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The Honorable Kenneth M. Carr Chairman U.S. Nuclear Regulatory Commission Washington, D.C. 20555

Dear Chairman Carr:

SUBJECT: NRC SAFETY RESEARCH PROGRAM BUDGET

During the 360th meeting of the Advisory Committee on Reactor Safeguards, April 5-7, 1990, we discussed the proposed NRC Safety Research Program and budget for FY 1991. Our Subcommittee on the Safety Research Program met with the Executive Director for Operations, representatives from the Office of Nuclear Regulatory Research (RES), and the Office of Nuclear Reactor Regulation (NRR) on February 7, 1990, and discussed the proposed FY 1991 budget along with the rationale for the continually dwindling NRC Safety Research Program budget and the associated impacts. After considering the information gathered at these meetings, we find ourselves concerned, not so much about the proposed FY 1991 budget, but about the trend of continually diminishing funding for the NRC research program. Unless this trend is arrested, the overall effectiveness of the agency will be seriously compromised.

We have been critical of certain parts of the NRC research program in the past and remain so (Refs. 1-6). It is not our intent to address program deficiencies in this report, but to communicate our belief that a viable research program is an essential part of the NRC regulatory process. In the following paragraphs, we describe the reasons for our concerns about the research budget trend, and offer suggestions for change.

TREND IN THE RESEARCH PROGRAM BUDGET

Pertinent figures from the NRC budgets for fiscal years 1975, 1981, 1983, and 1991 follow:

	Total Agency		Research Program	
	Funding	Total	Support Funding*	
Fiscal	(in constant	Agency	(in constant	No. of FTEs*
Year	1975 dollars)	FTEs	1975 dollars)	for Research
1975	\$148.1M	2006	\$ 61.2M	94
1981	294.6M	3139	129.5M	155
1983	277.4M	3403	110.OM	140
1991	218.OM	3240	36.1M	120

When the total NRC budget increased markedly in the late 1970s and early 1980s, the research budget increased proportionally. However, since 1981 funding for research has been much more dramatically diminished than that for the agency. From 1983 to 1990, the research program support budget, in 1975 dollars, was reduced by a factor of three.

POSSIBLE EXPLANATIONS FOR THE RESEARCH BUDGET TREND

Among the reasons that might be offered for the trend in research funding are:

- The Commission has explicitly decided that research has become less important than other agency activities. It may have concluded that nuclear power has reached relative maturity and that most of the technical questions relating to reactor safety and regulation have been answered. In competition with other demands on resources (e.g., the belief that more inspections of operating plants are needed), research has taken a "back seat."
- Research funding has been reduced as part of a policy directed by the Administration or the Congress, perhaps for the reasons mentioned above.
- Given the government budgeting process, it is easier to reduce funding for NRC research, which is largely allocated to persons and institutions not on the NRC payroll, than to curtail or terminate regulatory activities that directly involve NRC employees.

*Associated with actual research support which includes planning, coordination, and managing research projects. Does not include technical assistance support for developing rules and regulations, resolving generic and unresolved safety issues, or review of IPE/PRA submittals.

All of these reasons may have influenced the research funding trend, but we believe that the third reason has had a disproportionate influence. As evidence for this, staff presentations to us described the largest portion of the agency's budget, which includes funding for salaries, rent, travel, office accessories, etc., as "nondiscretionary." When pressed, the staff agreed that these funds were not really "nondiscretionary" in the sense that there is explicit guidance to that effect from the Commission.

HISTORICAL BENEFITS OF NRC RESEARCH

Since its inception, the NRC has expended over \$2 billion (actual dollars) on research. Research has led to numerous important technical contributions to the NRC's regulatory program and nuclear safety. Several examples follow:

• In the thermal-hydraulics area, extensive research has confirmed that emergency core cooling systems would adequately respond to the worst credible loss-of-coolant accidents, resulting in revision to Appendix K, with a potential avoided capital cost of about \$8 billion (Ref. 7). Later, improved methods of analysis provided guidance for responding to questions arising from the TMI-2 accident about plant operation, and have permitted optimizations in reactor systems and operations.

- Several elements of the plant aging research program have led the way in assessing the effects of aging on nuclear power plant components and structures. They have also led to the development of examination and testing techniques and the identification of the essential elements for managing the effects of aging. The results of these research elements constitute the principal technical basis for addressing the aging-related issues associated with nuclear plant life extension and license renewal.
- In the geophysics and seismic areas, NRC-sponsored research programs have provided better understanding of the Eastern U.S. seismicity, which has permitted more realistic assessment of risk from earthquakes.
- In the area of materials science, NRC-sponsored research has provided means to improve and ensure the reliability of inspection methods and has provided key information in managing problems of stress corrosion cracking in BWRs. Additionally, research has provided the means for dealing with the pressurized thermal shock issue. Other research has made it possible to improve reactor safety by justifying the elimination of unnecessary pipe supports.
- •NRC-sponsored research has led the way in development of methods for risk analysis. In addition, research has made it possible for the NRC to come to grips with severe accident questions.

