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SUBJECT: Responds to addl concerns associated w/proposed amend 126 to plant TS,revising TS 3.1.f, "Min Conditions of Criticality," to specify that MTC shall be no greater than 5.0 pcm/f at or below 60% rated thermal power.

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December 22, 1994

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555

Ladies/Gentlemen:

Docket 50-305
Operating License DPR-43
Kewaunee Nuclear Power Plant
Response to Additional Concerns Associated with Proposed Amendment 126 to Kewaunee's Technical Specifications

Reference 1) Proposed Amendment 126 to the Kewaunee Nuclear Power Plant Technical Specifications, from C. R. Steinhardt (WPSC) to Document Control Desk (NRC), dated April 11, 1994.

2) Additional Commitment Required for Expedited Approval of Proposed Amendment 126 to Kewaunee's Technical Specifications, from C.A. Schrock (WPSC) to Document Control Desk (NRC), dated November 30, 1994.

On April 11, 1994, Wisconsin Public Service Corporation submitted proposed amendment (PA) 126 to the Kewaunee Nuclear Power Plant (KNPP) Technical Specifications (TSs)(reference 1). This PA was submitted to revise TS 3.1.f, "Minimum Conditions of Criticality", to specify that the moderator temperature coefficient (MTC) shall be no greater than 5.0 pcm/°F at or below 60% rated thermal power. This PA also incorporated required actions to be implemented if the MTC specification is not met. WPSC also submitted an additional commitment that supplemented PA 126 (Reference 2). That letter addressed potential concerns associated with an Anticipated Transient Without Scram (ATWS) event. In that letter, WPSC committed to using NRC approved methods to design each cycle's core

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at the KNPP to have a MTC no less negative than −8 pcm/°F for 95% of the scheduled time at full power.

On December 15, 1994, during a telephone conversation with Mr. Rich Laufer and Mr. Howard Richings (NRC), WPSC was asked to provide additional information associated with the following three items:

1) Why is Kewaunee requesting an allowed MTC of +5.0 pcm/°F?

2) Explain the uncertainties associated with the MTC calculations.

3) Where does the basis for the TS allowing a MTC of +5.0 pcm/°F explain the ATWS related limit of −8.0 pcm/°F?

Attachments 1 provides the explanation of why Kewaunee has requested approval of a TS that allows reduced power operation with a MTC of +5 pcm/°F, even though the KNPP's core design can not fully use that allowance at this time. Attachment 2 explains the uncertainties associated with the MTC calculations used for KNPP's core design procedures. Attachment 3 is the TS Basis pages for TS 3.1.f, "Minimum Conditions for Criticality", which have been revised to include an explanation of the ATWS related design limit. These TS Basis pages (TS B3.1-10 through TS B3.1-12) replace their respective pages submitted as part of PA 126.

It is WPSC's understanding that this information provides the Staff with the information necessary to complete the review and approval process for PA 126. If you have any further questions, please contact me or a member of my staff.

Sincerely,

C. A. Schrock

C. A. Schrock
Manager - Nuclear Engineering

RTS/san

Attach.

cc - US NRC Region III
US NRC Senior Resident Inspector

ATTACHMENT 1

Letter from C.A. Schrock (WPSC)

To

Document Control Desk

Dated

December 22, 1994

EXPLANATION OF WHY KEWAUNEE IS REQUESTING A MODERATOR TEMPERATURE COEFFICIENT OF +5.0 pcm/ °F.

Proposed amendment (PA) 126 to the Kewaunee Nuclear Power Plant (KNPP) Technical Specifications (TSs) was submitted on April 11, 1994. PA 126 includes a moderator temperature coefficient (MTC) upper limit of +5.0 pcm/°F for power levels up to 60% power. This MTC limit was selected based on the results of a reanalysis of the relevant events analyzed in the Updated Safety Analysis Report. Engineering judgement was initially used in estimating that a MTC of +5.0 pcm/°F could be analyzed for safe operation at power levels up to 60% power. Subsequent analysis has confirmed that safe operation would exist with a MTC of +5.0 pcm/°F up to 60% power.

