NRC-82-163

WISCONSIN PUBLIC SERVICE CORPORATION

P.O. Box 1200, Green Bay, Wisconsin 54305

September 17, 1982

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

References (1) July 15, 1982 letter from S. A. Varga to C. W. Giesler requesting additional information on IE Bulletin 80-04.

(2) May 7, 1980 letter from E. R. Mathews to J. G. Keppler providing response to IE Bulletin 80-04.

In response to your questions of July 15, 1982, (REF. 1) we submit the following information.

ITEM 1

REQUEST 1. Provide the estimated runout AFW flow to the affected steam generator. This should be determined from the manufacturer's pump curves at zero backpressure, unless the system contains reliable anti-runout provisions or an actual backpressure value during the MSLB has been conservatively calculated.

The estimated runout AFW flow to the affected steam generator peaks at 610 gpm, 160 seconds into the accident. The flow was determined from iterations of the DYNODE/P computer code. The Dynode code calculated the S/G pressure and break flow, which was subsequently used to calculate the integrated energy addition to containment.

The AFW flow rate provided for the DYNODE calculations were determined from the combined maximum AFW pump flow and later split according to pressure differences in the two piping trains and steam generators. The maximum AFW pump flow was determined from the pump manufacturer's pump curves at the point of minimum head - maximum capacity.

REQUEST 2. Provide an evaluation of the potential for exceeding containment design pressure using the runout feedwater flow rate determined in Item 1, Request 1. Justify any assumptions made for this evaluation.

We have concluded from our analysis that containment design pressure will not be exceeded, using the runout AFW flow rate determined for request 1 above. Referring to the attached graph, it is evident that energy removal from containment is always greater than energy addition to containment.

There are a number of conservatisms in our analysis which provide an additional margin of safety. These conservatisms include the following:

- Initially, the reactor is assumed to be at Hot Zero Power to maximize the steam generator inventory and energy content.

- Only one train of SI is assumed available, to minimize flow of boric acid to the RCS.

- The main steam line isolation valve is assumed to close in 10 seconds. This allows both steam generators to blowdown for the first 10 seconds. (Refer to figure 10.2-1 of the updated FSAR. The check valve should actually prevent this from happening and the stop valve should close in less than five seconds. However, no credit has been taken for this.)

- All fluid exiting the SG is assumed to be dry steam. Consistent with the FSAR methodology the energy release results calculated by the DYNODE/P code were multiplied by 0.85 (Reference FSAR section 14.2 - 35a).

- All three AFW pumps operate from the start of the break (at runout flow) and continue for 10 minutes: Main feedwater is isolated.

This last conservatism is particularly noteworthy since the third AFW pump (turbine driven) will not be started unless there is a loss of offsite power, or both steam generators have reached the Lo-Lo level setpoint. However, we have assumed all three AFW pumps are operating at the start of the accident.

REQUEST 3. Your submittal of May 7, 1980, takes credit for operator action to identify the affected steam generator and isolate AFW flow to that steam generator within 10 minutes after the start of the accident. Provide the tasks to be taken by the operator to identify the affected generator and isolate the AFW flow and the jusitification for your assumption of 10 minutes for these actions.

As stated in our May 7, 1980 response, and reiterated here, the assumption of operator action at 10 minutes is justified. The operator action is the identification of the affected steam generator and isolation of AFW flow to it. The operator will be alerted to the affected steam generator through a number of redundant signals such as, but not limited to, the following:

a) Feed flow - steam flow mismatch
b) Feed flow mismatch between the two SG's.
c) Rapid steam generator pressure decrease in the affected generator
d) Increase in steam flow downstream of orifice
e) RCS temperatures decrease
f) Decreasing Pressurizer level and pressure
g) Increasing (or high) containment humidity

Given the number of redundant alarms and indications, the operator will be able to immediately determine the affected steam generator. We have assumed a 10 minute time limit for the sake of analysis only and are convinced the operator will actually implement corrective actions for the affected S/G much sooner. The operator is required by our Emergency Operating Procedures to perform specific actions subsequent to identifying the affected generator. In the case of a MSLB, the operator must close a motor operated gate valve in a common cross connection line and trip the respective AFW pump. Both of these actions can be implemented remotely from the control room. Hence, the 10 minute assumption is conservative and can be adequately met by the operators.

REQUEST 4. Because in your analysis you are relying on operator action within 10 minutes to mitigate the consequences of this accident, provide the time to exceed the containment design pressure, the time to reach peak pressure, and the magnitude of peak pressure if no operator action is taken.

As noted above, 10 minutes is used as a point of analysis - our operators will be able to identify the affected steam generator and isolate AFW flow well within this time limit. Furthermore, as shown on the attached graph, and already mentioned, containment design pressure will never be exceeded during the accident, since energy removal is always greater than energy addition. In fact, the containment heat removal system's capability gets increasingly greater even though the energy addition rate remains relatively constant.

Since the containment design pressure is never exceeded, we considered it unnecessary to calculate the time to reach peak pressure or its magnitude. It can be seen from the attached graph that even if the operator failed to act within 10 minutes, containment integrity would not be challenged for two reasons: (1) The critical portion of the transient occurs in the first minute, because of the high energy in the steam generator blowing down to atmospheric pressure out the break, and (2) the energy addition to containment becomes relatively constant with time while the heat removal system's capability rapidly grows.

ITEM 2

REQUEST 1. Provide the estimated runout AFW and MFW flow to the affected steam generator during the MSLB. This should be determined from the manufacturer's pump curves at zero backpressure, unless the system contains reliable anti-runout provisions or an actual backpressure value during the MSLB has been conservatively calculated.

