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SUBJECT: Responds to IE Bulletin 80-04 re analysis of PWR main steam line break w/continued feedwater addition.Analysis demonstrates that containment pressure will not exceed design pressure for main steam line break.

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May 7, 1980

Mr. J. G. Keppler, Regional Director
Office of Inspection and Enforcement
Region III
U. S. Nuclear Regulatory Commission
799 Roosevelt Road
Glen Ellyn, IL 60137

Dear Mr. Keppler:

Docket 50-305
Operating License DPR-43
Kewaunee Nuclear Plant
IE Bulletin 80-04: Analysis of a PWR Main Steam Line Break with Continued Feedwater Addition

The following information is presented in response to the above referenced bulletin.

Item 1

The containment pressure response for a main steam line break is discussed on pages 14.2-35 through 14.2-35b of the Kewaunee FSAR. In summary, the containment pressure calculation was performed for three cases with varying degrees of conservatism:

1. The nominal no-load inventory of one steam generator was entirely vaporized and discharged to the containment;

2. A ten second blowdown of both steam generators followed by the entire blowdown of one steam generator assuming all fluid is discharged as dry steam;

3. Same as case (2), except that credit was taken for liquid entrainment from the steam generator.

In all three cases, the design pressure of the containment was not exceeded. These analyses did not include the effects of continued feedwater or auxiliary feedwater flow to the affected steam generator.

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In order to determine the capability of the containment to withstand a main steam line break assuming continued auxiliary feedwater flow, we performed a steam line break analysis using the computer code DYNODE/P, with the following assumptions:

- Initially, the reactor is conservatively assumed to be at hot zero power to maximize the inventory and energy content of the steam generators.

- Conservative end of life shutdown margin and moderator temperature coefficient are assumed.

- Only one train of safety injection is assumed available to minimize the flow of high concentration boric acid to the RCS.

- Main steam line isolation valve closure is assumed to occur at ten seconds, allowing blowdown of 2 steam generators for the first ten seconds. (In reality, the check valve will prevent this flow and the stop valve will close in less than five seconds.)

- All three auxiliary feedwater pumps are assumed to be operating from the start of the break and continue to operate for 10 minutes, and main feedwater is assumed to be isolated.

The last assumption is conservative because during normal operation at hot zero power the main feedwater is not in use; furthermore, a safety injection signal at Kewaunee will isolate the main feedwater by closing all feedwater control valves, the feedwater pump discharge valves, and the main feedwater isolation valves, and by tripping the main feedwater pumps. Also, the normal hot-shutdown condition does not normally require three auxiliary feedwater pumps, since the equivalent full flow of one pump is usually sufficient to remove the heat from the RCS. Three pumps are assumed, however, because the turbine driven auxiliary feedwater pump will start on a loss of offsite power.

The DYNODE/P code was utilized to determine the energy deposited into the containment from the steam line break. All fluid is assumed to exit the steam generator as dry steam. In consideration of the numerous conservatisms assumed in this calculation, the energy release results calculated by the DYNODE/P code were multiplied by 0.85. This is consistent with the FSAR methodology.

Integrated energy was then compared to the capability of the containment to remove energy without exceeding design pressure (figures 14.3-31 and 14.3-32 of the Kewaunee FSAR). This comparison is shown graphically on the figure included with this response. Since the energy deposited from the steam line break is always less than the containment capability, we conclude that the containment design pressure will not be exceeded for a main steam line break at the Kewaunee Plant with continued maximum available auxiliary feedwater flow to the affected steam generator.

This conclusion is supported by analyses of other high energy breaks. For example, Table 14.6-5 of the FSAR shows the blowdown enthalpies of various loss of coolant accidents. These energies range from 160.51 million BTU's to to 170.52 million BTU's deposited into the containment in times ranging from 12.1 to 7.5 seconds. The peak blowdown pressure reached in containment in these cases is 39.7 psig, which is 6.3 psi less than the design pressure of 46 psig. For comparison, the results for the main steam line break analysis indicate the blowdown energy for the first 10 seconds is only 90.9 million BTU's. After 180 seconds, the heat removal capability of two fan coil units and one containment spray pump exceeds the rate of energy addition to the containment from the steam generator. The integrated energy deposited in the containment at 180 seconds is calculated to be 210.2 million BTU's which is less than the amount which would be deposited into containment at that time from a large area rupture of the reactor coolant system (220 million BTU's). The entire energy deposited into containment after 10 minutes is predicted to be 229.6 million BTU's for a main steam line break compared to 260 million BTU's for a large LOCA. The margin to design pressure at 180 seconds is approximately 30 million BTU's and at ten minutes it is approximately 70 million BTU's.

The operators will be able to identify the affected steam generator within ten minutes by observing the steam generator pressures and levels. Analysis indicates that the affected steam generator will exhibit a very rapid decrease in pressure and level as compared to the unaffected steam generator. Early recognition of the affected steam generator will enable the operator to perform the actions necessary to isolate the steam generator to limit the pressure increase well below the Containment design value.

Our review of the auxiliary feedwater system operating characteristics indicates that there will be adequate NPSH for the auxiliary feedwater pumps for a main steam line break. It is likely that the pumps will become motor-limited during steam line break events. In that event the automatic protection system for the pump would actuate, tripping the pump and alerting the operator via control room annunciation. Since heat removal is not critical for a steam line break, the operator would have time to take corrective action by securing auxiliary feedwater flow to the affected steam generator. The steam driven pump would not trip but would obtain a balance between power required and power developed by the turbine and would deliver water at that balancing flowrate.