Wisconsin Public Service Corporation fully recognizes KNPP's MTC design limit for an Anticipated Transient Without Scram (ATWS) event is currently the bounding MTC limit. This limitation for the KNPP core design ensures that the MTC will be -8.0 pcm/°F over 95% of the time at hot full power (HFP). This design limit has been incorporated into the Basis for TS 3.1.f, "Minimum Conditions for Criticality". As a result of this ATWS related limit, the KNPP currently can not take full advantage of allowing a MTC of +5.0 pcm/°F up to 60% power.

However, should the HFP MTC ATWS design limit be revised in the future, Kewaunee will be in position to better implement the results of the revision.

ATTACHMENT 2

Letter from C.A. Schrock (WPSC)

To

Document Control Desk

Dated

December 22, 1994

MODERATOR TEMPERATURE COEFFICIENT CALCULATIONAL UNCERTAINTIES

Wisconsin Public Serviee Corporation (WPSC) determines Kewaunee's raw calculated moderator temperature coefficient (MTC) value for the beginning of cycle (BOC), hot zero power (HZP) conditions. This raw calculated MTC is adjusted in accordance with the NRC approved methods documented in the following two reports: 1)"NRC Safety Evaluation Report for Qualification of Reactor Physics Methods for Application to Kewaunee", dated October 22, 1979, and 2) "NRC Safety Evaluation Report for the Reload Safety Evaluation Methods for Application to Kewaunee", dated April 11, 1988.

A bias is added to the raw calculated MTC value. The bias is the average difference between the raw calculated MTC value and the actual measured MTC value. The bias changes from cycle to cycle as more data is obtained. The current bias is +3.1 pcm/°F based on data from the Kewaunee Nuclear Power Plant (KNPP) Cycles 13 through 20. The bias is used to translate the raw calculated MTC into a biased calculated MTC. The biased calculated MTC is the best estimate value expected at the KNPP when the mcasurement is actually taken.

In addition, a reliability factor is applied to the biased calculated MTC to account for the statistical scatter that is observed between measured values and predicted results. The reliability factor establishes an interval having a 95% probability at the 95% confidenee level that the measured MTC will be bounded by the value of the biased calculated MTC plus or minus the reliability factor. The current value of the reliability factor is 2.7 pcm/°F based on data from KNPP Cycles 13 through 20.

For example, the Cycle 21 raw calculated MTC at BOC, HZP is -4.1 pcm/°F. Adding the bias of +3.1 pcm/°F makes the biased calculated MTC equal to -1.0 pcm/°F. Therefore, Kewaunee's best estimate is that the Cycle 21 BOC HZP MTC will be measured to be −1.0 pcm/°F.

Due to statistical scatter, the reliability factor establishes that the Cycle 21 BOC HZP measured MTC will fall in the interval of -1.0 ± 2.7 pcm/°F. Therefore it is 95% probable at the 95% confidence level that the Cycle 21 measured BOC HZP MTC will fall between −3.7 pcm/°F and +1.7 pcm/°F.

ATTACHMENT 3

Letter from C.A. Schrock (WPSC)

To

Document Control Desk

Dated

December 22, 1994

Maximum Reactor Coolant Oxygen, Chloride and Fluoride Concentration (TS 3.1.e)

By maintaining the oxygen, chloride and fluoride concentrations in the reactor coolant below the limits as specified in TS 3.1.e.1 and TS 3.1.e.4, the integrity of the Reactor Coolant System is assured under all operating conditions.[15]

If these limits are exceeded, measures can be taken to correct the condition, e.g., replacement of ion exchange resin or adjustment of the hydrogen concentration in the volume control tank[16]. Because of the time-dependent nature of any adverse effects arising from oxygen, chloride, and fluoride concentration in excess of the limits, it is unnecessary to shut down immediately since the condition can be corrected. Thus, the time periods for corrective action to restore concentrations within the limits have been established. If the corrective action has not been effective at the end of the time period, reactor cooldown will be initiated and corrective action will continue.

The effects of contaminants in the reactor coolant are temperature dependent. The reactor may be restarted and operation resumed if the maximum concentration of any of the contaminants did not exceed the permitted transient values; otherwise a safety review by the Plant Operations Review Committee is required before startup.

