review sessions during our audit. Included in the reviews were RES staff presentations on the status of their various projects. If the DEDO was not able to identify specific regulatory applications or contributions during the reviews, he subsequently suggested that either the project focus be sharpened, or funding in those areas be reduced. For example, the DEDO questioned the need for projects totaling about \$6 million, and convened an advisory panel of NRC staff to further review the projects, and determine whether they should be continued or brought to closure. This review was still underway when we completed our audit. The DEDO also stated he frequently convenes advisory panels to help guide his decisions on particularly difficult issues regarding research direction, or build consensus on sensitive regulatory topics.

The DEDO told us he does not have specific measurement criteria, and uses "straight judgement" to assess whether RES's programs support NRC's mission. Much of this judgement centers on his assessment of the level of funding that should be devoted to certain programs, not the number of research projects that support them.



In commenting on these reviews, RES staff stated they were not aware of the criteria the DEDO uses to evaluate their programs, or reallocate research funds to other RES programs. In their opinion, some resulting budget reductions appear arbitrary, and are made without regard to the program's technical merits or potential contributions to improving nuclear plant safety.

## CONCLUSIONS

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The need for focused research -- which plays an important role in NRC's mission -- is highlighted by a growing awareness of the need to ensure that federal programs meet measurable goals. However, neither NRC nor RES has established needed management tools, such as performance criteria and a structured process, to guide the research program and evaluate whether projects are meeting stated goals and objectives. We believe such measurements are critical to ensuring that NRC's limited research funds are managed effectively, make positive contributions to the regulatory process, and yield maximum return on the Federal investment. Without these fundamental management tools, we believe NRC and RES will have difficulty (1) determining research objectives, (2) developing a strategy of how to best achieve the objectives, (3) determining appropriate research funding levels, and (4) assessing the contributions of research products and their resulting regulatory impact.

## RECOMMENDATIONS

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To correct the management weaknesses we identified, we recommend that NRC and RES officials:

(1) Establish criteria to measure the performance and contributions of the broad programs and individual projects that comprise the research program. The criteria should outline how broad programs and supporting projects will be measured as they provide specific answers to regulatory issues and concerns.

(2) Use performance criteria to evaluate the 733 projects that support the research program and identify where (a) research may have achieved its objectives, (b) the need for additional research to protect public health and safety continues to exist, or (c) research should be re-directed or terminated.

We believe that NRC and RES management should terminate broad research programs and supporting projects that do not meet this criteria, or where regulatory application is not identified.

(3) Establish an internal control mechanism that reconciles individual research projects with RES's 5-Year Plan, broad program elements, and "user-need" letters. Once this mechanism is in place, use it and the performance criteria to periodically assess research programs and projects to ensure they effectively support NRC's mission of protecting public health and safety.

### **AGENCY COMMENTS**

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The Deputy Executive Director for Nuclear Reactor Regulation, Regional Operations and Research supports the basic thrust of this report and outlined actions to enhance program management. His comments are included as Appendix III. Because the research program plays an important role in supporting NRC's mission, we are designating this as a high-priority for a follow up audit. Our work will evaluate the effectiveness of NRC's actions to address its research management weaknesses, and whether RES's products meet the needs of those requesting research.

## **OBJECTIVES, SCOPE, AND METHODOLOGY**

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The Senate Committee on Appropriations' report accompanying the Nuclear Regulatory Commission's (NRC) Fiscal Year (FY) 1992 Appropriation expressed concern about increases in NRC's budget, especially requests for increased research funding. The report directed the agency to conduct an external review of this growth. The NRC Chairman subsequently requested that the Office of the Inspector General review and report on increases in NRC research. On May 1, 1992, we issued a report that discussed budget changes within the Office of Nuclear Regulatory Research (RES). We built upon information developed in that effort to develop this report. We conducted our review between June and December 1992.

In obtaining information for this report, we interviewed a cross-section of RES officials responsible for managing broad research programs and supporting projects, and analyzed information they provided. We supplemented this information with the views and perspectives of internal and external groups who provide technical advice to NRC.

To observe how NRC management exercises oversight of the research program, we interviewed the Deputy Executive Director for Nuclear Reactor Regulation, Regional Operations and Research, the Chairman of the Committee to Review Generic Requirements (CRGR), and attended RES staff briefings before these groups. We also attended an oversight briefing conducted by NRC's Senior Contract Review Board (SCRB).

