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August 5, 1993

U.S. Nuclear Regulatory Commission
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Ladies/Gentlemen:

Docket No. 50-305
Operating License No. DPR-43
Kewaunee Nuclear Power Plant
RESPONSE TO GENERIC LETTER 93-04

Pursuant to the requirements of 10 CFR 50.54 (f), the Nuclear Regulatory Commission (NRC) issued Generic Letter (GL) 93-04," Rod Control System Failure and Withdrawal of Rod Control Cluster Assemblies," dated June 21, 1993. GL 93-04 was addressed to all licensees with Westinghouse Rod Control Systems (except Haddam Neck) for action and to all other licensees for information.

The GL requires that each licensee provide an assessment of whether the licensing basis for their facility is satisfied with regard to a single failure in the Rod Control System (GDC 25 or equivalent). This assessment (Required Response 1.(a)) is to be provided within 45 days from the date of the GL. If the assessment indicates that the licensing basis is not satisfied, then the licensee must describe compensatory short-term actions consistent with the guidelines contained in the GL, and within 90 days, provide a plan and schedule for long-term resolution (Required Response 1.(b)).

Subsequent correspondence between the Westinghouse Owners Group (WOG) and the NRC resulted in schedular relief for Required Response 1.(a). This schedular relief was granted in a letter from Mr. Ashok C. Thadani (NRC) to Mr. Roger Newton (WOG) dated July 26, 1993. This portion of the required actions will now be included with the 90-day response.

Wisconsin Public Service Corporation (WPSC) hereby submits its response to the Generic Letter as it applies to the Kewaunee Nuclear Power Plant. Attachment 1 provides a summary of the

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compensatory actions taken by WPSC in response to the Salem rod control system failure event. Attachment 2 provides a summary of the generic safety analysis program conducted by the Westinghouse Owners Group and its applicability to the Kewaunee Nuclear Power Plant.

This submittal completes the actions required for the 45 day response (as amended by NRC letter dated July 26) for GL 93-04.

Sincerely,

C. R. Steinhardt
Senior Vice President-Nuclear Power

VJC/cjt

Attach.

cc - US NRC Region III
US NRC Senior Resident Inspector
Mr. R. S. Cullen, PSCW

Subscribed and Sworn to
Before Me This 5th Day
of August 1993

Notary Public, State of Wisconsin

My Commission Expires:

May 19, 1996

LIC\NRC\SALEM.WP

ATTACHMENT 1

To

Letter from C. R. Steinhardt (WPSC) to Document Control Desk (NRC)

Dated

August 5, 1993

Compensatory Short Term Actions

For Generic Letter 93-04

RESPONSE TO NRC GL 93-04

Compensatory Actions

The purpose of this discussion is to provide a response to the three areas of compensatory short-term actions identified by the NRC in Generic Letter 93-04 (Required Response I.(b)). In addition, a summary of other actions taken by Wisconsin Public Service Corporation (WPSC) is provided.

1. "additional cautions or modifications to surveillance and preventive maintenance procedures" -

   In a July 2, 1993 Westinghouse Owners Group (WOG) letter, a recommendation was made that licensees review their surveillance procedures to ensure demonstration of rod control system operability and address maintenance trouble-shooting, if required.

   Review of Surveillance Procedures

   WPSC staff has reviewed the surveillance procedures associated with the functioning of the rod control system. A summary of this review is provided below:

   A pre-startup control rod drive mechanism operability test (RXT-15) is performed after each refueling. Performance of this procedure demonstrates the proper operation of the rod control system for outward demanded motion. This surveillance contains appropriate procedural notations to verify individual rod position for the demanded motion. The procedure contains appropriate precautions and direction if abnormalities should be detected.

   The rod position system calibration surveillance (SP 49-025) is performed after each refueling. Performance of this procedure demonstrates the proper operation of the rod control system in both inward and outward motion while calibrating the individual rod position indicators. This surveillance contains appropriate procedural steps to verify correct directional rod motion in both the inward and outward directions. The procedure contains appropriate precautions and direction if abnormalities are observed.

   The control rod drop time surveillance (SP 49-074A) test is performed after each refueling. Performance of this procedure demonstrates the proper operation of the rod control system for outward demanded motion. This surveillance contains appropriate procedural notations to verify individual rod position for the demanded motion. The procedure contains appropriate precautions and direction if abnormalities should be detected.

