

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

OFFICE OF NUCLEAR REACTOR REGULATION
Frank J. Miraglia, Jr., Acting, Director

In the Matter of)
All Power Reactor Licensees)
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FINAL DIRECTOR'S DECISION UNDER 10 CFR 2.206

I. INTRODUCTION

By a Petition submitted pursuant to 10 CFR 2.206 on April 13, 1994, Mr. Paul M. Blanch (Petitioner) requested that the U.S. Nuclear Regulatory Commission (NRC) take immediate action with regard to all power reactor Licensees, concerning the potential failure of the fuel in the spent fuel pools for all reactors in the United States. Specifically, the Petitioner requested that the NRC: (1) immediately issue an information notice or other appropriate notification forwarding all information in its possession to all power reactor Licensees regarding the potential failure of fuel in spent fuel pools, and reminding Licensees of their responsibilities to perform timely operability determinations in accordance with their technical specifications and NRC Generic Letter 91-18; (2) direct each Licensee to immediately perform an evaluation of this potential deficiency to determine compliance with its current licensing basis; (3) deny all requests for license amendments for the expansion of spent fuel pool capacity until these safety concerns are fully

resolved¹; and (4) after evaluation by each Licensee, if the NRC determines there is little or no risk to public health and safety, the NRC may issue a Notice of Enforcement Discretion which represents a determination by the NRC not to enforce an applicable technical specification or license condition.

As a basis for his requests, the Petitioner asserted that approximately 1-1/2 years before the Petition was submitted, the NRC was informed of a potential substantial nuclear safety hazard at the Susquehanna Steam Electric Station (SSES) operated by Pennsylvania Power and Light Company (PP&L or Licensee) and that the NRC overlooked the need to inform utilities of this potential problem. The Petitioner claimed that this hazard involves a major design flaw such that, during a design-basis loss-of-coolant-accident, the electrical power to the fuel pool cooling system would be turned off, resulting in loss of cooling for the spent fuel pool. Petitioner alleged that, as a result of the loss-of-coolant-accident, radiation levels in the reactor building would prohibit operators from entering the reactor building to restart the system. Petitioner claimed that, if cooling is not restored, the water in the spent fuel pool will boil, water will evaporate and, since the valves which must be opened to provide replacement water are located within the inaccessible reactor building, replacement water cannot be provided. Petitioner postulated that this would result in high onsite and offsite radiation levels and a failure of the spent fuel in the pool and a consequent release of massive amounts of airborne radioactivity outside of primary and secondary containment. Petitioner alleged further that the

¹This request by Petitioner is not within the scope of the 2.206 process as it does not request enforcement action as is more fully discussed in my letter transmitting this Director's Decision to Petitioner. Accordingly, it will not be further addressed in this Director's Decision.

residual heat removal system could not cool the fuel pool under accident conditions, and that if replacement water could be provided, temperature and humidity conditions inside the reactor building would cause the emergency systems to fail, resulting in additional fuel failure and failure of the primary and secondary containment.

In a letter of May 5, 1994, the Director of the Office of Nuclear Reactor Regulation acknowledged receipt of the Petition and denied the Petitioner's requests for immediate relief. In the acknowledgement letter, he informed the Petitioner that the remaining requests were being evaluated under 10 CFR 2.206 of the Commission's regulations and that action would be taken in a reasonable time.

The NRC staff's review of the issues related to spent fuel storage pool safety raised in the April 13, 1994, Petition is now complete. As explained below, the NRC staff has taken actions which, in part, address Petitioner's requests. A discussion of these issues and the NRC response to the Petitioner's requests follows.