To obtain the perspective of external advisory groups, we met with the Chairman of the Nuclear Safety Research Review Committee (NSRRC). We also attended oversight briefings that RES staff conducted for an NSRRC subcommittee, and the Advisory Committee on Reactor Safeguards (ACRS).

To obtain the industry perspective of research program management we met with representatives from the Electric Power Research Institute (EPRI) and the Nuclear Management and Resources Council (NUMARC). EPRI officials also provided detailed briefings on their research programs and management oversight procedures.

To determine how RES allocates its funding across program areas, we obtained financial information that RES maintains on its projects. We developed a computer program to sort RES projects into a data base of research program categories we identified. Where appropriate, we used this data base as a point of reference during discussions with officials from NRC and external organizations.

We performed our review in accordance with generally accepted Government auditing standards.

### OIG ANALYSIS OF ACTIVE<sup>1</sup> AND PLANNED<sup>2</sup> RESEARCH PROJECTS BY CATEGORY (IN MILLIONS OF DOLLARS)

<u>OIG Assigned Research Category</u>	<u>Number of Projects</u>	<u>FY 90</u>	<u>FY 91</u>	<u>FY 92</u>	<u>3-Yr TOTAL</u>
Research & Analysis of Severe Nuclear Power Plant Accidents <sup>3</sup> (↓)					
Active	34	\$5.4	\$4.6	\$3.3	\$13.2 <sup>4</sup>
Analysis of Advanced Nuclear Reactor Designs <sup>5</sup> (↑)					
Active	39	2.8	3.8	9.3	15.9
Planned	1				.1
Research on Aging Effects at Nuclear Power Plants <sup>6</sup> (=)					
Active	34	10.0	9.4	9.8	29.2
Computer Simulation Studies of Nuclear Reactor Operations and Accidents (↑)					
Active	62	7.8	7.3	8.5	23.7 <sup>4</sup>

<sup>1</sup>Contractors are currently working on these projects.

<sup>2</sup>RES has decided work will be done in this category, but has not selected a contractor.

<sup>3</sup>Funding for this program shows a decreasing trend. (↓)

<sup>4</sup>Figures do not total due to rounding.

<sup>5</sup>Funding for this program shows an increasing trend. (↑)

<sup>6</sup>Funding for this program has remained relatively constant. (=)

Analysis of Containment Building Integrity In Accident Conditions (4)					
Active	25	6.0	5.7	5.4	17.1
Planned					.2
Analysis of the Interaction Between Molten Reactor Material and Concrete Containment Structures (4)					
Active	13	4.5	4.6	3.1	12.2
Analysis of Radiological Health Effects (=)					
Active	46	2.7	3.4	2.9	9.0
Planned					.1
Analysis of Radiation Effects on Reactors and Components (1)					
Active	30	9.7	9.8	11.1	30.5 <sup>4</sup>
Resolving Generic Issues & Problems Pertaining to Nuclear Power Plant Operation (4)					
Active	17	3.0	2.1	1.6	6.7
Planned					.1
Analysis of Human Performance in Nuclear Power Plants (1)					
Active	43	2.8	4.0	3.1	9.8 <sup>4</sup>
Planned	2				.1



Analysis of Hydrogen Effects During Nuclear Reactor Accidents (†) Active	6	.8	.4	.3	1.5
Analysis of Reactor Instrumentation and Control Systems (†) Active	14	.7	.9	1.6	3.2
Individual Plant Examinations (†) Active	8	.3	.4	1.3	2.0
Developing and Assessing Nuclear Power Plant Maintenance and Inspection Procedures (†) Active	17	2.1	2.6	1.6	6.3
Planned					.1
Research to Support NUREG 1150, Assessing Severe Accident Risks at 5 Nuclear Power Plants (=) Active	6	.7	.8	.9	2.4
Assessing the Effect of Utility Organizational Structures on Nuclear Plant Performance (†) Active	3	.6	.4	.9	2.0 <sup>4</sup>

Integrating Probabilistic Risk Analysis Methodologies into Nuclear Programs (†) Active	26	2.0	2.3	3.4	7.7
Research to Ensure Pipe Integrity at Nuclear Power Plants (=) Active	11	.6	.8	.8	2.3 <sup>4</sup>
Research to Support NRC Regulations (†) Active Planned	17	1.9	2.9	2.6	7.4 .2
Analysis of Seismic Effects on Nuclear Power Plants (+) Active	54	4.6	4.0	3.9	12.5
Research to Ensure the Safe Shutdown of Nuclear Power Plants (†) Active Planned	17	1.3	3.5	4.2	9.0 .3
Analyzing Radiological Effects of Nuclear Power Plant Accidents (=) Active	9	1.1	1.2	1.3	3.6
Research to Analyze Operational Effects on Steam Generators (†) Active	5	.3	.3	.7	1.3

