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(Monday, June 17, 1996)

NOTE TO EDITORS:

The Nuclear Regulatory Commission has received the attached report from its Advisory Committee on Reactor Safeguards (ACRS). The report, in the form of a letter, provides comments on the potential use of individual plant examinations for external events in determining where the current number of nuclear plants in operation fall in relation to radiological risk and the NRC's safety goals.

In addition, the NRC's executive director for operations received four ACRS reports. They provide comments on:

--A proposed rule on operations at nuclear power plants during shutdowns;

--Regulatory guidance documents related to digital instrumentation and control systems;

--The adequacy of the NRC's multiple system responses program in resolving safety issues; and

--Implementation of NRC's regulatory review group recommendations.

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Attachments:
As stated

June 6, 1996

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

Dear Chairman Jackson:

SUBJECT: POTENTIAL USE OF IPE/IPEEE RESULTS TO COMPARE THE RISK
OF THE CURRENT POPULATION OF PLANTS WITH THE SAFETY
GOALS

This report is in response to a Staff Requirements Memorandum dated September 20, 1994, in which the Commission requested further guidance and insight on determining where the current population of operating plants, both individually and collectively, fall in relation to the safety goals. Our intent in developing a response was to examine the Individual Plant Examinations (IPEs)/Individual Plant Examinations of External Events (IPEEEs) results to see if they can be extended so as to compare the risk of the current population of plants with the safety goals.

During the 431st meeting of the Advisory Committee on Reactor Safeguards, May 23-25, 1996, we completed our discussions on this subject. During the 418th, February 1995, and 419th, March 1995 meetings, we heard presentations by an ACRS Senior Fellow on an approach for estimating the risk associated with some of the missing or incomplete elements of the IPEs. During our 431st meeting, we reviewed a study by the Brookhaven National Laboratory (BNL) (performed as part of the IPE Insights Program) that investigated the use of some of the IPEs to compare the plant risk to the safety goals. We also had the benefit of the documents referenced.

The prompt fatality and latent health effects quantitative safety goals are posed in risk terms. Consequently, to establish the status of the population of plants with respect to these goals, a full-scope Level 3 probabilistic risk assessment (PRA) of acceptable quality for every plant would seem to be required. Such PRAs would need to include all internal and external events (including low-power and shutdown operations) and would also need to take into consideration the individual site characteristics.

In almost all cases, the IPEs and IPEEEs are not and were not intended to be full-scope PRAs. For example, a large number of IPEEEs used the Fire Induced Vulnerability Evaluation (FIVE)

Methodology to search for potential fire vulnerabilities and the Seismic Margins Methodology to search for seismic vulnerabilities, neither of which gives a direct expression of risk. Furthermore, shutdown risk was not a part of the IPEs/IPEEEs. While most licensees performed some type of Level 2 containment analysis, the vast majority did not perform a Level 3 offsite consequences analysis.

The BNL study represents a good attempt to estimate the effects of some of the missing elements in the IPEs/IPEEEs. This study did not attempt to evaluate the risk resulting from seismic and fire events, nor did it attempt to evaluate risk in the shutdown mode.

Information is available that arguably would make it possible to bound the effects on risk of elements missing from the IPEs/IPEEEs and to develop an approximate comparison with the safety goals. Such a bound would be of questionable value and would have very large uncertainties. We do not recommend that this be done.

The evidence from the BNL study, NUREG-1150, other PRAs, and scoping studies of shutdown risk indicates that, on average, the population of plants meets the safety goals. A definitive determination of this, however, will only be possible when acceptable, full-scope Level 3 PRAs are available for all the plants. We believe that the required effort to develop such comprehensive PRAs cannot be justified for the sole purpose of comparison with the safety goals. Such PRAs, however, will be needed in the long run to move toward a coherent risk-informed regulatory system.