II. DISCUSSION

On November 27, 1992, a report was filed pursuant to 10 CFR Part 21 by two contract engineers at SSES, which notified the Commission of potential design deficiencies in spent fuel pool decay heat removal systems and containment systems at the Susquehanna Steam Electric Station. The report noted that, under certain conditions, systems designed to remove decay heat from the spent fuel pool would be unable to perform their intended function and that, due to concurrent plant conditions, it would not be possible for operators to place backup systems in service or that backup systems would also otherwise be

unable to perform their intended function. The report contended that, under such conditions, the spent fuel pool could reach boiling conditions and that the adverse environment created by a boiling pool would render systems designed to remove decay heat from the reactor core and systems designed to limit the release of fission products to the environment unable to perform their intended function. The ultimate consequence of this condition would be the failure of fuel in both the reactor vessel and the spent fuel pool and a substantial release of fission products to the environment that would cause significant harm to the public health and safety.

The NRC staff determined initially that the issues appeared to be of low safety significance because of the low probability that the necessary sequence of events would take place. Specifically, the NRC staff observed that a loss-of-coolant accident followed by multiple failures of emergency core cooling systems would be necessary to achieve the adverse radiological conditions that would preclude operator actions to ensure continued adequate decay heat removal from the spent fuel pool. On this basis, the NRC staff determined that immediate actions to assure public health and safety were not warranted.

However, because of the complex nature of the issues raised in the Part 21 report, the NRC staff undertook an extensive evaluation of the matter which continued from November 1992 to June 1995. The NRC staff review process included information-gathering trips to the Licensee's engineering offices and to the Susquehanna Steam Electric Station (SSES), public meetings with the Licensee, public meetings and written correspondence with the authors of the Part 21 report, and numerous written requests for information to the Licensee and corresponding responses. The staff issued Information Notice 93-83, "Potential Loss of Spent Fuel Pool Cooling After a Loss-of-Coolant Accident,"

on October 7, 1993, which informed licensees of all operating reactors of the nature of the issues raised in the Part 21 report.

The NRC staff reviewed and evaluated the plant design and expected operation of plant equipment with respect to the various event sequences described in the Part 21 report. The staff also evaluated the response of plant equipment to a broader range of initiating events than was identified in the Part 21 report. For example, the staff considered the safety significance of a loss of spent fuel pool decay heat removal capability resulting from loss of offsite power events, from seismic events, and from flooding events. The staff considered the potential for such events to lead to spent fuel pool boiling sequences that could in turn jeopardize safety-related equipment needed to maintain reactor core cooling. The NRC staff conducted both deterministic and probabilistic evaluations to fully understand the safety significance of the issues raised. In addition, the staff evaluated the impact of certain modifications made by the Licensee during the course of the NRC staff's review. Finally, the staff examined issues associated with the design of the spent fuel pool cooling system to determine the extent to which the Licensee's design and operation met the applicable regulatory requirements.

The NRC staff issued a draft safety evaluation addressing the issues raised in the Part 21 report regarding SSES for comment on October 25, 1994. After receiving comments from the Licensee, the authors of the Part 21 report and the Advisory Committee on Reactor Safeguards, the staff issued a final

safety evaluation regarding the issues raised in the Part 21 report for the Susquehanna Steam Electric Station on June 19, 1995 (SSES SE).²

In the SSES SE, the staff documented the deterministic and probabilistic evaluations regarding the spent fuel pool issues raised in the Part 21 report and resulting conclusions. On the basis of the deterministic analysis of the plant as it was configured at the time the SSES SE was prepared, the NRC staff concluded that systems used to cool the spent fuel storage pool are adequate to prevent unacceptable challenges to safety-related systems needed to protect the health and safety of the public during design-basis accidents.

On the basis of the probabilistic evaluation, the NRC staff concluded that the specific scenario involving a large radionuclide release from the reactor vessel, which was described in the Part 21 report, is a sequence of very low probability. The NRC staff's evaluation concluded that, even with consideration of the additional initiating events described above, "loss of spent fuel pool cooling events" represented events of low safety significance at the time the Part 21 report was submitted. However, the staff also concluded that the plant modifications and procedural upgrades made during the course of the staff's review, which included removal of the gates that separate the spent fuel storage pools from the common cask storage pit, installation of remote spent fuel pool temperature and level indication in the control room, and numerous procedural upgrades, provided a measurable improvement in plant safety and that these conclusions had potential generic implications. In summary, with regard to loss of spent fuel pool cooling

²Letter to R. Byram, PP&L, from J. Stolz, NRC, "Susquehanna Steam Electric Station, Units 1 and 2, Safety Evaluation Regarding Spent Fuel Pool Cooling Issues (TAC NO. M85337), dated June 19, 1995.

events, the design of the SSES facility was adequate to protect public health and safety.