Research on Accident Effects on the Three Mile Island Nuclear Reactor (4) Active	9	1.7	1.5	.8	3.9 <sup>4</sup>
Research to Support the Storage of High- and Low-Level Radioactive Waste (†) Active	63	6.7	8.1	10.0	24.7 <sup>4</sup>
Research to Support the Office of Nuclear Material Safety & Safeguards (†) Active Planned	15	.2	.5	.6	1.4 .1
Technical Assistance and Standards Development (†) Active	15	.4	.6	1.1	2.1
Miscellaneous Projects That Do Not Fall Into the Above Categories (4) Active Planned	83	7.1	6.3	5.5	18.8 .1
Sub Total Active Projects	721	\$87.9	\$92.0	\$99.4	\$279.3
Planned Projects	<u>12</u>	—	—	<u>1.1</u>	<u>1.1</u>
Total Projects	733	\$87.9	\$92.0	\$100.5	\$280.4

## AGENCY COMMENTS ON DRAFT REPORT



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

February 17, 1993

MEMORANDUM FOR: Thomas J. Barchi  
Assistant Inspector General for Audits

FROM: James H. Sniezek  
Deputy Executive Director for  
Nuclear Reactor Regulation,  
Regional Operations and Research

SUBJECT: COMMENTS ON OIG DRAFT REPORT "PERFORMANCE CRITERIA AND BETTER  
MANAGEMENT OVERSIGHT NEEDED TO ENHANCE NRC'S RESEARCH PROGRAM  
CONTRIBUTIONS"

I am replying to your January 7, 1993 letter transmitting your draft report on this subject. Our response to your three recommendations is as follows:

### Comments on Recommendations

- Recommendation (1):  
"(1) Establish criteria to measure the performance and contributions of the broad programs and individual projects that comprise the research program. The criteria should outline how broad programs and supporting projects will be measured as they provide specific answers to regulatory issues and concerns."

### Response:

We agree on the importance of criteria for evaluation of research programs and projects. Such criteria were developed by RES in response to the 1986 report of the National Research Council entitled, Revitalizing Nuclear Safety Research, in which the National Research Council of the National Academy of Sciences reviewed the NRC's safety research program. This report recommended, among other things, that NRC develop a philosophy of research. The NRC responded to the National Research Council recommendations, including the statement on Nuclear Safety Research Philosophy in a report (NUREG-1325) sent to Frank Press, Chairman of the National Research Council on April 6, 1988. This statement, with minor revision, is included in the Five-Year Plan. It has also been reviewed by both the ACRS and the NSRRC. We have extracted the key criteria in the philosophy in terms of a set of questions, given in Enclosure 1. We have been using the Research Philosophy, including the criteria, for evaluation and management of research projects, and we believe these are the appropriate criteria and applicable to research projects. They are used with the informed professional and managerial judgment that their application demands.

Thomas J. Barchi

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February 17, 1993

We believe that decisions to initiate research or the judging of the worth of research performed cannot be reduced to purely mechanical application of criteria. Such criteria can aid decision making, but cannot replace knowledgeable, informed, competent, and involved management. Further, we believe that the primary measure of the value and usefulness of research results is whether the research product meets the user's needs. This measure involves a process which starts with the definition of the research effort, its further delineation in work plans covering broad areas of research (e.g., Severe Accident Research Program Plan, NUREG-1365) and the successful and timely implementation of these plans. It should be noted that these plans are routinely reviewed by the user group, advisory committees, the Executive Director for Operations, the Commission, and, not infrequently, technical experts outside the agency. Many activities are periodically reviewed by the same organizations as the work progresses. The resulting research product is judged not only by the user group but also by the advisory committees, the public, the industry, and peer reviewers, often including comments from the academic world, the Commission and the EDO, and the international community. These reviews bring new and independent perspectives to bear, help identify weaknesses, and, overall, provide confidence that the work was soundly based, responsive to the need, and valid for regulatory decision making.