Sincerely,

/S/

T. S. Kress
Chairman, ACRS

REFERENCES:

1. Memorandum dated September 20, 1994, from John C. Hoyle, Acting Secretary, NRC, to John T. Larkins, Executive Director, ACRS, Subject: Staff Requirements - Periodic Meeting with ACRS, Thursday, September 8, 1994
2. Richard Sherry, ACRS Senior Fellow, "A Simplified Approach to Estimation of Seismic Core Damage Frequencies from a Seismic Margins Methods Analysis"
3. U. S. Nuclear Regulatory Commission, NUREG-1150, "Severe Accident Risks: An Assessment for Five U.S. Nuclear Power Plants," Office of Nuclear Regulatory Research, December 1990

4. U. S. Nuclear Regulatory Commission, NUREG-XXXX, "Individual Plant Examination Program: Perspectives on Reactor Safety and Plant Performance," Draft for Comment dated April 1996
5. U.S. Nuclear Regulatory Commission, NUREG/CR-6144, "Evaluation of Potential Severe Accidents During Low Power and Shutdown Operations at Surry, Unit 1," Brookhaven National Laboratory, July 1994
6. U. S. Nuclear Regulatory Commission, NUREG/CR-6143, "Evaluation of Potential Severe Accidents During Low Power and Shutdown Operations at Grand Gulf, Unit 1," Sandia National Laboratories, March 1995

June 14, 1996

Mr. James M. Taylor
Executive Director for Operations
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Dear Mr. Taylor:

SUBJECT: PROPOSED RULE ON SHUTDOWN OPERATIONS

During the 431st meeting of the Advisory Committee on Reactor Safeguards, May 23-25, 1996, we held discussions with representatives of the NRC staff and the Nuclear Energy Institute (NEI), concerning the subject proposed rule and the probabilistic risk assessment (PRA) studies that were performed for the Surry and the Grand Gulf Nuclear Power plants. Our Subcommittee on Plant Operations met with the staff, NEI, and a utility representative on May 21, 1996, to discuss these matters. We also had the benefit of the documents referenced. We previously commented on the staff effort to resolve the shutdown operations issue in our letters dated August 13, 1991, April 9, 1992, September 15, 1992, and May 13, 1994.

According to the staff, the proposed rule will contain performance-based elements. Since the supporting regulatory analysis and regulatory guide are still being developed, we discussed only the proposed rule during our meeting. The staff has held several public meetings with NEI to obtain industry input on the formulation of this rule.

We made a number of comments on the risk basis for the rule. The staff agreed to consider our comments as it finalizes the draft rule, which it plans to publish for public comment in September 1996. We plan to provide comments on the proposed final rule after the staff has reconciled the public comments.

The concern for risk associated with shutdown operations has arisen from incidents that have occurred. Our quantitative understanding of the risk posed by plants in low-power or shutdown modes of operation is limited. Risk assessments for shutdown operations were performed for Surry (a three-loop PWR with loop isolation valves and a sub-atmospheric pressure containment) and Grand Gulf (a BWR-6 with a Mark III containment). Neither of these plants is a particularly good surrogate for the entire population of PWRs and BWRs.

The studies of shutdown risk consisted of two phases. The first phase was a deliberately conservative scoping analysis. The second phase focused on a single, high-risk plant operational state among the many that exist during shutdown operation. Such an approach could lead to an incorrect assessment of risk (a historical analogue is the selection of the large-break, loss-of-coolant accident as a bounding event) or to the adoption of operating practices that might increase risk.

The available evidence does suggest that shutdown operations can make important contributions to the overall risk to the public posed by nuclear power plants. On the eve of our entry into an era of risk-informed rulemaking, there are no complete, reliable assessments of risk during shutdown operations even for a few representative plants. Certainly, there is nothing commensurate with the NUREG-1150 study of risk during full-power operation.

The staff effort toward an interim solution by promulgating this proposed rule is based on engineering judgment and will probably lessen risk. A risk-informed understanding will require a quantitative evaluation of risk during low-power and shutdown operations. We therefore recommend that priority attention be given to performing Level 3 PRAs for shutdown operations at the NUREG-1150 plants with consideration of spent fuel pool risk and uncertainty assessments.