The staff issued Information Notice 93-83, Supplement 1, "Potential Loss of Spent Fuel Pool Cooling After a Loss-of-Coolant Accident or a Loss of Offsite Power," to all power reactor licensees on August 24, 1995, in which the SSES SE was summarized. The information notice also described the staff's plans to undertake an action plan to evaluate the generic concerns raised in the SSES SE and to address certain additional concerns arising from a special inspection at a permanently shutdown reactor facility.³ The generic action plan, entitled "Task Action Plan for Spent Fuel Storage Pool Safety" (Task Action Plan) was issued on October 13, 1994, and included the following actions: (1) a search for and analysis of information regarding spent fuel storage pool issues, (2) an assessment of the operation and design of spent fuel storage pools at selected reactor facilities, (3) an evaluation of the assessment findings for safety concerns, and (4) selection and execution of an appropriate course of action based on the safety significance of the findings.

As part of its review under the Task Action Plan, the staff performed assessment visits to four operating reactors. The staff also reviewed

³On January 25, 1994, the licensee for Dresden Unit 1, a permanently shutdown facility, discovered approximately 55,000 gallons of water in the basement of the unheated Unit 1 containment. The water originated from a rupture of the service water system that occurred due to freeze damage. The licensee investigated further and found that, although the fuel transfer system was not damaged, there was a potential for a portion of the fuel transfer system inside containment to fail and result in a partial drain-down of the spent fuel pool that contained 660 spent fuel assemblies. The NRC issued Bulletin 94-01, "Potential Fuel Pool Draindown Caused by Inadequate Maintenance Practices at Dresden Unit 1," on April 8, 1994 to all licensees with permanently shutdown reactors who had spent fuel stored in spent fuel pools. The NRC requested that such licensees take certain actions to ensure that spent fuel storage safety did not become degraded.

operating experience, as documented in Licensee Event Reports and other information sources, as well as in previous studies of spent fuel pool issues. Finally, the staff gathered detailed design data for every operating reactor and analyzed this data to identify potential safety issues.

The NRC staff completed its work under the Task Action Plan in July 1996. The staff forwarded the results of its review to the Commission on July 26, 1996⁴. In the report, the staff concluded that existing spent fuel storage pool structures, systems, and components provide adequate protection for public health and safety. Protection is provided by several layers of defense involving accident prevention (e.g., quality controls on design, construction, and operation), accident mitigation (e.g., multiple cooling systems and multiple makeup water paths), radiation protection, and emergency preparedness. Design features addressing each of these areas for spent fuel storage for each operating reactor have been reviewed and approved by the staff. In addition, the limited risk analyses available for spent fuel storage suggest that current design features and operational constraints cause issues related to spent fuel pool storage to be a small fraction of the overall risk associated with an operating light-water reactor.

Notwithstanding the findings resulting from the Task Action Plan, the NRC staff reviewed each operating reactor's spent fuel pool design to identify strengths and weaknesses, and to identify potential areas for safety enhancements. The NRC staff identified seven categories of design features that reduce the reliability of spent fuel pool decay heat removal, increase the potential for loss of spent fuel coolant inventory, or increase the

⁴Memorandum to the Commission, from J. Taylor, "Resolution of Spent Fuel Storage Pool Action Plan Issues," dated July 26, 1996.

potential for consequential loss of essential safety functions at an operating reactor. The NRC staff determined that these design features existed at twenty-two sites.

As the staff has concluded that present facility designs provide adequate protection of public health and safety, possible safety enhancements will be evaluated pursuant to 10 CFR 50.109(a)(3). The analyses for possible safety enhancement backfits will consider whether modifications to the plant design to address the plant-specific design features identified by the NRC staff could provide a substantial increase in the overall protection of public health and safety and whether such modifications could be justified on a cost-benefit basis.

