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(Wednesday, February 26, 1997)

NOTE TO EDITORS:

The Nuclear Regulatory Commission has received a report from its Advisory Committee on Reactor Safeguards (ACRS). The report, in the form of a letter, provides comments on the Human Performance Plan.

The ACRS has also sent Vice-President Al Gore its 1996 report on the NRC's Safety Research Program.

Attachments:  
As stated

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February 21, 1997

The Honorable Albert Gore, Jr.  
President of the United States  
Senate  
Washington, D.C. 20510

Dear Mr. President:

I am pleased to transmit to the Congress the 1996 report of the Advisory Committee on Reactor Safeguards on the U. S. Nuclear Regulatory Commission's Safety Research Program. This report is required by Section 29 of the Atomic Energy Act of 1954, as amended by Section 5 of Public Law 95-209.

Sincerely,

/s/

R. L. Seale  
Chairman

Enclosure:

U. S. Nuclear Regulatory Commission, "The Advisory Committee on Reactor Safeguards Report on Nuclear Safety Research and Regulatory Reform," dated February 1997

February 21, 1997

The Honorable Newt Gingrich  
Speaker of the United States  
House of Representatives  
Washington, D.C. 20515

Dear Mr. Speaker:

I am pleased to transmit to the Congress the 1996 report of the Advisory Committee on Reactor Safeguards on the U. S. Nuclear Regulatory Commission's Safety Research Program. This report is required by Section 29 of the Atomic Energy Act of 1954, as amended by Section 5 of Public Law 95-209.

Sincerely,

/s/

R. L. Seale  
Chairman

Enclosure:

U. S. Nuclear Regulatory Commission, "The Advisory Committee on Reactor Safeguards Report on Nuclear Safety Research and Regulatory Reform," dated February 1997

THE ADVISORY COMMITTEE ON REACTOR SAFEGUARDS REPORT  
ON NUCLEAR SAFETY RESEARCH AND REGULATORY REFORM

The Advisory Committee on Reactor Safeguards, in the past, reported on very specific reactor safety research issues and programs. In light of the diminished resources available to support the U.S. Nuclear Regulatory Commission's Safety Research Program, we have chosen, instead, to report on the potential effects of a reduced Safety Research Program on regulatory reform and the ability to provide adequate safety oversight for a changing nuclear industry.

A vigorous research program dealing with the safety of commercial nuclear power production has served the Nuclear Regulatory Commission and the public well in the past. The continued availability of unbiased safety research information will be essential as the Nuclear Regulatory Commission establishes itself as the leader in the national effort to reform the regulatory process to focus on real risks, continued safety of operating nuclear power plants, and the performance of licensees. At the same time, initiatives taken by the commercial nuclear power industry in response to ongoing and anticipated deregulation of electrical power generation make it even more important that the Nuclear Regulatory Commission continue to have a Safety Research Program that provides the information needed to modify and improve its regulations to protect public health and safety.

From the inception of the civilian use of nuclear energy to generate electrical power, public safety has been of paramount concern. Initially, little experience and few industrial safety standards were available to ensure that nuclear power could be generated safely. As a result, prescriptive, highly conservative approaches that blanketed all aspects of nuclear power generation were adopted by both the regulatory authority and the industry. Faults and vulnerabilities identified through operation of nuclear power plants were used to add layers of protection on this regulatory structure. Indeed, regulation of nuclear power generation has been successful in protecting public safety in this country. But, safety has been achieved through highly conservative regulation at great cost to both the producers and consumers of nuclear power.

As nuclear power generation has matured, experience has been gained in our understanding of the real risks of nuclear power. The Safety Research Program has enabled the Nuclear Regulatory Commission to develop a method called probabilistic risk assessment that can provide quantitative measures of these risks. The sophistication of this understanding has reached the point that it is now possible to initiate a reformation of the regulatory structure for nuclear power generation. This reformation will focus attention on what is significant to safety and at the same time will allow the industry to identify and use cost-effective strategies to mitigate risks. Reformation of regulation of all types to focus on risk is, of course, a national priority. The Nuclear Regulatory Commission is taking the lead in this national effort with its policy of risk-

informed and performance-based regulation. Based on information that has come from the Safety Research Program, operational experience, and the ability to quantify risk, the Nuclear Regulatory Commission has been able to set forth safety goals that define how safe is safe enough. By working with individuals experienced in plant operations and using the tools of risk analysis the NRC can now identify regulations that do not contribute to safety, and it will be able to define a rational, cost-benefit basis for imposing additional regulatory requirements.

Steps are being taken in the direction of risk-informed and performance-based regulation. The performance-based maintenance rule (10 CFR 50.65) is a tangible accomplishment. Rather than imposing bureaucratic prescriptions on every aspect of safety system maintenance, this rule allows the industry to find creative strategies to meet performance objectives approved by the Nuclear Regulatory Commission based on risk information. Satisfactory performance by licensees is rewarded by reductions in regulatory burdens while performance failures elicit increased regulatory scrutiny.

The Safety Research Program has aided the Nuclear Regulatory Commission in the development of standards for regulatory use of risk assessment. This would permit additional uses of this approach to focus dwindling resources on issues of most importance for protecting public health and safety. Target applications of these new standards are in-service inspection, in-service testing, and technical specifications for reactor safety systems. Continued research will be essential for further regulatory reforms.

