



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

April 1, 1997

MEMORANDUM TO: Geoffrey E. Grant, Director
Division of Reactor Safety
Region III

FROM: Cynthia A. Carpenter, *Cynthia A. Carpenter* Acting Director
Project Directorate III-3
Division of Reactor Projects - III/IV
Office of Nuclear Reactor Regulation

SUBJECT: TECHNICAL ASSISTANCE REQUEST (AIT 97-004) ON POTENTIAL
UNREVIEWED SAFETY QUESTIONS RELATED TO THE AUXILIARY
FEEDWATER SYSTEM - KEWAUNEE NUCLEAR POWER PLANT
(TAC NO. M97969)

In a memorandum dated February 14, 1997, you requested technical assistance from the Office of Nuclear Reactor Regulation (NRR) to resolve concerns regarding potential unreviewed safety questions associated with the auxiliary feedwater system at the Kewaunee Nuclear Power Plant. These concerns were raised as a result of a safety system operations inspection which exited with the licensee on January 31, 1997.

The Plant Systems Branch in cooperation with the Reactor Systems and Mechanical Engineering Branches have reviewed the subject Region III task interface agreement request and prepared the attached evaluation. This completes NRR action on the subject Action Item AIT 97-004 and closes TAC No. M97969.

If you have any questions regarding this evaluation, please contact Rich Laufer at (301) 415-1373.

Docket No. 50-305

Attachment: As stated

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EVALUATION OF RIII CONCERNS (AIT 97-004) ON
POTENTIAL UNREVIEWED SAFETY QUESTIONS RELATED TO THE
AUXILIARY FEEDWATER SYSTEM
KEWAUNEE NUCLEAR POWER PLANT

BACKGROUND

The Plant Systems Branch (SPLB) in cooperation with the Reactor Systems and Mechanical Engineering Branches (SRXB and EMEB) have reviewed the subject Region III task interface agreement request (TIA) transmitted to the Office of Nuclear Reactor Regulation (NRR) by memorandum dated February 14, 1997. In the TIA, the region requested assistance in determining if the operation of the auxiliary feedwater (AFW) system was consistent with the design and licensing basis for the plant. As identified in the region's memorandum, at issue is whether certain conditions constitute unreviewed safety questions (USQs) and whether license amendments are now required to restart the plant from its current outage.

Region III completed a safety system operations inspection (SSOPI) at Kewaunee Nuclear Power Plant which exited on January 31, 1997. In the course of that inspection, two issues were identified which appeared to be USQs. Region III requested that NRR evaluate the two conditions and determine if either constitutes a USQ. The region noted in the TIA that if the conditions are determined to be USQs, then they would have to be resolved prior to restarting the plant. These two issues and the staff's responses are discussed below. The staff has concluded that neither of the identified issues constitute a USQ at this time, but Issue 1 is an operability concern and a potential USQ depending on the actions of the licensee.

ISSUE 1

The inspectors identified that the individual AFW pumps could not provide 200 gallons per minute (gpm) to the steam generators (SGs) as described in the plant licensing basis. The Kewaunee Updated Safety Analysis Report (USAR), Section 6.6, describes the two motor-driven (MD) and the single turbine-driven (TD) AFW pumps as each having a capacity of 240 gpm with up to 40 gpm of the 240 gpm providing continuous recirculation. Also in Section 6.6 of the USAR, it is stated that, "The feedwater flow rate required to prevent thermal cycling of the tube sheet and for removing residual heat is the same, about 160 gpm for the reactor (or 80 gpm per SG). A 200 gpm flow to the SGs is, therefore, sufficient to fulfill the above functions." The Kewaunee technical specification (TS) basis Section B3.4.b also contains these same quoted words. The licensee maintained that the "margin of safety" for AFW pump capacity was included in the conservatism in the Westinghouse analysis that established the 160 gpm figure. Thus, the 160 gpm represented the higher bounding figure of some unknown margin. The licensee reported that a subsequent computer analysis was run using 160 gpm, and design limits were not exceeded.