The NRC staff also identified three additional categories of design features that may have the potential to reduce the reliability of spent fuel pool decay heat removal, increase the potential for loss of spent fuel coolant inventory, or increase the potential for consequential loss of essential safety functions at an operating reactor. The NRC staff preliminarily determined that these design features existed at eleven sites. However, the staff has insufficient information at this time to determine whether backfits pursuant to 10 CFR 50.109(a)(3) are warranted. For plants identified as having design features in these three categories, the NRC staff will gather and evaluate additional information prior to determining whether to require any backfits.

In addition to the plant-specific analyses described above for twenty-two sites which will address certain design features, the NRC staff plans to address issues relating to the functional performance of spent fuel pool decay heat removal, as well as the operational aspects related to coolant inventory

control and reactivity control, for all operating reactors. The staff plans to expand the proposed, performance-based rule for shutdown operations at nuclear power plants (10 CFR 50.67) to encompass fuel storage pool operations to address these performance and operational considerations.

The NRC staff has sent the July 26, 1996, report to all licensees. For those licensees whose plants have one or more of the design features which warrant an analysis of possible plant-specific safety enhancements, the staff has provided an opportunity for licensees to comment on (1) the accuracy of the NRC staff's understanding of the plant design, (2) the safety significance of the design concern, (3) the cost of potential modifications to address the design concern, or (4) the existing protection from the design concern provided by administrative controls or other means. In developing a schedule and plans for conducting the plant-specific regulatory analyses, the NRC staff will consider comments received from licensees.

III. RESPONSE TO PETITIONER'S REQUESTS

A. Issuance of Generic Communications to Licensees on Failure of Spent Fuel

The NRC staff has issued three information notices on matters related to adequate decay heat removal from the spent fuel pool. Information Notice 93-83, "Potential Loss of Spent Fuel Pool Cooling After a Loss-of-Coolant Accident," was issued on October 7, 1993, and described the concerns raised in the November 27, 1992, Part 21 report. Information Notice 93-83, Supplement 1, was issued on August 24, 1995, to inform licensees of the results of the NRC review of the concerns at SSES. Information Notice (IN) 95-54, "Decay Heat Management Practices During Refueling Outages," was issued on December 1, 1995. It described recent NRC assessments of events at certain plants

regarding licensee control of refueling operations and the methods for removing decay heat produced from the irradiated fuel stored in the spent fuel pool during refueling outages. In IN 95-54, the NRC staff communicated to licensees that the plant-specific events described in IN 95-54 and the previous information notices illustrated the importance of assuring that (1) planned core offload evolutions, including refueling practices and irradiated decay heat removal, are consistent with the licensing basis, including the Final Safety Analysis Report, technical specifications, and license conditions; (2) changes are evaluated through the application of the provisions of 10 CFR 50.59, as appropriate; and (3) all relevant procedures associated with core offloads have been appropriately reviewed.

As described in Section II, the NRC staff also forwarded the July 26, 1996, report on spent fuel to all licensees. The NRC has determined that these generic communications to power reactor licensees are sufficient to provide licensees with information on spent fuel pool cooling issues.

Petitioner's request that the NRC issue an information notice or other appropriate notification forwarding all information in its possession to all power reactor licensees regarding the potential failure of fuel in spent fuel pools is granted to the extent that the NRC staff has provided information on spent fuel storage safety issues by way of the generic communications and correspondence described above.

Petitioner's request that the NRC remind licensees of their responsibilities to perform timely operability determinations in accordance with their technical specifications is granted to the extent that the NRC has communicated to licensees the importance of conducting relevant spent fuel

pool decay heat removal activities in accordance with technical specifications and other plant-specific applicable regulatory requirements in IN 95-54.