The Commission has been involved in this process, exercising their role of oversight of research, to ensure that the scope and depth of the research program reflect the agency's needs. The Commission has carefully reviewed research progress on severe accidents, pressurized thermal shock, reactor aging, high-level wastes, human factors, and other issues. The Commission's oversight involvement spans the planning, initiation, and conduct of research and utilization of research results. The Commission approves the Five-Year Plan and the Budget Estimate Books (Blue Book and Green Book), in which planned research program activities for the five-year period and the Fiscal Year, respectively, are described. The Commission also reviews specific areas of research periodically at Commission meetings, providing its direction through the Staff Requirements Memoranda following the meeting.

Using the criteria in Enclosure 1, prior to approval of a Request for Proposal/Statement of Work, the cognizant RES Division Director will evaluate the proposed activities to ensure they are supportive of the overall NRC mission as set forth in the NRC Five Year Plan. This evaluation will be in place by July 1, 1993.

\* Recommendation (2):

"(2) Use performance criteria to evaluate the 733 projects that support the research program and identify where (a) research may have achieved its objectives, (b) the need for additional research to

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protect public health and safety continues to exist, or (c) research should be re-directed or terminated. We believe that NRC and RES management should terminate broad research programs and supporting projects that do not meet this criteria, or where regulatory application is not identified."

Response:

The criteria and processes described in our comments on Recommendation (1) have been and continue to be used in evaluating all active research projects, including questions of project re-direction or termination. The review processes are extensive, and, as a result of the reviews, activities have been redirected and terminated. A recent example of this is the research program on in-vessel severe accident phenomena.

We recognize that there is always room for improvement, and that on occasion adjustments to new and newly evident data requirements and problems are needed. An increased emphasis on research program plans, adjustment of program structure to the evolving needs of the agency, and the creation and use of the NSRRC are examples of RES initiatives in recent years.

We will seek other possible improvements in order to more fully and clearly articulate our processes for planning, conducting, and evaluating research, and to make the work and its relation to the NRC's safety regulatory mission more clearly visible. Specifically, reviews to this end by the cognizant RES Deputy Directors will be included not only in the annual budget review process but also at mid-year.

• Recommendation (3):

"Establish an internal control mechanism that reconciles individual research projects with RES's 5-Year Plan, broad program elements, and 'user-need' letters. Once this is [sic] mechanism is in place, use it and the performance criteria to periodically assess research programs and projects to ensure they effectively support NRC's mission of protecting public health and safety."

Response:

RES systematically and routinely reconciles individual research projects with the Five-Year Plan, broad program elements, and user need letters. In this regard, we note that the Five-Year Plan is the principal document that defines the future course, nature, and timing of the research program. It is carefully and thoroughly reviewed internally and approved by the Commission. Project listings are routinely maintained by RES that track precisely to program elements as defined in the Five-Year Plan.



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In the budget structure that supports the Five-Year Plan, there are five program elements (e.g., Reactor Licensing Support) and nine broad programs (e.g., Reactor Accident Analysis). The broad programs contain 48 sub-programs (e.g., Containment Performance), which are specifically identified in the budget structure. All RES projects and their associated funds are traceable back to any and all of these program levels. Specifically, computer printouts of all project accounts (e.g., by FIN and project) are updated at least monthly, and these show the complete structure from bottom to top. User need letters are maintained in the project management files and user needs are also articulated in the Statements of Work for RES projects. RES Division Directors or their Deputies review every Statement of Work prior to issuance by RES. One important aspect of their review is to see that work statements are clear, specific, and responsive to user needs in terms of project deliverables and schedules and that they contain a clear statement of the regulatory issue and the user need served.

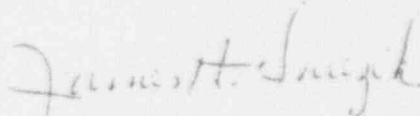
The evaluations outlined in the responses to Recommendations (1) and (2) are consistent with and will satisfy the issues set forth in this recommendation.

General Comment

We believe there are a number of areas and statements in the report that are not properly balanced and do not provide the reader with a level perspective of the research program and its formulation and implementation process. For example, the report does not recognize the whole process that guides the planning, funding, implementation, and evaluation of NRC research. The picture is therefore incomplete, because it does not capture the full nature of the current checks and balances governing the program. In this respect the draft report very likely will mislead readers who are not aware of the management and review processes that are utilized in NRC research management. A number of examples in this regard are described in Appendix A, which should be regarded as an integral part of this memorandum.

