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STEINHARDT,C.R.	Wisconsin Public Service Corp.
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SUBJECT: Forwards summary of generic safety analysis program conducted by WOG,incorporating words inadvertently from page 4 of Attachment 2 of util 930805 response to GL 93-04, "Rod Control Sys Failure & Withdral of Rod Control Clusster...."

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August 10, 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

On August 5, 1993, Wisconsin Public Service Corporation (WPSC) submitted to the Nuclear Regulatory Commission (NRC) its response to Generic Letter 93-04, "Rod Control System Failure and Withdrawal of Rod Control Cluster Assemblies". This submittal completed the actions required for the 45 day response (as amended by NRC letter dated July 26) for GL 93-04. However, in subsequent review of this response, it was noted that on Attachment 2, Page 4, several words were inadvertently omitted from the last sentence.

The attachment to this letter contains Attachment 2, in its entirety. WPSC apologizes for any inconvenience this may have caused.

160029

A030
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Sincerely,

C. A. Schrock for

C. R. Steinhardt
Senior Vice President-Nuclear Power

BJD/cjt

Attach.

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

Subscribed and Sworn to
Before Me This 10th Day
of August 1993

Jeanne M. Stein
Notary Public, State of Wisconsin

My Commission Expires:
June 18, 1995

NRC\LIC\SALEM1.WP

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.

<u>Assessment of Applicability of Generic Safety Analysis Program Results to Kewaunee Nuclear Power Plant</u>

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 assurance that DNBR limits are met.

References

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 Assessment of Asymmetric Rod Cluster Control Assembly Withdrawal," WCAP-13803, August 1993.