New challenges to the regulation of nuclear power are emerging. These challenges come from the deregulation of electrical energy production and the need for the nuclear power industry to become more cost competitive. The nuclear industry is aggressively pursuing changes to remain economically viable. These changes could have significant safety implications that will require regulatory approval when they affect the licensing basis for nuclear power plants. Among the changes under consideration are increased fuel lifetimes, elevated operating power, digital instrumentation and control systems, and downsized work forces. Each of these changes could challenge the existing regulations for the protection of public health and safety. We believe that applied regulatory research programs will be required to develop bases/criteria for regulatory approval of these changes. Of particular importance are the changes that may affect human performance in the operation of nuclear power plants.

Funding for research activities has fallen by a factor of about 3 over the last 10 years and all evidence points toward continued reductions in the future. While much of this decrease can be attributed to the maturation of the technology, funding for the Safety Research Program has been reduced to a level that may not allow a cost-effective response to these new challenges. The Nuclear Regulatory Commission now does not have the technical tools needed to evaluate all of the safety implications of extending fuel lifetimes to the extent the nuclear industry has requested. It cannot evaluate quantitatively the risk implications of personnel reductions and modernization that are being proposed by the nuclear industry. The Safety Research Program will have to be sustained

and even augmented if the Nuclear Regulatory Commission is to complete its transformation to risk-informed and performance-based regulatory approach. Without the needed research support, the Nuclear Regulatory Commission may be forced to rely on historical, conservative, costly regulations not necessarily focused on risks. Safety innovations by the industry may be stifled. The opportunity to use regulation of nuclear power as an example of successful regulatory reform may be lost.

February 13, 1997

The Honorable Shirley Ann Jackson  
Chairman  
U.S. Nuclear Regulatory Commission  
Washington, D.C. 20555-0001

Dear Chairman Jackson:

SUBJECT: HUMAN PERFORMANCE PROGRAM PLAN

During the 438th meeting of the Advisory Committee on Reactor Safeguards, February 6-8, 1997, we completed our review of the NRC activities identified in the Human Performance Program Plan (HPPP). Our Subcommittee on Human Factors met on September 20 and December 3, 1996, to review these activities. During these reviews, we had the benefit of discussions with representatives of the staff.

In your remarks of December 2, 1996, to all NRC employees, you stated:

As we move to an era of nuclear power industry restructuring and declining NRC and industry resources, it is imperative that we are able to diagnose potentially declining licensee performance as early as possible.

We agree with your assessment. We believe that an appropriate HPPP would contribute significantly to the development of such diagnostic tools.

#### **Conclusions and Recommendations**

1. The HPPP is not a plan. It is, instead, an inventory of human performance projects within the agency. The HPPP should state explicitly what its goals are, what research efforts will be required to achieve these goals, and when and how it will be known that they have been achieved. The ownership of the present plan is diffuse. The success of such a plan as well as its dynamic nature require that ownership of the entire plan be clearly assigned.
2. A well-planned research effort in human performance is urgently needed to support both the regulation of plant operations and the transition to risk-informed and performance-based regulation. The overall perspective that can be provided by high-level models of human performance would be helpful in the planning of this research effort. A number of such models are reviewed in NUREG/CR-6350.

3. The development of indicators of a good safety culture, the design of a meaningful human performance reporting system, and the impact of downsizing and deregulation on human performance should be major elements of the research effort.

### Discussion

Operational experience has shown that human performance is a major factor in the safe operation of nuclear power plants. Understanding what can go wrong at a plant requires an integrated evaluation of both hardware and human performance; i.e., the plant must be viewed as a sociotechnical system. In particular, the term "human error," which carries the implication that the operators are to be blamed, is inaccurate in many instances and one must investigate and understand the context within which plant personnel function. This context is determined by both the design and the physical conditions of the plant, as well as by the prevailing safety culture.

The development of a plan for research on human factors is certainly not a simple task. This task would be made easier and the recommendations more convincing if the task were guided by a high-level model that identifies the important elements that influence the likelihood of unsafe human acts. Various models and taxonomies have been proposed in the literature and some are beginning to receive wide acceptance. Human performance models and error classifications that could be suitable guides for developing a research plan are being used in other projects in the Office of Nuclear Regulatory Research. The models discussed in NUREG/CR-6350, along with insights from operational experience, could serve to guide the development of an HPPP.

One specific element we would like to see addressed in the HPPP is the impact of situational assessment on compliance with procedures. Investigations of actual incidents and simulator exercises from nuclear and other industries have demonstrated the importance of what Professor James Reason of the University of Manchester calls "intended violations" (circumventions) of procedures by plant personnel. The researchers who collected data from simulator exercises point out that these were not necessarily errors; the operators simply did what they felt was the optimal response to the evolving accident. We believe there is a need to understand the reasons for such deviations and how training, procedures, and the plant safety culture could be modified to eliminate "circumventions" to the extent possible.

The present HPPP contains elements that are worth pursuing. Other elements that should be contained in the HPPP include activities to gain a better understanding of the concept of safety culture and to develop indicators of a good safety culture. The human reliability analysis research project should also be part of the HPPP. We will continue to work with the staff in developing an effective HPPP.

Sincerely,

/s/



R. L. Seale  
Chairman

References:

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9. International Atomic Energy Agency, Vienna, International Nuclear Safety Advisory Group, "Safety Culture," Report 75-INSAG-4, 1991
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