Further Discussion

We appreciate the opportunity to review this report. If you wish to discuss this matter, please let me know.



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Appendix A: Specific Comments  
Appendix B: Enclosures

APPENDIX A: SPECIFIC COMMENTS

This Appendix includes specific comments on some of the findings in the draft report that illustrate our concerns with the draft report's balance and perspective.

1. OIG statement (page 3):

"While there has been a recent increase in research program oversight by senior level NRC management, the criteria used in these reviews is based on 'personal judgement', not established performance measurements of how effectively research contributes to or serves NRC's mission."

Comment:

Professional and managerial judgment formed with the aid of the criteria and review processes described in response to Recommendation (1) is used as the principal indication of research performance. Performance indicators that figure in the formation of such judgments include use of the results (by NRC or offices, the regulated industry, the international community), significance of the results, validity and robustness of the results, difficulty of the research accomplished, anticipation of problems, and the efficiency with which the work is performed.

Administrative measures include on-time and within-budget performance. Management effectiveness is evaluated by appraisals and consideration for awards and promotions.

Overall, the criterion of success is the extent to which research results are available to support needed regulatory decisions in a timely and sound manner. This involves a broad judgment of a high order. Judgment cannot be removed from the process. Put another way, performance measurement applies well to standardized procedures that are quantifiable, whether in the factory or the office, but the evaluation of research requires judgment, with the final determinant being user need satisfaction.

2. OIG statements (pages 4 and 10):

"... the utility industry's research management is more product-oriented than NRC's, ..."

"In comparing NRC and EPRI research programs, EPRI officials said their research is more 'product-oriented' because it is aimed at solving specific operational problems identified and funded by EPRI's member utilities."

We think that these observations about EPRI's program are correct, and we intend to learn more about EPRI management methods to see if we can usefully employ them. At the same time, there are important differences both between the NRC and EPRI programs and the users of these programs. Some of these differences are highlighted in the letter of Professor Anthony J. Baratta to Eric Beckjord, dated January 27, 1993 (Enclosure 2). (Professor Baratta is working at RES during his 1993 sabbatical from Pennsylvania State University.) We infer from Professor Baratta's observations that what serves EPRI's needs may not be sufficient for NRC's needs.

3. OIG statement (page 5):

"RES staff told us the primary driving forces behind research are the 5-Year Plan and 'user-need' letters. However, since these documents do not outline the research that will be performed to accomplish specific objectives, we found RES staff have considerable discretion in scoping their work."

Comment:

We agree with the statement, but we see it in a positive rather than a negative light. Research is motivated and justified by user needs. RES staff participates with NRR, NMSS, and AEOD in the formulation of the user-need letters, to ensure a clear understanding of the intended regulatory uses for which the research data are sought. It is true that these letters do not outline the way in which the research is to be conducted. Rather, they set the basis for RES planning of the required research. RES is responsible for accomplishing it in an effective and efficient manner. The Five-Year Plan and related budget documents, Division and Branch annual plans, specific program plans, and more detailed plans and work statements for specific research projects are the documents reflecting the priorities and nature of the work to be performed. The "considerable discretion" available to RES is important to the effective planning and conduct of the research work, and further to achievement of successful and useful projects.

4. OIG statement (page 5):

"We also found that program direction and budget decisions are based on fund availability, and staff judgement of how these funds should be allocated among RES's wide range of issues. RES staff generally indicated that the perceived importance of most research programs is often reflected in the level of funding they receive. The staff were not aware of any criteria ..."

Comment:

The RES evaluation of potential research projects for budgeting purposes is guided by criteria discussed in our comment on Recommendation (1). Further reviews by user offices, budget review committees, EDO, Commission, and advisory committees often reflect other perspectives. Enclosure 3, showing RES program support prioritization for FY 1994-95, provides an example step in the budgeting process. Prioritization in a particular program area (severe accident research) is discussed in the second enclosure to the NSRRC letter in Enclosure 7.

5. OIG statement (page 6):

"We also noted that when research in large program areas has been completed, RES often supports additional work at the 'maintenance level' to retain contractor expertise in highly technical areas. RES staff expressed the fear that if they did not continue some work in certain areas, they might not have an adequate body of expertise to support future research initiatives. For this reason, staff stated they believe public interest dictates that NRC conduct research in as many aspects of nuclear operations as possible."

