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October 15, 1982

Mr. H. R. Denton, Director
Office of Nuclear Reactor Regulation
U. S. NUCLEAR REGULATORY COMMISSION
Washington, D. C. 20555

Attention: Mr. R. A. Clark, Chief
Operating Reactors, Branch 3

Gentlemen:

DOCKET NOS. 50-266
ADDITIONAL INFORMATION
TECHNICAL SPECIFICATION CHANGE REQUEST NO. 85
POINT BEACH NUCLEAR PLANT, UNIT 1

As you are aware, we have submitted the subject Technical Specification change request to cover operation of Point Beach Unit 1 in the event that additional steam generator tube plugging causes primary system flow to drop below the thermal design flow (TDF) value of 178,000 gpm. Although the analyses submitted cover operation at up to 91% power, it is planned that, during Cycle 11, Unit 1 will continue to be operated at less than 80% power. This is because with the lower inlet temperature of 557°F, which we have imposed to minimize further tube corrosion, it isn't possible to achieve more than 80% power. The Technical Specification change requested would no longer be applicable following steam generator replacement.

During a telephone conference call on October 5, 1982, Mr. Colburn and other members of your staff requested additional information concerning our license amendment application for reduced thermal design flow operation of Point Beach Nuclear Plant as requested in our letter dated September 17, 1982. The specific inquiries and our responses are contained in the attached attachments to this letter. Should you have any additional questions regarding either the license amendment application or the attached information, please let us know.

Very truly yours,

Assistant Vice President

C. W. Fay

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Attachments

Copy to NRC Resident Inspector

Question from NRC Justify using the same set of core DNB limits in terms of allowable Tin vs. % of full power for both the case where (a) full power = 1381.8 MWt and flow = 169,100 gpm and for the case (b) full power = 1518.5 and flow = 178,000 pgm.

Response When core limits are mapped into Tin vs % full power space the absolute value of the power corresponding to any particular point on the core limit curve depends on the value of full power that is used. Therefore, the same point on the core limit curves for reference case (a) will have a 9% lower value of power than it will for case (b). Thus having the same set of core limit curves for references cases (a) and (b) implies that for the same allowable inlet temperature there is a 9% power penalty for case (a) in order to offset the 5% flow reduction.

There are three basic limits which are factored into the core limit curves. There are:

(1) Vessel Exit Boiling Limits.
(2) Hot Channels Exit Quality LImits.
(3) Core DNB limits.

Each of these limits will be discussed with respect to cases (a) and (b) in question.

(1) Vessel Exit Boiling Limits - These set limits on allowable values of Tin in order to prevent saturation at the vessel exit. When flow is reduced by 5%, a corresponding power reduction of 5% is required from an enthalpy balance standpoint in order to maintain allowable Tin at the same value as before. In this case, we are reducing power by 9%. Therefore, it is conservative to use the same vessel exit boiling curves that are applicable for case (b) for the case (a) situation.

(2) Hot Channel Exit Quality Limits - These set limits on allowable values of Tin in order to prevent hot channel exit qualities from exceeding 15%, which is the quality limit for the W-3 L grid correlation. Since there is no change in core radial power distribution it can be argued from an enthalpy balance standpoint that if the flow is reduced by 5% power, a power reduction of 5% is required to maintain allowable Tin at the same value as before. In this case we are reducing power by 9%. Therefore it is conservative to use the same hot channel exit quality limit curves that are applicable for case (b) for the case (a) situation.

(3) Core DNB Limits - These set limits on allowable values of Tin based on the min DNBR (as predicted by the W-3 correlation) not going below 1.30. Since a 1% flow reduction corresponds to a 1% DNBR reduction, 1% DNBR reduction can be offset by reducing the power by approximately 0.5%. It can be seen that if the flow is reduced by 5%, a 2.5% reduction in power is required to maintain the allowable Tin at the same value as before.

In this case we are reducing power by 9%. Therefore it is definitely conservative to use the same core DNB limit curves that are applicable for case (b) for the case (a) situation.

While the above arguments are conclusive enough, check runs were made with the THINC 1 computer code to justify that the core limit curves generated for case (b) were conservatively applicable for case (a).