ATTACHMENT

The inspectors, however, concluded that the 160 gpm to 200 gpm pump capacity (to the SGs) represented a margin of safety as defined in the basis for a TS and, thus, a USQ is involved according to 10 CFR 50.59. Calculations by the inspectors indicated that the worst pump condition would provide 182 gpm (to the SGs); however, instrumentation inaccuracies were not included which could lower the capacity further. The licensee agreed that the 200 gpm could not be delivered to the SGs against the highest potential pressure (the secondary relief valve setpoint plus accumulation). The licensee also told the inspectors that 200 gpm to the SGs (240 gpm pump capacity) had been used in their accident analyses.

RESPONSE TO ISSUE 1

The staff agrees with the inspectors' conclusion that 200 gpm to the SGs (240 gpm total pump capacity) is the capacity that should be used as the basis for the TSs. This is because 240 gpm is the pump capacity that is assumed in the licensee's Chapter 14 accident analyses in the USAR. While 160 gpm may be sufficient to remove decay heat and protect the core, it is not necessarily sufficient to meet all of the acceptance criteria used for accident analysis. If it is the licensee's intent not to restore the AFW pumps to the design capacity, then revised Chapter 14 analyses (and other design-basis analyses where 240 gpm capacity pumps were assumed such as station blackout, ATWS, and fire protection safe shutdown) need to be performed and submitted along with other appropriate USAR changes. The revised analyses would reduce the margin of safety as defined in the basis for the TSs. Therefore, proposed revisions to the Chapter 14 analyses would require the staff's approval.

For the current situation, the plant should be considered outside of its design basis and should have an operability determination that the AFW pumps are still operable based on an appropriate analysis. The pumps may be considered degraded, but operable based on Generic Letter 91-18. We are also concerned that the acceptance criteria established to perform pump testing in accordance with the ASME Code allow the hydraulic performance of the AFW pumps to degrade below the design condition. Although the Code does not require inservice testing to be performed at the flow rate specified in the safety analysis, acceptance criteria must be established to prevent pump performance from degrading below the required performance at the design-basis condition. It appears that the pumps have degraded to below the point where they should have been declared inoperable following ASME Code testing.

The staff concludes that the design capacities (240 gpm) of the AFW pumps are the current licensing and design basis. The licensee, therefore, should have declared the pumps degraded, made an operability determination, and established a long-term corrective action plan. However, if the licensee proposes to reduce the design-basis flow capacity of the AFW pumps, the licensee would have to get prior staff approval because it results in a USQ by reducing the safety margin used as a basis for the TSs.

ISSUE 2

The inspectors also identified that a modification to provide AFW pump protection may have involved a USQ. The modification installed a low discharge pressure AFW pump trip. Inspectors identified that in the event of a faulted SG, a low discharge pressure would exist. If only two of the three pumps automatically started, their output would not be sufficient to maintain the discharge pressure above the setpoint of the trip, and both pumps would quickly trip. The safety evaluation for the modification and station procedures did not recognize this as an expected result. One of the design bases in Section 6.6.3 of the USAR states that the AFW pumps are capable of automatically starting and delivering full flow within 1 minute after the signal for pump operation. The inspectors concluded that the pumps tripping during an event was a possible malfunction not previously evaluated and, therefore, a USQ.

The licensee believes that this condition was bounded by earlier reviews. A January 3, 1996, revision to the TSs authorized low power throttling of the AFW discharge valves and placing the pump control in the "pullout" position. The TS basis B3.4.b also indicated that this could have been acceptable at all power levels. In addition, the licensee also believed that this potential was reviewed in response to Bulletin 80-04, "Steam Line Breaks with Continued Feedwater Addition"; however, the low discharge pressure pump trips did not exist at that time. Also, the USAR Chapter 14 accident analysis for a steam line break considers a single failure as "one failure in the Auxiliary FW runout protection system." This implies that when the other single failure cases were analyzed, they included AFW pump runout protection trips. To the inspectors, these references were not specific enough to conclude that the reviews were bounding.