Comment:

"Maintenance-level" research is conducted in areas of recognized current or anticipated longer-term need or where needs for prompt assistance to address urgent safety concerns may arise. This situation is individually determined and justified and certainly does not involve work "in as many aspects...as possible." Such efforts are maintained in furtherance of research objectives in accordance with the criteria discussed in our comments on Recommendation (1). RES seeks to establish an appropriate level for such efforts to maintain "centers of expertise"; excess is avoided.

A memorandum on this subject from Commissioner Remick and the response of the Director of RES are enclosed. (Enclosure 4)

6. OIG statement (page 6):

"In ACRS's view, this situation places RES 'in the position of a traveller with no road maps'."

Comment:

The reader of the draft report would be led to believe from this comment that RES does not know where it is going with this program. In actual fact, the situation is very different. This can be seen most clearly in the complete text of the ACRS letter, "Severe Accident Research Program Plan," David A. Ward to Chairman Selin, dated August 18, 1992, and in

the response to it from James M. Taylor to David A. Ward, dated September 23, 1992. (Enclosures 8 and 9). These letters clearly show the complexity of the severe accident research, and the favorable evaluation given it by the ACRS by comparison with past reviews (1983-1988) which had been critical of the program because it had lacked clear objectives and plans for realizing them.

What appears to be suggested in the OIG draft report is not what ACRS means. Note, for example, the following two quotations from the ACRS letter, the first from its "General Comments" section and the second from its "Closing Comments":

"[W]e commend the staff for the extensive peer reviews that are now being required. The planning of research, the results of the research, and the conclusions drawn from the work are now being subjected to review. Our observations lead us to believe that, as a result, the current research activities are making more efficient use of resources. Further review of the results and of their interpretation by those outside RES should produce conclusions that have greater general acceptance and are more broadly useful than has been the case in the past."

"Finally, lest this report seem overly negative, we emphasize that we concentrated our comments primarily on areas that were perceived to require further attention."

7. OIG statement (page 8):

"The advisory groups primarily focused on broad program objectives, without discussing how supporting projects work together to form an integrated research package."

Comment:

Since 1988, the Nuclear Safety Research Review Committee (NSRRC), established by the Commission in response to the 1986 NAS report, has been advising the Director of RES and the Commission on matters of overall management importance in the direction of the NRC's program of nuclear safety research, including conformance with Commission plans, likelihood of meeting user needs, appropriateness of longer range programs and their direction, and whether the work is being done by the best people in the best places. NSRRC advice has gone much beyond a focus on broad program objectives. Of the 39 review topics to date, listed in Enclosure 5, seven can be classified as broad overviews and 18 as program reviews, while 14 focused on specific research issues. The

two most recent NSRRC letters are enclosed. (Enclosure 6) The NSRRC made separate comments on your report in the light of conclusions from these reviews. (Enclosure 7)

The specific detail in which the ACRS reviews major programs and specific supporting projects is illustrated by a recent ACRS report (on severe accident research) and staff response provided in Enclosures 8 and 9. We include the response as well as the ACRS letter to illustrate the depth of interaction involved in these reviews.

8. OIG statement (page 9):

"Our analysis showed there has been a recent gradual annual increase in research project funding, from about \$88 million in FY 1990 to about \$100 million in FY 1992."

Comment:

We show in Enclosure 10 the actual research program budget since 1986. The graph and data in Enclosure 10 show a slightly downward trend with small fluctuations since 1986. They do not show an increase over the period.

9. OIG statement (page 10):

"GAO found that research and development experts recognize the importance of establishing measurable performance goals, coupled with clear decision points for effective management oversight. In their view, the objectives of research projects should be well-defined and have quantitative parameters."

Comment:

We agree that it is important to have appropriate performance goals. At the same time we are mindful of the difficulties of evaluating research.

Since research by its nature seeks information about what is not known, the quantity, quality, and character of the results are uncertain and difficult to determine prior to completion of the work. Objectives and goals should be set, but performance relative to them is not the sole measure of the effectiveness or worth of research. It is an intellectual and professional pursuit demanding special knowledge and judgment of a high order. It does not lend itself to evaluation by any simple common metric. OMB's July 13, 1992 "Report on Common Performance Measures," states, in part:

"Performance measures for basic and applied research are very difficult, if not impossible, to develop."