Sincerely,

/s/

T. S. Kress
Chairman, ACRS

References:

1. Memorandum dated April 5, 1996, from Robert C. Jones, Office of Nuclear Reactor Regulation, to John T. Larkins, ACRS, Subject: Development of §50.67, "Shutdown Operation of Nuclear Power Plants"
2. U. S. Nuclear Regulatory Commission, Prepared by Brookhaven National Laboratory, NUREG/CR-6144, "Evaluation of Potential Severe Accidents During Low Power and Shutdown Operations at Surry, Unit 1," Summary of Results, October 1995
3. U. S. Nuclear Regulatory Commission, Prepared by Sandia National Laboratories, NUREG/CR-6143, "Evaluation of Potential Severe Accidents During Low Power and Shutdown Operations at Grand Gulf, Unit 1," Summary of Results, July 1995
4. Nuclear Management and Resources Council, Inc., NUMARC 91-06, "Guidelines for Industry Actions to Assess Shutdown Management," December 1991

June 6, 1996

Mr. James M. Taylor
Executive Director for Operations
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Dear Mr. Taylor:

SUBJECT: REGULATORY GUIDANCE DOCUMENTS RELATED TO DIGITAL
INSTRUMENTATION AND CONTROL SYSTEMS

During the 429th and 431st meetings of the Advisory Committee on Reactor Safeguards, March 7-9 and May 23-25, 1996, we reviewed portions of the proposed Standard Review Plan (SRP), Branch Technical Positions (BTPs), and Regulatory Guides related to digital instrumentation and control (I&C) systems. We held discussions with representatives of the NRC staff and its contractor, the Lawrence Livermore National Laboratory (LLNL). In addition, our Subcommittee on I&C Systems and Computers met with the NRC staff and LLNL to discuss these documents on March 6 and May 22, 1996. We also had the benefit of the documents referenced.

The staff requested ACRS to review the SRP Chapter 7 update in the early stages of development to accommodate the schedule set forth in the Digital I&C Task Action Plan. The staff expects to complete development of the SRP Chapter 7 update and associated guidance in September 1996, integrate the recommendations from the National Academy of Sciences/National Research Council (NAS/NRC) Phase 2 study report in October 1996, publish the Draft SRP Chapter 7 and associated guidance for public comment in December 1996, and issue the final SRP and related guidance in May 1997.

The staff is revising the SRP, adding two new sections, developing new BTPs, and preparing six regulatory guides that endorse eight industry standards. The staff presented a safety evaluation report (SER) on an Electric Power Research Institute (EPRI) topical report for electromagnetic/radiofrequency interference (EMI/RFI) design requirements and testing. A planned BTP on commercial off-the-shelf (COTS) software may be replaced by an SER on a topical report being developed by an EPRI working group. We concur with the staff conclusions in the SER associated with the EPRI topical report on EMI/RFI and encourage the staff to complete an SER for the EPRI topical report on COTS.

Considering the fact that the staff is using generally accepted U.S. software engineering practices, it appears that the staff

approach is appropriate to update the SRP and associated guidance to codify the current regulatory framework for digital I&C. We raised several issues (e.g., the linkage between SRP Chapter 7 and other SRP chapters, and graded approaches based on importance to safety) that were subsequently clarified by the staff. The staff agreed to document these clarifications.

We have raised other issues that include the level of detail provided in the regulatory guides and the balance in the guidance between the review of the design process and the assessment of the product. We plan to report on these and other digital I&C issues at a later date.

We plan to review the staff's remaining SRP sections, the BTPs, and the SER on the EPRI topical report on COTS when they become available.