B. Licensee Evaluation of Compliance With the Licensing Basis

Petitioner requested that the staff direct each licensee to immediately perform an evaluation of the potential failure of the fuel in the spent fuel pool to determine compliance with the current licensing basis. The NRC staff examined the issue of the conformance of the existing plant design with the facility licensing basis in great detail for SSES.⁵ As documented in the SSES SE, the NRC staff concluded that neither operation of spent fuel pool cooling during design-basis accident conditions nor mitigation of the effects of a loss of spent fuel pool cooling during normal and design-basis accident conditions could be considered part of the SSES licensing basis with the exception of mitigation of loss of spent fuel pool cooling following a design-basis seismic event. In general, the NRC staff's conclusion is based on the fact that, with respect to operation of the spent fuel pool cooling systems during normal and design-basis accident conditions, the SSES operating license safety evaluation report⁶ (SER) did not cite the applicable General Design Criteria (GDC)(GDC 44 and GDC 61 in its entirety) as the basis for finding the system acceptable. With respect to the mitigation of the effects of a loss of spent fuel pool cooling during normal and design-basis accident conditions, in

⁵In the SSES spent fuel pool design review, the NRC staff determined which regulations the licensee was required to comply with. In addition, operational limitations were extracted from plant-specific licensing documents including the Final Safety Analysis Report, technical specifications, license amendments and other docketed correspondence.

⁶U.S. Nuclear Regulatory Commission, "Safety Evaluation Report Related to the Operation of Susquehanna Steam Electric Station, Units 1 and 2," NUREG-0776, April 1981.

the SSES SE, the staff found no evidence that it expected secondary containment systems to accommodate the added heat and vapor loads that would follow a sustained loss of spent fuel pool cooling for any design-basis event with the specific exception of a design-basis seismic event.

The NRC staff's finding that mitigation of a loss of spent fuel pool cooling following a design basis seismic event was part of the licensing basis was based on specific statements in the SER that acceptance of a non-seismic spent fuel pool cooling system was an acceptable deviation from GDC 2, based, in part, on the existence of an adequate standby gas treatment system. At the time of the original licensing review, the staff did not attempt to extend the licensing basis for loss of spent fuel pool cooling following a design basis seismic event to any other design basis events.

During its review of spent fuel pool concerns at SSES, the NRC staff raised its concerns to the Licensee regarding the ability to mitigate a loss of spent fuel pool cooling following a seismic event. As discussed in the SSES SE, the Licensee took certain actions, including implementing routine operation of the adjacent spent fuel pools in a cross-connected manner, that adequately addressed NRC staff concerns. In summary, with regard to the spent fuel pool issues raised by Petitioner, SSES design and operation conform to the facility licensing basis.

As part of the Task Action Plan, the staff considered on a generic basis the history of regulatory requirements related to spent fuel pools as they were applied in plant licensing activities. The staff observed that such regulatory requirements evolved since the first nuclear power plants were licensed and observed that specific regulatory guidance on the design of spent fuel pool cooling systems was not issued until 1975 when the Standard Review

Plan was issued, after construction permits for most currently operating reactors were issued. Because the regulatory requirements were not constant during the era when the staff was conducting licensing reviews for the current generation of operating reactors, the staff observed that approved designs varied from plant to plant. However, the staff did conclude, based on information available during the recent review of spent fuel pool system design, that all operating reactors had design features for spent fuel storage (addressing accident prevention functions, accident mitigation functions, radiation protection functions, and emergency preparedness functions) which had been reviewed and approved by the staff and that these facility designs were in compliance with the NRC requirements applied at the time of licensing.

Although the NRC staff concluded that plants were in compliance with the NRC design requirements applied at the time of licensing, the NRC staff also recently reviewed certain operating practices at all operating reactors to verify that the plants were being operated consistent with the plant design described in the licensing basis⁷. Specifically, the staff reviewed refueling outage practices with regard to offloading irradiated fuel into the spent fuel pool. The staff concluded on the basis of the information collected and reviewed and the specific licensee actions taken and commitments made during the course of this review, core offload practices are currently consistent with the spent fuel pool decay heat removal licensing basis for all plants or will be prior to the next refueling outage. However, during the course of the review, the staff determined that 9 sites (15 units) needed to perform evaluations or make modifications, pursuant to 10 CFR 50.59 or 10 CFR

⁷Memorandum to the Commission, from J. Taylor, dated May 21, 1996.

