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CERTIFIED BY:

James Carroll - 8/8/96

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
PLANT OPERATIONS SUBCOMMITTEE
MEETING MINUTES
MAY 21, 1996
ROCKVILLE, MARYLAND

INTRODUCTION

The Advisory Committee on Reactor Safeguards (ACRS) Subcommittee on Plant Operations held a meeting on May 21, 1996, in Room T-2 B3, 11545 Rockville Pike, Rockville, Maryland, with representatives of the U.S. Nuclear Regulatory Commission (NRC), Nuclear Energy Institute (NEI), and a utility. The purpose of this meeting was to review the proposed Rule on Shutdown Operations and an associated Regulatory Guide as well as studies on shutdown risk at Surry and Grand Gulf nuclear plants. The entire meeting was open to the public. Mr. Amarjit "Jit" Singh was the Cognizant ACRS staff engineer for this meeting. The meeting was convened at 8:30 a.m. and adjourned at 4:40 p.m.

ATTENDEES

ACRS Members

J. Carroll, Chairman
R. Seale, Member
T. Kress, Member

G. Apostolakis, Member
W. Shack, Member
W. Lindblad, Member

Nuclear Energy Institute

T. Pietrangelo

Entergy Corporation

K. Hughey

Principal NRC Speakers and Consultants

H. VanderMolen, Office of Nuclear Regulatory Research (RES)
T. Chu, Brookhaven National Laboratory (BNL)
D. Whitehead, Sandia National Laboratories (SNL)
R. Jones, Office of Nuclear Reactor Regulation (NRR)
W. Lyon, NRR

No written comments or requests for time to make oral statements were received from members of the public. Approximately 13 members of the public attended the meeting. A list of those who registered is available in the ACRS Office.

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OPENING REMARKS BY THE SUBCOMMITTEE CHAIRMAN

Mr. James Carroll, Chairman of the Plant Operations Subcommittee, convened the meeting at 8:30 a.m. and stated that the purpose of the meeting was to discuss the proposed Rule on Shutdown Operations, and an associated Regulatory Guide as well as studies on shutdown risk at Surry and Grand Gulf nuclear plants. He also stated that the subcommittee will gather information, analyze relevant issues and facts, and formulate proposed positions and actions, as appropriate, for deliberation by the full Committee.

DISCUSSION OF ITEMS

Introduction to the Risk Studies to the Draft Rule - Mr. Harold VanderMolen, RES

Mr. VanderMolen presented a brief background and the results of the risk studies performed by BNL and SNL at Surry and Grand Gulf Nuclear Power Plants, respectively.

Mr. VanderMolen stated that originally the staff's interest in low power and shutdown risk was based on BNL and French studies which indicated that contribution of such a risk to the core-damage frequency (CDF) during shutdown mode could be significant. These studies became part of NRC's research plan in response to the Chernobyl accident in 1986. This project included two parallel studies performed by BNL and SNL. Two plants, Surry and Grand Gulf, were selected to be studied. The objectives of these studies were to, assess the risks of severe accidents due to internal events, internal fires, internal floods, and seismic events initiated during various plant operational states other than full power operation and to compare the estimated core-damage frequencies, important accidents sequences and other qualitative results with those resulting from accidents during full power operation as assessed in NUREG 1150, "Severe Accident Risks: An Assessment for Five U.S. Nuclear Power Plants." The scope of these studies included a level 3 PRA for these plants.

Mr. VanderMolen stated that the results of shutdown risk studies at Grand Gulf showed a CDF in "mid- 10^{-5} " range and Surry CDF was in "mid- 10^{-6} " range. The details of these studies were discussed later by Dr. Chu of BNL and Mr. Whitehead of SNL.

The main finding of the study at Surry was that during mid-loop operation the risk of consequence measures related to long-term health effects, latent cancer fatalities and population dose, were high, comparable to those at full power operation. The main conclusion from the Grand Gulf study was that with many plant features unavailable to mitigate a release, the potential exists for a large release of radioactive material, should core damage

occur. For the most likely accidents, the containment is open, the suppression pool is bypassed, and the containment sprays are not available.

Members asked if Grand Gulf and Surry were typical representation of the all the population of plants in the U.S. The staff responded that the above-mentioned studies were plant specific.

Surry Shutdown Risk Study - Dr. Chu, BNL

Dr. Chu presented the overview, background, and results of Shutdown Risk Study at Surry nuclear power plant.

Dr. Chu stated that during 1989, NRC initiated an extensive program to examine the potential risks during low power and shutdown operations in response to Chernobyl accident. BNL started its study in the fall of 1989. This study was performed in two Phases. Phase 1, which was completed in Fall 1991, a coarse screening analysis examining accidents initiated by internal events was performed for all plant operational states. The Phase 1 study identified potential vulnerable plant configurations, characterized (on a high, medium, or low CDF basis) the potential core damage accident scenarios and risk, and provided a foundation for a detailed Phase 2 analysis.

Dr. Chu briefly presented the insights of the Phase 2 study for Surry. Scope of the Phase 2 study included a Level 3 PRA. Phase 2 study was more detailed and evaluated the risk during mid-loop operation. The main finding of the study was that during mid-loop operation the risk of consequence measures related to long-term health effects, latent cancer fatalities, and population dose, are high, comparable to those at full power, despite the much lower level of the decay heat and the radionuclide inventory. The reason for this was that containment was likely to be isolated for a significant fraction of the accidents initiated during mid-loop operation so the releases to the environment were large and the radionuclide species (such as cesium), which mostly contribute to long term health effects (such as cesium), have long half-lives. Another finding of the study was that the risk of early fatalities was low despite the unisolated containment due to the decay of the short-lived radionuclides, such as iodine and tellurium, which contributed to early fatality risk. The estimated risk was to have a range of uncertainty extending over approximately two orders of magnitude from the 5th to the 95th percentiles of the distribution.