Minimum Conditions for Criticality (TS 3.1.f)

During the early part of the fuel cycle, the moderator temperature coefficient may be calculated to be positive at ≤ 60% RATED POWER. The moderator coefficient will be most positive at the beginning of life of the fuel cycle, when the boron concentration in the coolant is greatest. Later in the fuel cycle, the boron concentrations in the coolant will be lower and the moderator coefficients either will be less positive or will be negative.[17][18]

The requirement that the reactor is not to be made critical except as specified in TS 3.1.f.1 provides increased assurance that the proper relationship between reactor coolant pressure and temperature will be maintained during system heatup and pressurization whenever the reactor vessel is in the nil-ductility temperature range. Heatup to this temperature will be accomplished by operating the reactor coolant pumps and by the pressurizer heaters.

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[15] USAR Section 4.2

[16] USAR Section 9.2

[17] USAR Table 3.2-1

[18] USAR Figure 3.2-8

The shutdown margin specified in TS 3.10 precludes the possibility of accidental criticality as a result of an increase in moderator temperature or a decrease in coolant pressure.[19]

The requirement that the pressurizer is partly voided when the reactor is < 1% subcritical assures that the Reactor Coolant System will not be solid when criticality is achieved.

The requirement that the reactor is not to be made critical when the moderator coefficient is > 5.0 pcm/°F has been imposed to prevent any unexpected power excursion during normal operation, as a result of either an increase in moderator temperature or a decrease in coolant pressure. The moderator temperature coefficient limits are required to maintain plant operation within the assumptions contained in the USAR analyses. Having an initial moderator temperature coefficient no greater than 5.0 pcm/°F provides reasonable assurance that the moderator temperature coefficient will be negative at 60% rated thermal power. The moderator temperature coefficient requirement is waived during low power physics tests to permit measurement of reactor moderator coefficient and other physics design parameters of interest. During physics tests, special operating precautions will be taken. In addition, the strong negative Doppler coefficient[20] and the small integrated $\Delta k/k$ would limit the magnitude of a power excursion resulting from a reduction in moderator density.

Suitable physics measurements of moderator coefficients of reactivity will be made as part of the startup testing program to verify analytical predictions.

Analysis has shown that maintaining the moderator temperature coefficient at criticality ≤ 5.0 pcm/°F will ensure that a negative coefficient will exist at 60% power. Current safety analysis supports operating up to 60% power with a moderator temperature coefficient ≤ 5.0 pcm/°F. At power levels greater than 60%, a negative moderator temperature coefficient must exist.

In addition to the TS limit, there is the anticipated transient without scram (ATWS) commitment[21] that the calculated hot full power (HFP) moderator temperature coefficient be more negative than -8.0 pcm/°F over 95% of a cycle's time at HFP.

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[19] USAR Table 3.2-1

[20] USAR Figure 3.2-9

[21] C.A. Schrock (WPSC) to Document Control Desk (NRC), dated November 30, 1994.

NRC approved methods will be used to determine the lowest expected HFP moderator temperature coefficient for the 5% of HFP cycle time with the highest boron concentration. If this HFP moderator temperature coefficient is more negative than -8.0 pcm/°F, then the ATWS design limit will be met for 95% of the cycle's time at HFP. If this HFP moderator temperature coefficient design limit is still not met after excluding the 5% of the cycle burnup with the highest boron concentration, then the core loading must be revised.

The results of this design limit consideration will be reported in the Reload Safety Evaluation Report.

In the event that the limits of TS 3.1.f.3 are not met, administrative rod withdrawal limits shall be developed to prevent further increases in temperature with a moderator temperature coefficient that is outside analyzed conditions. By imposing limits on the temperature and the moderator temperature coefficient, the probability of an uncontrolled power excursion remains low.

Due to the control rod insertion limits of TS 3.10.d and potentially developed control rod withdrawal limits, it is possible to have a band for control rod location at a given power level. The withdrawal limits are not required if TS 3.1.f.3 is satisfied or if the reactor is subcritical.

If after 24 hours, withdrawal limits sufficient to restore the moderator temperature coefficient to within the limits of TS 3.1.f.3 are not developed, the plant shall be taken to HOT STANDBY until the moderator temperature coefficient is within the limits of TS 3.1.f. The reactor is allowed to return to criticality whenever TS 3.1.f is satisfied.