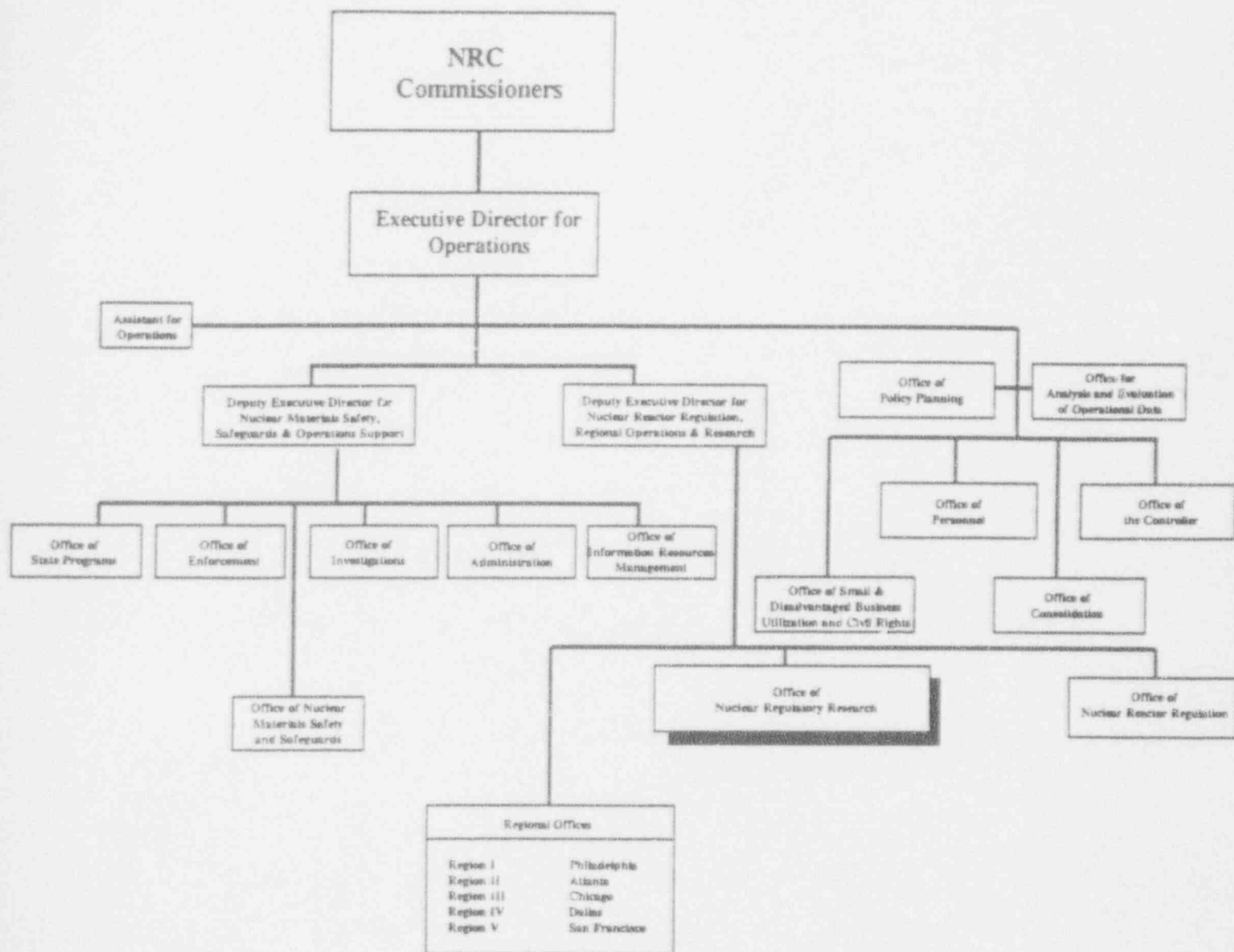
"The very nature of R&D does not easily lend itself to numeric evaluation, nor would it be easy to determine commonly accepted measures of performance...."

"Outcomes for basic and applied research are abstract and not easily quantified; research results are often intangible. There is an unavoidable time lag in judging the effectiveness of a basic or applied research grant."

"Common measures for basic and applied research could falsely treat each project or program as if they were the same. This treatment would not be sensitive to differences in program objectives or level of effort involved."

Overly simplified performance measures may act as wrong incentives: people would be motivated to work to criteria that distort real needs and objectives and real opportunities and constraints. The result might well maximize the performance measures, but fail to achieve the fundamental objectives established in the first place.

### U.S. NRC FUNCTIONAL ORGANIZATIONAL CHART



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