Grand Gulf Unit 1 Shutdown Risk Study - Mr. Donnie Whitehead, SNL

Mr. Whitehead briefly presented the results of the Grand Gulf risk study. Mr. Whitehead stated that the objectives of the Phase 1 were essentially the same as were previously discussed by Dr. Chu

for Surry. Phase 2 was the detailed analysis performed for Grand Gulf and also included the Level 3 PRA.

Mr. Whitehead presented the results of the Phase 2 risk study at Grand Gulf. He stated that from the strict core damage view point, there were two plant operational states (POS) that appeared to be most important. The POS 5, which is essentially cold shutdown and then POS 6, which is the early part of refueling as defined by the Technical Specifications. Initiating events that may occur during POS 5 were identified and accident sequence events were developed and quantified using the integrated reliability and risk analysis system (IRRAS) PRA (computer code). Surviving sequences were examined for recovery potential, appropriate human recovery actions were incorporated into the sequence cut sets, and the sequences were then requantified. Those sequences surviving this preliminary recovery analysis were then reexamined during a "time window" analysis, which allows for more realistic incorporation of the effects of the decrease in decay heat and more time-specific incorporation of equipment unavailabilities as the plant transitions from the beginning to the end of POS 5. The core-damage frequency was estimated per calendar year for the Grand Gulf plant to be in "mid- 10^{-5} " range per calendar year. This was compared with the total internal event (excluding fire and flood) mean core damage frequency of 4×10^{-4} per year estimated in the NUREG-1150 study of full power operations. The risk associated with Grand Gulf, as it operates in POS 5 during a refueling outage, was shown to be comparable with the risk associated with full power operation. In NUREG-1150, the risk from full power operation of Grand Gulf was shown to be quite low. While the risk associated with POS 5 is low, there were very few features of the plant that were available to attenuate a release should one occur.

Mr. Whitehead concluded that most likely accidents in POS 5 have an open containment, the suppression pool was bypassed, the containment sprays were not available. The risks from POS 5 were not significant compared with the risks from full power operation. Hence, the full-power risk distributions by themselves do not completely characterize the risks associated with operation of this plant.

NRR Staff Presentation - Mr. Warren Lyons, NRR

Mr. Lyons provided an overview on the progress of the proposed Shutdown Operations Rule. The rule was characterized as risk-informed with performance elements. Significant points made during the discussion include:

- The proposed Shutdown Operations Rule and Regulatory Guide are being developed with emphasis upon risk-informed and performance-based approach.

- The proposed Rule will apply to all licensees who have light water nuclear power plants. The rule is structured into three operational areas: (1) safety criteria, (2) licensee determined performance criteria for normal operation bounded by safety criteria, and (3) backup cooling capability and containment.
- The definition of the Shutdown Operation is the state when the reactor is subcritical, one or more fuel assemblies are located in the reactor vessel or in refueling cavity, and the reactor coolant system (RCS) temperature and pressure permit operation of the decay heat removal system.
- Proper implementation of the guidelines in the NUMARC 91-06 document, "Guidelines for Industry Actions to Assess Shutdown Management," will satisfy the limiting conditions of operation requirements. The staff does not believe that NUMARC 91-06 document is sufficient to ensure uniform compliance by all licensees.
- The staff is in the process of revising the regulatory analysis and the associated Regulatory Guide to incorporate the NEI comments.

Mr. Carroll stated that the Maintenance Rule should address the staff's concerns with shutdown risk. Mr. Warren did not think that the Maintenance Rule will address all the staff's concerns.

Nuclear Energy Institute (NEI) Presentation - Mr. Tony Pietrangelo, NEI

Mr. Tony Pietrangelo provided comments on the proposed rule. He stated that industry still questions the need for a shutdown rule. He also stated that NUMARC 91-06 was issued to provide guidance to the industry to assess plant management during shutdown.

NEI's has a number of concerns that seriously question whether the proposed rule is necessary or justified. These concerns were focused in three principal areas:

- Utility management responsibility for outage planning
- Overlap of the proposed requirements with the maintenance Rule
- Lack of an updated regulatory analysis that meets 10 CFR 50.109

Mr. Pietrangelo further stated that the staff's risk analyses and event experience do not demonstrate that a problem exists. Finally, Section (c)(4) dealing with the noncompliance with Paragraph (c)(1) or Paragraph (c)(3) of the proposed rule is not necessary.

Utility Presentation - Mr. Kenneth Hughey, Director of Central Licensing for Entergy Plants

Mr. Hughey provided his general view of the proposed Shutdown Operations Rule. He stated that the full risk assessment is performed for all the outages for all the Entergy plants. Additionally, the pre-outage assessment is performed to identify high risk areas. Primarily, all the Entergy plants follow the guidelines included in NUMARC 91-06. All the emergency operating procedures are written in accordance with the BWR Owner's Group guidelines.

SUBCOMMITTEE ACTION

The Subcommittee recommended that the staff provide a presentation to the full Committee at the May 23-25, 1996 ACRS meeting, and the Subcommittee Chairman prepare a report to the NRC Chairman concerning the proposed Shutdown Operation Rule.

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NOTE: Additional details of this meeting can be obtained from a transcript of this meeting available in the NRC Public Document Room, 2120 L Street, N.W., Washington, D.C. 20006, (202) 634-3274, or can be purchased from Neal R. Gross & Co., Inc., Court Reporters and Transcribers, 1323 Rhode Island Avenue, N.W., Washington, D.C. 20005, (202) 234-4433.