The control rod exercise surveillance (SP 49-075) is performed every two weeks when containment integrity is required (i.e. > 200 degrees F) in accordance with Kewaunee Technical Specifications (Table TS 4.1-3, item 1). Performance of this surveillance demonstrates the proper functioning of the rod control system for both inward and outward demanded motion. This surveillance contains appropriate procedural steps to verify all rods are stepping simultaneously and the appropriate functioning of the individual rod position indicators. This procedure contains appropriate precautions and direction if abnormalities should be detected.

Based on the above review, WPSC has concluded that additional cautions or modifications to Kewaunee surveillance procedures are not appropriate at this time. WPSC has also concluded that more frequent surveillance testing is not merited.

Review of Operating Procedures

WPSC staff also reviewed the normal operating procedure for the control of startup evolutions. The reactor startup procedure (N-CRD-49B) provides the requirements that govern reactor startup. Use of this procedure verifies proper operation of the rod control system during startup. This procedure contains appropriate procedural steps for monitoring/verification of rod control system operation. Based on this review, WPSC has concluded that additional cautions or modifications to Kewaunee operating procedures are not appropriate at this time.

Conduct of Preventive Maintenance

Periodic comprehensive preventive maintenance activities are performed by Westinghouse. The periodicity of these activities is adjusted based on operating experience.

2. "additional <u>administrative</u> controls for plant startup and power operation" -

WPSC has considered the imposition of additional administrative controls for plant startup (such as dilution to criticality) and power operation. As the NRC staff is aware, neither Westinghouse nor the WOG has endorsed procedural modifications that require deborating to criticality for normal startup operations. Preclusion of an asymmetric rod withdrawal from the subcritical condition is credibly assured with the rod control system in manual and credit for operator action. WPSC has concluded that imposition of additional administrative controls is not warranted.

3. "additional instructions and training to heighten operator awareness of potential rod control system failures and to guide operator response in the event of a rod control system malfunction" -

On June 11, 1993 a night order was issued to the operating shifts. This night order disseminated the NRC Information Notice 93-046 dated June 10, 1993, and the Operating Experience 6017 information for the Salem inadvertent rod withdrawal event.

The night order required operations crews to review the applicable abnormal and emergency rod control procedures. Prior to standing the watch, each licensed operator was required to acknowledge the information provided. In addition, each shift was briefed on the applicability and concerns of the Salem event at the beginning of the shift.

4. Other actions taken by WPSC -

In accordance with recommended action # 2 of Westinghouse Nuclear Safety Advisory Letter (NSAL) 93-007 (dated June 11, 1993), the functionality of the rod deviation alarm was confirmed on the same date by plant technical staff.

In accordance with recommended action # 3 of NSAL 93-007, WPSC has researched Kewaunee maintenance records to respond to the WOG survey regarding logic cabinet failures. The Kewaunee data was provided to Westinghouse on July 9, 1993.

ATTACHMENT 2

To

Letter from C. R. Steinhardt (WPSC) to Document Control Desk (NRC)

Dated

August 5, 1993

Summary of the Generic Safety Analysis Program (Conducted by the Westinghouse Owners Group)

Assessment of Applicability of Generic Safety Analysis Program Results To Kewaunee Nuclear Power Plant

Background

By letter dated July 14, 1993, the Westinghouse Owners Group (WOG) requested schedular relief in responding to the licensing basis assessment requested by Generic Letter 93-04. Partial schedular relief was granted by Mr. Ashok C. Thadani in a letter dated July 26, 1993. Mr. Thadani's letter requested licensees provide a response that included the results of the generic safety analysis program sponsored by the WOG. In addition, licensees were requested to provide a determination of the applicability of the program's results for their facility.

Wisconsin Public Service Corporation (WPSC) hereby submits a "Summary of the Generic Safety Analysis Program" provided by the WOG. WPSC has completed an assessment of the applicability of the results of the WOG generic safety analysis program and results for the Kewaunee Nuclear Power Plant. The "Plant Applicability" and "Evaluation of Results of Generic Analyses to Kewaunee", and "Conclusions" sections presented below incorporate the results of this assessment.

Summary of the Generic Safety Analysis Program

Introduction

As part of the Westinghouse Owners Group (WOG) initiative, the WOG Analysis subcommittee is working on a generic approach to demonstrate that for all Westinghouse plants there is no safety significance for an asymmetric RCCA withdrawal. The purpose of the program is to analyze a series of asymmetric rod withdrawal cases from both subcritical and power conditions to demonstrate that DNB does not occur.