Beyond these technical accomplishments is another benefit which is not always explicitly recognized, yet is as important as the others. We believe it to be generally accepted that the NRC's research program has been an important contributor to the high technical quality of the staff. The research program has not only developed important safety information, but has attracted capable people to work for the NRC and its contractors, and has provided a resource of technical expertise to all activities of the agency.

REASONS FOR CONTINUING A COMPREHENSIVE RESEARCH PROGRAM

Important questions about nuclear safety and regulation remain unanswered. Applications of nuclear energy involve demanding technologies, and society expects nuclear activities to be carried out to extremely high standards of public and environmental safety. While analysis indicates that the NRC has been largely successful in its task of ensuring safe practices, significant uncertainties in risk predictions and lack of understanding of certain important phenomena remain. These involve technical areas such as components and materials performance, seismic risk, accident management, severe accident phenomena, and human behavior. Continuing research can gradually provide information and understanding that will be valuable in dealing with these questions and uncertainties.

In addition, it is necessary to maintain the technical quality and credibility of the NRC staff. We were told that the average age of the research staff is now about 50. Vital and consistently

funded programs will retain the contributions of experienced researchers and attract capable new people to the agency, in both research and nonresearch positions.

Many of the manifestations of several years of decreasing research funding are already visible:

- Important research programs are being curtailed or terminated.
- The national laboratories are systematically moving their better people to more attractive programs.
- RES is having difficulty in attracting competent technical personnel with research experience, which has led to an overall reduction in quality.
- The results of several expensive experimental programs have been lost.
- University programs have essentially ceased to exist in most areas.
- The role of RES as a world leader in research has diminished.
- The use of large-scale and separate-effects facilities has ended.
- RES participation in major cooperative foreign experimental programs is diminishing.

CONCLUDING REMARKS

It is difficult to establish the proper magnitude of support for research. Two aspects should be considered.

First is the absolute magnitude. In 1975, NRC research was funded at \$61 million. In 1981, research funding had increased to \$197 million, which was about \$130 million in 1975 dollars. In 1991, the budget calls for about \$78 million for NRC research which is about \$36 million in 1975 dollars. Appropriate funding for a research program must be sufficient to retain vitality in programs, personnel, and facilities. What is appropriate depends on a number of factors, many of them imponderables. The nature of important research questions, the existence or nonexistence of appropriate facilities, results of early research, and experience in plant operation are among them. In the face of these uncertainties, the Commission must make judgments about funding research. Our judgment is that the present research funding level is below the minimum. If there are further reductions, RES will not be able to support and maintain an effective research program.

The fraction of the total NRC budget allocated to research is also an important consideration. It is a measure of the extent to which research programs can be expected to help maintain the technical expertise of the agency. We mentioned above that the research budget has been reduced from over 40 percent in the earlier years of the agency to about 16 percent in 1991, and that may be further reduced by the Congress. We believe there is evidence that this is too low and suggest that a guideline of at least one-quarter of the agency budget is more appropriate for a viable research program.

Finally, we suggest that you not take just our word for it. The agency has in place an excellent panel of experts to advise the RES Director, namely the Nuclear Safety Research Review Committee. We suggest that they focus more on their primary mission, which is to advise on general safety research philosophy and long-range strategy, rather than on the details of specific ongoing research programs. They should consider questions of what might constitute a viable research program, in terms of the technical areas and funding requirements, both absolute and relative.

Sincerely,

Carlyle Michelson Chairman

References:

- ACRS Report dated March 15, 1989, from Forrest J. Remick, ACRS Chairman, to Lando W. Zech, Jr., NRC Chairman, Subject: Proposed Severe Accident Research Program Plan.
- ACRS Report dated July 7, 1988, from David A. Ward, Acting ACRS Chairman, to Lando W. Zech, Jr., NRC Chairman, Subject: NRC Research Related to Heat Transfer and Fluid Transport in Nuclear Power Plants.
- 3. ACRS Letter dated December 8, 1987, from William Kerr, ACRS Chairman, to Victor Stello, Jr., EDO, Subject: ACRS Comments on Memorandum from Victor Stello, Jr., EDO, dated October 7, 1987, Regarding the Embrittlement of Structural Steel.
- 4. ACRS Report dated September 11, 1987, from William Kerr, ACRS Chairman, to Lando W. Zech, Jr., NRC Chairman, Subject: ACRS Comments on Code Scaling, Applicability and Uncertainty Methodology for Determination of Uncertainty Associated with the Use of Realistic ECCS Evaluation Models.
- 5. ACRS Letter dated July 15, 1987, from William Kerr, ACRS Chairman, to Victor Stello, Jr., EDO, Subject: ACRS Comments on the Embrittlement of Structural Steel.
- 6. ACRS Report dated July 15, 1987, from William Kerr, ACRS Chairman, to Lando W. Zech, Jr., NRC Chairman, Subject: ACRS Comments on Draft NUREG-1150, "Reactor Risk Reference Document."
- Letter dated February 8, 1985, from E. P. Rahe, Jr., Nuclear Safety Manager, Westinghouse Electric Corporation, to D. F. Ross, Office of Nuclear Regulatory Research, NRC, Subject:

LOCA Margin Benefits.