Item 2

We have reviewed the FSAR analysis which was performed to determine the core response to a main steam line break. That analysis is described on pages 14.2-27 through 14.2-34 of the FSAR. In addition to the assumptions explained on those pages, the following was also assumed:

1. The reactor is assumed initially to be at hot shutdown conditions, at the minimum allowable shutdown margin.

2. Full main feedwater is assumed from the beginning of the transient at a very conservative cold temperature.

3. All auxiliary feedwater pumps are initially assumed to be operating, in addition to the main feedwater. The flow is equivalent to the rated flow of all pumps at the steam generator design pressure.

4. Feedwater is assumed to continue at its initial flow rate until feedwater isolation is complete, approximately 10 seconds after the break occurs, while auxiliary feedwater is assumed to continue at its initial flow rate.

5. Main feedwater flow is completely terminated following feedwater isolation.

It should be noted that these assumptions are conservative, but also inconsistent - i.e., assuming all auxiliary feedwater and main feedwater pumps are delivering flow while at a hot shutdown condition.

We have concluded that the original steam line break analysis for the Kewaunee Plant presented in the FSAR adequately considered the effects of continued feedwater to the steam generators, and conservatively predicts the core response. This conclusion is supported by comparison to the results of the DYNODE/P analysis which was described in Section 3.14 of our report, Reload Safety Evaluation Methods for Application to Kewaunee, submitted by letter from Mr. E. W. James (WPS) to Mr. A. Schwencer (NRC), February 14, 1979. That analysis demonstrates agreement with the FSAR results for a main steam line break indicating the adequacy of the current FSAR analysis.

Item 3

The above analysis demonstrates that at Kewaunee the containment pressure will not exceed design pressure for a main steam line break with continued auxiliary feedwater flow and the reactor-return-to-power is conservatively calculated in the FSAR main steam line break analysis; therefore, no further action in this regard is necessary.

Very truly yours,

E.R. Mathews

E. R. Mathews, Vice President
Power Supply & Engineering

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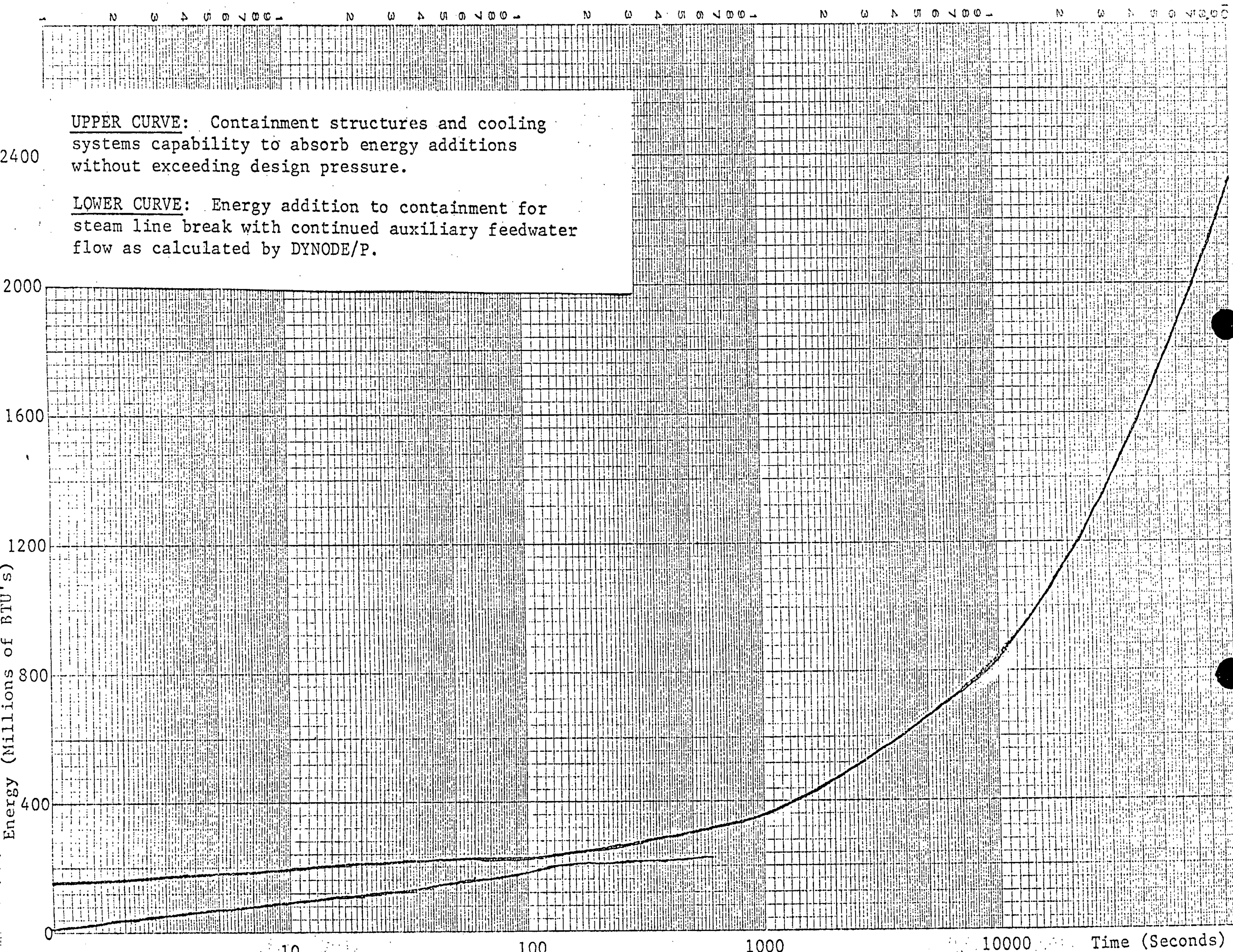

CONTAINMENT CAPABILITY STUDY