The current Westinghouse analysis methodology for the bank withdrawal at power and from subcritical uses point-kinetics and one-dimensional kinetics transient models, respectively. These models use conservative constant reactivity feedback assumptions which result in an overly conservative prediction of the core response for these events.

A three-dimensional spatial kinetics/systems transient code (LOFT5/SPNOVA) is being used to show that the localized power peaking is not as severe as current codes predict. The 3-D transient analysis approach uses a representative standard 4-Loop Westinghouse plant with conservative reactivity assumptions. Limiting asymmetric rod withdrawal statepoints (i.e., conditions associated with the limiting time in the transient) are established for the representative plant which can be applied to all Westinghouse plants. Differences in plant designs are addressed by using conservative adjustment factors to make a plant-specific DNB assessment.

Description of Asymmetric Rod Withdrawal

The accidental withdrawal of one or more RCCAs from the core is assumed to occur which results in an increase in the core power level and the reactor coolant temperature and pressure. If the reactivity worth of the withdrawn rods is sufficient, the reactor power and/or temperature may increase to the point that the transient is automatically terminated by a reactor trip on a High Nuclear Flux or Over-Temperature Delta-T (OTDT) protection signal. If the reactivity rise is small, the reactor power will reach a peak value and then decrease due to the negative feedback effect caused by the moderator temperature rise.

The accidental withdrawal of a bank or banks of RCCAs in the normal overlap mode is a transient which is specifically considered in plant safety analysis reports. The consequences of a bank withdrawal accident meet Condition II criteria (no DNB). If, however, it is assumed that less than a full group or bank of control rods is withdrawn, and these rods are not symmetrically located around the core, this can cause a "tilt" in the core radial power distribution. The "tilt" could result in a radial power distribution peaking factor which is more severe than is normally considered in the plant safety analysis report, and therefore cause a loss of DNB margin. Due to the imperfect mixing of the fluid exiting the core before it enters the hot legs of the reactor coolant loops, there can be an imbalance in the loop temperatures, and therefore in the measured values of T-avg and delta-T, which are used in the Over-Temperature Delta-T protection system for the core. The radial power "tilt" may also affect the ex-core detector signals used for the High Nuclear Flux trip. The axial offset (AO) in the region of the core where the rods are withdrawn may become more positive than the remainder of the core, which can result in an additional DNB penalty.

Methods

The LOFT5 computer code is used to calculate the plant transient response to an asymmetric rod withdrawal. The LOFT5 code is a combination of an advanced version of the LOFT4 code (Reference 1), which has been used for many years by Westinghouse in the analysis of the RCS behavior to plant transient and accidents, and the advanced nodal code SPNOVA (Reference 2).

LOFT5 uses a full-core model, consisting of 193 fuel assemblies with one node per assembly radially and 20 axial nodes. Several "hot" rods are specified with different input multipliers on the hot rod powers to simulate the effect of plants with different initial $F\Delta H$ values. A "hot" rod represents the fuel rod with the highest $F\Delta H$ in the assembly, and is calculated by SPNOVA with LOFT5. DNBRs are calculated for each hot rod within LOFT5 with a simplified DNB-evaluation model using the WRB-1 correlation. The DNBRs resulting from the LOFT5 calculations are used for comparison purposes.

A more detailed DNBR analysis is done at the limiting transient statepoints from LOFT5 using THINC-IV (Reference 3) and the Revised Thermal Design Procedure (RTDP). RTDP applies to all Westinghouse plants, maximizes DNBR margins, is approved by the NRC, and is licensed for a number of Westinghouse plants. The LOFT5-calculated DNBRs are conservatively low when compared to the THINC-IV results.

Assumptions

The initial power levels chosen for the performance of bank and multiple RCCA withdrawal cases are 100 %, 60 %, 10 %, and hot zero power (HZP). These power levels are the same powers considered in the RCCA Bank Withdrawal at Power and Bank Withdrawal from Subcritical events presented in the plant Safety Analysis Reports. The plant, in accordance with RTDP, is assumed to be operating at nominal conditions for each power level examined. Therefore, uncertainties will not affect the results of the LOFT5 transient analyses. For the at-power cases, all reactor coolant pumps are assumed to be in operation. For the hot zero power case (subcritical event), only 2/4 reactor coolant pumps are assumed to be in operation. A "poor mixing" assumption is used for the reactor vessel inlet and outlet mixing model.