Sincerely,

/S/

T. S. Kress
Chairman, ACRS

References:

1. U. S. Nuclear Regulatory Commission, Standard Review Plan, Section 7.0, "Instrumentation and Controls—Overview of Review Process," Draft Version 3.0, February 12, 1996
2. U. S. Nuclear Regulatory Commission, Standard Review Plan, Section 7.1, "Instrumentation and Controls—Introduction," Draft Version 7.0, February 14, 1996
3. U. S. Nuclear Regulatory Commission, Standard Review Plan, Section 7.2, "Reactor Trip System," Draft Version 6.0, April 17, 1996
4. U. S. Nuclear Regulatory Commission, Standard Review Plan, Section 7.9, "Data Communications," Draft Version 4.1, April 18, 1996
5. U. S. Nuclear Regulatory Commission, (Proposed) Branch Technical Position HICB-14: "Guidance on Software Reviews for Digital Computer-Based Instrumentation and Control Safety Systems," Version 9.0, February 14, 1996
6. U. S. Nuclear Regulatory Commission, (Proposed) Branch Technical Position HICB-16: "Guidance on the Level of Detail Required for Design Certification Applications Under 10 CFR Part 52," Version 7.0, April 12, 1996

7. U. S. Nuclear Regulatory Commission, Draft Regulatory Guides, transmitted by memorandum dated February 9, 1996, from M. Wayne Hodges, Director, Office of Nuclear Regulatory Research, NRC, to John T. Larkins, ACRS:
 - U. S. Nuclear Regulatory Commission, Draft Regulatory Guide DG-XXXX, Version 2.7.2, "Verification, Validation, Reviews, and Audits for Digital Computer Software Used in Safety Systems of Nuclear Power Plants"
 - U. S. Nuclear Regulatory Commission, Draft Regulatory Guide DG-XXXX, Version 2.0.7, "Configuration Management Plans for Digital Computer Software Used in Safety Systems of Nuclear Power Plants"
8. U. S. Nuclear Regulatory Commission, Draft Regulatory Guides, transmitted by memorandum dated April 26, 1996, from M. Wayne Hodges, Director, Office of Nuclear Regulatory Research, NRC, to John T. Larkins, ACRS:
 - Draft Regulatory Guide DG-XXXX, Version 2.0, "Software Unit Testing for Digital Computer Software Used in Safety Systems of Nuclear Power Plants"
 - Draft Regulatory Guide DG-XXXX, Version 2.0, "Developing Software Life Cycle Processes for Digital Computer Software Used in Safety Systems of Nuclear Power Plants"
 - Draft Regulatory Guide DG-XXXX, Version 2.0, "Software Requirements Specifications for Digital Computer Software Used in Safety Systems of Nuclear Power Plants"
 - Draft Regulatory Guide DG-XXXX, Version 2.0, "Software Test Documentation for Digital Computer Software Used in Safety Systems of Nuclear Power Plants"
9. Memorandum dated January 30, 1996, from F. Miraglia, Office of Nuclear Reactor Regulation, NRC, to E. Jordan, Committee to Review Generic Requirements, NRC, Subject: Request for Endorsement of the Safety Evaluation Report on Electric Power Research Institute Topical Report, TR-102323, "Guidelines for Electromagnetic Interference Testing in Power Plants"

June 3, 1996

Mr. James M. Taylor
Executive Director for Operations
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Dear Mr. Taylor:

SUBJECT: RESOLUTION OF THE MULTIPLE SYSTEM RESPONSES
PROGRAM ISSUES

During the 431st meeting of the Advisory Committee on Reactor Safeguards, May 23-25, 1996, we completed our review of the adequacy of the resolution of the Multiple System Responses Program (MSRP) issues. During the 427th meeting, December 7-8, 1995, we heard presentations by and held discussions with representatives of the NRC staff and an ACRS Senior Fellow regarding this matter. We also had the benefit of the documents referenced.

In the process of reviewing a number of Unresolved Safety Issues (USIs) during the mid-1980s, the ACRS expressed concern that treating each safety issue in isolation might not identify significant system interactions. The ACRS also raised a number of questions concerning system interactions that were not addressed in the proposed resolution of certain USIs. Subsequently, the staff established the MSRP in 1986 to address ACRS concerns and other related issues.