Questions: Describe the method used to generate T avg versus power.

Response: The core limits (Tin vs. Power) are simply converted into T_{avg} vs. Power for the new nominal conditions, defining the fraction of power level for any given Tin as a fraction of 1381.8 MWt rather than 1518.5 MWt. The constant volumetric flow rate used to calculate a mass flow rate for each Tin was 95% of thermal design flow (TDF) again rather than 100% of TDF. For each point on the thermal core limit lines, the inlet enthalpy is known, and the vessel average enthalpy rise (and thus the exit enthalpy) is calculated. From the exit enthalpy, Tout is known.

T_{avg} = (Tout + Tin) ÷ 2, corresponding to the power level defining Tin.

For hot leg boiling, Tout = Tsat and again:
(Tout + Tin) ÷ 2 = T_{avg}

Question: Provide justification for not performing a new LOCA calculation of the peak clad temperature (PCT) under the conditions of 95% thermal design flow (TDF), 91% power and 24% steam generator tube plugging (SGTP), in support of the hand calculated PCT value of 2128°F at an F_Q of 2.52.

Response: The following provides a discussion of the calculations performed, the results of which were reported in the Request for Technical Specification Change No. 85.

Table 1 gives parameters of interest for three computer runs performed for Point Beach (WEP) under various conditions. These runs were made as a part of a series of sensitivity studies that were made in November 1979, specifically for Point Beach #1 (WEP).

Comparing Case 1 with Case 3, it was noted that there was an 84.8°F rise in PCT for a six percent increase in steam generator tube plugging level. This translates to a sensitivity of 14.1° PCT rise for each 1% SGTP.

Comparing Case 1 and Case 2, note that a 17% drop in power results in a 413.5°F drop in PCT, which yields a sensitivity of 24.3°F drop in PCT for each 1% drop in power level.

There were no WEP specific sensitivities to reduction in thermal design flow available, but some generic 2-loop sensitivities had been performed by Westinghouse. This study showed that a 4°F drop in T_{in} resulted in a 6°F drop in PCT - a relatively minor effect. Since a drop in thermal design flow is roughly comparable to a drop in T_{in}, it is expected to have a small effect and will not be quantified.

The current analysis on file for WEP was performed at 100% power, 100% TDF and 18% SGTP and resulted in a PCT of 2062°F at an F_Q of 2.32. Using the sensitivities just described, the following calculations were performed to estimate results with the proposed conditions:

1. Increase of SGTP from 18% to 24%, a 6% increase. Using the sensitivity of +14.1°F for each + 1% SGTP, we expect a rise of 84.6°F in PCT with this change.

2. Reduction in power, from 100% to 91%, a 9% reduction. Using the sensitivity of 24.3°F drop in PCT for each 1% drop in power, we expect a 218.7°F reduction in PCT with this change.

3. Reduction in thermal design flow, from 100% to 95%. Again, this is not quantifiable, but is considered to be a minor effect.

Using these sensitivities, the estimated PCT under the new conditions for WEP would be 1928.1°F. This leaves margin to the 2200°F PCT Limit which can be used to support a higher F_Q of 2.52 required for fuel considerations. Using a sensitivity of +0.01 in F_Q for each + 10°F in PCT we see that a 0.2 rise in F_Q would raise the PCT 200°F. Thus, the final estimated results for 91% power, 95% TDF and 24% SGTP are a PCT of 2128°F and F_Q of 2.52. The Point Beach Nuclear Plant utilizes upper plenum injection. A 60°F increase in temperature should be added to this calculated peak clad temperature to account for explicit modelling of upper plenum injection. This still leaves an acceptible margin to the applicable 10 CFR Part 50 Appendix K limits.

TABLE 1

PARAMETER	CASE 1	CASE 2	CASE 3
Power Level (%)	100	83	100
TDF (GPM/loop)	89,000	89,000	89,000
% SGTP	18	18	12
RCS Pressure (psia)	2,000	2,000	2,000
T_{cold} (°F)	510	510	510
FQ	2.32	2.32	2.32
PCT (°F)	2,179.6	1,766.11	2,094.8
PCT Elevation (ft.)	6.0	7.5	6.0