50.90, to ensure that their reload practices adhered to their licensing basis. This is an indication that these plants may have previously performed full core offloads inconsistent with their licensing basis.

The staff has documented the details of its findings in recent NRC inspection reports for each of the nine sites. The staff will take regulatory action, as appropriate, to address these potential operational non-conformances.

Petitioner requested that evaluations be performed of Petitioner's concern regarding spent fuel pool cooling by licensees to determine compliance with their licensing basis. This request is granted to the extent that the NRC staff has performed evaluations of both the design and operational aspects of spent fuel pool storage issues for all operating reactors to the extent described above.

C. Issuance of Notices of Enforcement Discretion

The Atomic Energy Act of 1954, as amended, (the Act) and the Energy Reorganization Act of 1974, as amended, give NRC the authority to take enforcement actions necessary to ensure compliance with certain provisions of those Acts and with NRC regulations, orders, and licenses. Licenses include specified license conditions and facility technical specifications which are part of the license. The NRC's enforcement policy is published in NUREG-1600, "General Statement of Policy and Procedures for NRC Enforcement Actions," July 1995 (Enforcement Policy).

The Enforcement Policy recognizes that, on occasion, circumstances may arise concerning a licensee's compliance with a Technical Specification Limiting Condition for Operation or with some other license conditions which would involve an unnecessary plant transient or the performance of plant

testing that is inappropriate for the specific plant conditions. For such occasions, the Enforcement Policy provides a process, referred to as a Notice of Enforcement Discretion (NOED), by which the NRC staff, upon request from the licensee, may choose not to enforce compliance with the applicable technical specifications or license conditions in limited circumstances. A NOED will only be issued if the NRC staff is satisfied that the action is consistent with public health and safety.

In Request 4, Petitioner seems to suggest that the exercise of enforcement discretion by issuance of a NOED may be appropriate concerning spent fuel pool issues raised in the Petition. As discussed in Section B, with regard to potential failure of fuel in spent fuel pools, the NRC staff has determined that spent fuel pools contain design features which were reviewed and approved by the staff. In addition, these facility designs have been found to be in compliance with NRC requirements applied at the time of licensing. Based upon the review of the information provided in the Petition, the NRC staff has not identified any circumstances warranting the issuance of a NOED. If a situation is presented to the staff involving a request for a NOED, such a request will be considered in accordance with the Enforcement Policy.

IV. CONCLUSION

Based on the NRC staff's evaluation described above, the NRC staff has issued generic communications responsive to Petitioner's Request 1. In addition, the NRC staff has reviewed the aspect of compliance of NRC-licensed facilities in the area of spent fuel pool design responsive in part to Petitioner's Request 2. To this extent, the Petition is granted. With regard to Petitioner's Request 4, the NRC staff has concluded that there has been no

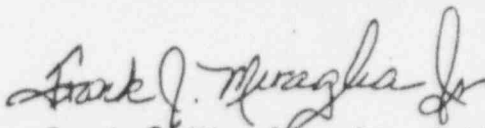
need for issuance of NOEDs regarding potential failure of fuel in spent fuel pools.

A copy of this Final Director's Decision will be placed in the Commission's Public Document Room, the Gelman Building, 2120 L Street, NW., Washington, D.C., and at the local public document room for all power reactor licensees.

A copy of this Final Director's Decision will also be filed with the Secretary of the Commission for review in accordance with 10 CFR 2.206(c) of the Commission's Regulations. This Decision will become the final action of the Commission 25 days after its issuance, unless the Commission, on its own motion, institutes review of the Decision within that time.

Dated at Rockville, Maryland, this 6th day of November 1996.

FOR THE NUCLEAR REGULATORY COMMISSION

A handwritten signature in cursive script, reading "Frank J. Miraglia, Jr.", is written over a horizontal line.

Frank J. Miraglia, Jr., Acting Director
Office of Nuclear Reactor Regulation