The MSRP identified 21 potential generic issues. In August 1995, the NRC staff issued a final report which concluded that none of the MSRP issues posed new or separate safety concerns and that these issues were being addressed under the scope of the existing Generic Safety Issue (GSI) process, or in the programs of Individual Plant Examinations (IPEs) and Individual Plant Examination of External Events (IPEEEs).

The MSRP issues have been treated to a degree in the IPE/IPEEE programs and in the GSI process. A review of a number of IPE/IPEEE submittals, however, failed to identify satisfactory resolution for some issues (e.g., the treatment of interactions between nonsafety and safety systems, seismically induced interactions, and hydrogen line ruptures). We also note that the issues of nonsafety/safety systems interactions appear to be better treated in the IPEEE submittals that were based on probabilistic risk assessments than in those that were based on Seismic Margins Methodology and Fire-Induced Vulnerability Evaluation Methodology.

Incorporation of some MSRP issues into the IPE/IPEEE process may have been expedient, but the staff failed to put into place a mechanism to ensure that licensees had evaluated and resolved these issues in an adequate manner. Additional staff review to determine the adequacy of the resolution of these issues is, therefore, warranted.

As stated in our report to the Commission, dated August 16, 1988, we continue to emphasize that "systems interactions, some of which may be adverse to safety, will continue to be revealed by operating experience in existing plants. These should be evaluated by the staff as they occur, and the lessons learned incorporated into the requirements and practices of the agency."

Sincerely,

/s/

T. S. Kress
Chairman, ACRS

References:

1. U. S. Nuclear Regulatory Commission, NUREG/CR-5420, "Multiple System Responses Program - Identification of Concerns Related to a Number of Specific Regulatory Issues," Prepared by Oak Ridge National Laboratory, October 1989
2. Multiple System Responses Program - Final Report, transmitted by memorandum dated August 2, 1995 from L. C. Shao, Office of Nuclear Regulatory Research, to David L. Morrison, Office of Nuclear Regulatory Research
3. Memorandum dated January 12, 1996, from August W. Cronenberg, ACRS Senior Fellow, to ACRS Members and Staff, Subject: Observations from Review of Multiple System Responses Program (MSRP) Reports and Memoranda
4. U. S. Nuclear Regulatory Commission, NUREG-0933, "A Prioritization of Generic Safety Issues," July 1991
5. Report dated August 16, 1988, from W. Kerr, ACRS Chairman, to Lando W. Zech, Jr., NRC Chairman, Subject: Proposed Resolution of USI A-17, "Systems Interactions in Nuclear Power Plants"

June 5, 1996

Mr. James M. Taylor
Executive Director for Operations
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Dear Mr. Taylor:

SUBJECT: IMPLEMENTATION OF THE REGULATORY REVIEW GROUP
RECOMMENDATIONS

During the 431st meeting of the Advisory Committee on Reactor Safeguards, May 23-25, 1996, we reviewed the status of the implementation of the Regulatory Review Group recommendations. During our review, we had the benefit of discussions with representatives of the NRC staff and the referenced document.

The Regulatory Review Group was established by you on January 4, 1993, to conduct a comprehensive and disciplined review of power reactor regulations and related NRC procedures, programs, and practices. In August 1993, the Regulatory Review Group issued its final report containing recommendations to reduce the regulatory burden on licensees and to strengthen NRC administrative practices. The staff submitted its plan for implementing these recommendations in January 1994 and issued subsequent semiannual status reports.

We believe that the effort by the Regulatory Review Group has been successful. The Regulatory Review Group recommendations have been implemented or assigned to appropriate NRC offices for implementation. We would like to compliment the staff on its success.

Sincerely,

/s/

T. S. Kress
Chairman, ACRS

Reference:

SECY-96-024, dated February 2, 1996, from James M. Taylor, Executive Director for Operations, NRC, for the Commissioners, Subject: Semiannual Status Report on the Implementation of Regulatory Review Group Recommendations

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