Results

A review of the results presented in Reference 4 indicates that for the asymmetric rod withdrawal cases analyzed with the LOFT5 code, the DNB design basis is met. As demonstrated by the A-Factor approach (described below) for addressing various combinations of asymmetric rod withdrawals, the single most-limiting case is plant-specific and is a function of rod insertion limits, rod control pattern, and core design. The results of the A-Factor approach also demonstrate that the cases analyzed with the LOFT5 computer code are sufficiently conservative for a wide range of plant configurations for various asymmetric rod withdrawals. In addition, when the design $F\Delta H$ is taken into account on the representative plant, the DNBR criterion is met for the at-power cases.

At HZP, a worst-case scenario (three rods withdrawn from three different banks which is not possible) shows a non-limiting DNBR. This result is applicable to all other Westinghouse plants.

Assessment of Applicability of Generic Safety Analysis Program Results to Kewaunee Nuclear Power Plant

Plant Applicability

WPSC has assessed the applicability of the assumptions and information presented in WCAP 13803 "Generic Assessment of Asymmetric Rod Cluster Control Assembly Withdrawal" to Kewaunee. WPSC has determined that the reactivity assumptions used in the transient analysis are bounding with respect to Kewaunee core design, and therefore, the 3-D transient results (i.e., the identified limiting asymmetric rod withdrawal statepoints provided in WCAP 13803) are valid for Kewaunee.

It is important to note that the plant specific DNB evaluations performed under the generic safety analyses assumed Westinghouse OFA type fuel. Kewaunee currently uses fuel supplied by Siemens Power Corporation. Although the Westinghouse and Siemens fuel assemblies are similar, it is appropriate for WPSC to calculate Kewaunee specific DNBRs.

WPSC is confident that the DNB design basis for Kewaunee continues to be met based on the acceptable generic WCAP 13803 DNBR results which include the inherent conservatisms discussed below. WPSC anticipates the Kewaunee specific calculations will demonstrate a larger DNBR margin than that calculated by the generic WOG program.

WPSC hereby commits to perform Kewaunee specific DNBR calculations using approved methods and the specific characteristics of Siemens fuel. These calculations will be completed and the conclusions submitted for NRC review within 45 days from the date of this letter.

Evaluation of Results of Generic Analyses to Kewaunee

WPSC has examined the limiting statepoint cases in WCAP 13803 and the Kewaunee specific DNBR results provided by the WOG for those statepoints. All of the limiting statepoint cases meet the DNB design basis for Kewaunee.

As noted above, the Kewaunee plant uses Siemens fuel, whereas the plant specific DNBR margin results provided by the WOG assumed Westinghouse fuel. As stated previously, the Siemens fuel design is similar to Westinghouse fuel, and WPSC does not anticipate a significant shift in results due to fuel characteristics. Other aspects of the generic analyses result in conservative results for Kewaunee as follows:

* Credit was not taken for Kewaunee's less positive moderator temperature coefficient

* Penalty was taken for rod bow effects (although rod bow penalties do not apply to Siemens fuel)

* The assumed RCS design flow used in the calculation is less than Technical Specification minimum required RCS flow

* The assumed core inlet temperature is higher than actual operating inlet temperature

Conclusions

WPSC has determined that additional plant specific DNBR evaluation is warranted for the Kewaunee Nuclear Power Plant. A commitment has been made to complete and report the results of this analysis within 45 days. Until this analysis is complete, WPSC is confident that the Kewaunee DNBR results provided by the WOG are conservative and provide acceptable

Refereuces

1) Burnett, T.W.T., et al., "LOFTRAN Code Description," WCAP-7907-A, April 1984.

2) Chao, Y.A., et al., "SPNOVA - A Multi-Dimensional Static and Transient Computer Program for PWR Core Analysis," WCAP-12394, September 1989.

3) Friedland, A.J. and S. Ray, "Improved THINC IV Modeling for PWR Core Design," WCAP-12330-P, August 1989.

4) Huegel, Dl, et al., "Generic Assessınent of Asymınetric Rod Cluster Control Assenıbly Withdrawal," WCAP-13803, August 1993.