RESPONSE TO ISSUE 2

The staff does not totally agree with the licensee's response to the inspectors regarding the pump trip condition being bounded by the earlier reviews cited. The analysis for the 1996 TS revision demonstrated that there was adequate time (10 minutes) to protect the plant with reliance only on operator action to initiate AFW flow to an intact SG. However, operator actions to initiate AFW to an intact SG may vary significantly from the conditions assumed in the TS evaluation (control room pump switch in the pullout position) compared to the conditions that may occur from unexpected pump trips. The probability of failure to restart (particularly for restarting the TD pump) within 10 minutes following pump trips is likely to be higher than the probability of failure to start with the switch in the pullout position. Also, the staff only accepted manual actions to initiate AFW flow following an accident or transient with reactor power below 15 percent. Although the analyses may show that there is no significant safety concern associated with manually restarting the pumps following a steam line break,

the resulting pump trips following a faulted SG (steam or feed line break) should be considered as outside the plant licensing basis.

The licensee's reference to the single failure of AFW pump runout protection implies that the purpose of the low discharge pressure trips is to trip the AFW pumps following a steam line break. However, as described in USAR Chapter 6.6, the trips were added to protect the AFW pumps from a loss of the condensate storage tank (CST) which is not seismic and not protected against tornado missiles. It should be noted that (for containment and core effects) an AFW pump trip following a main steam line break may be preferred (more conservative) when compared to continued AFW flow to the faulted SG. However, if the low discharge pressure trip was considered to provide pump runout protection, then the safety evaluation for the modification and the plant emergency procedures should have included the pump trips following a faulted SG as an expected result of the installation of the low discharge pressure trip.

The staff considered that the addition of an AFW pump low discharge pressure trip would involve a USQ. However, prior staff approval (as required by 50.59) of this particular design change was given by the staff in a letter dated June 8, 1993. This design change is associated with a post TMI-1 commitment made by the licensee to install low suction pressure trips to protect the AFW pumps from a loss of the non-seismic Category I CST (not installed for pump runout protection during a steam line break). In a May 7, 1993, letter, the licensee indicated that in lieu of a low suction pressure trip, a low discharge pressure trip would be installed to alleviate concerns associated with the need for sub-atmospheric trip setpoints. Based on the staff's prior approval, we conclude that the licensee adequately addressed the requirements of 10 CFR 50.59. However, we also conclude that the licensee's evaluation of the design change was inadequate in that it failed to identify the potential failure mode identified by the inspectors in the recent SSOPI. The licensee should have performed an operability determination when the new failure mode was discovered and should have plans to rectify any deficiencies. Additionally, the USAR Chapter 14 reference to a failure in the AFW runout protection system was added to the USAR in a November 1995 revision. However, to our knowledge the runout protection system is not described nor discussed anywhere else in the USAR. The licensee should revise the USAR to be consistent with the Chapter 14 analysis and with the existing plant design.

SUMMARY OF CONCLUSIONS

At the present time, we have not identified any USQs related to these two issues. However, for Issue 1, if the licensee plans to change the design basis for the AFW system (as a long-term fix) by reducing the design AFW flow of the pumps, then prior staff approval is necessary because these design changes would involve a USQ. Regarding Issue 2, the licensee should perform a new evaluation under 50.59 for revisions to the emergency procedures. During

that evaluation, the licensee should determine if a USQ is involved with those revisions. Since prior staff approval was obtained for the modification, and the existing main steam and feedwater line break analyses already rely on operator action to isolate the affected SG and ensure adequate AFW flow to the intact SG, the staff does not anticipate that the changes would involve a USQ. The licensee should also revise all applicable sections of the USAR to be consistent with the actual plant design and the Chapter 14 analyses.

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