Refer to our response for ITEM 1, REQUEST 1. In addition, note that at HZP conditions (consistent with the FSAR methodology and normal operating practice) there is no Main Feedwater Flow.

REQUEST 2. Perform an analysis of the core reactivity response to a MSLB, considering the feedwater flow rates determined in Item 2, Request 1. Justify any assumptions made for this analysis.

The DYNODE/P analyses have shown that core reactivity transient results are very insensitive to AFW flow. All DYNODE/P reactivity results are bounded by the FSAR analysis. The first minute of the transient is dominated by higher steam flows contributing to primary - secondary heat transfer, which is the forcing function for both the reactivity and the thermal-hydraulics in the core.

Conclusions

We have concluded that the integrated energy addition to containment is relatively insensitive to feedwater flow. Although we increased the AFW flow to the affected steam generator nearly 50% from our previous analysis, the integrated energy added to containment changed less than 4%. Due to the large initial steam generator pressure and inventory, the earliest portions of the transient are the most critical and are only slightly affected by the runout AFW flow rate. In fact, the higher AFW flow in this analysis, reduced the energy added to containment slightly from our May, 1980 analysis. This reduction in energy added to containment results from the cool AFW temperature reducing the pressure in the steam generator which, in turn, reduces the break flow.

We have concluded from our analysis that containment design pressure will not be exceeded by a MSLB with continued AFW flow at the runout rate.

Sincerely yours,

C P Lwona for

C. W. Giesler
Vice President - Nuclear Power

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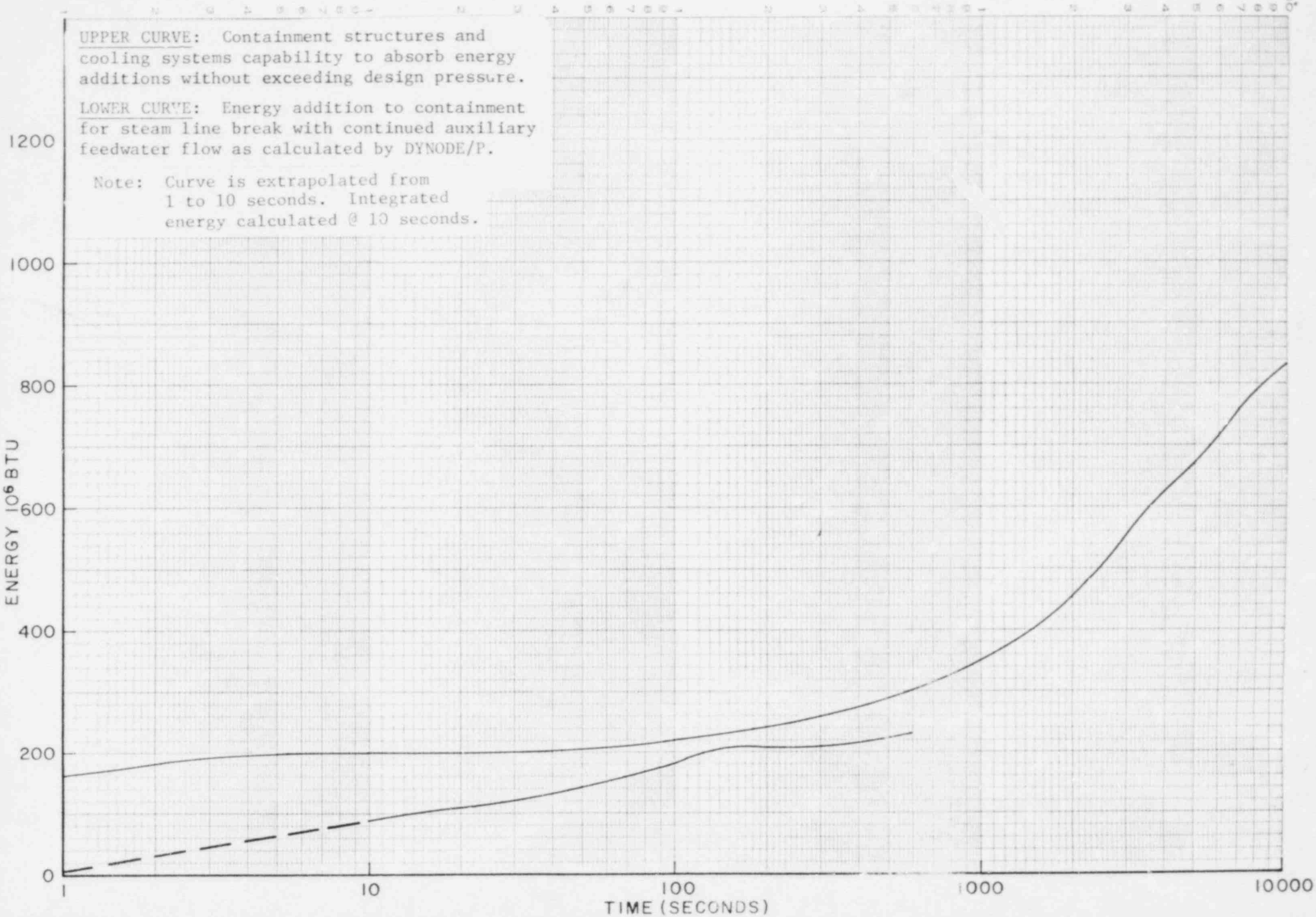
Attach.

cc - Mr. Robert Nelson, NRC Sr Resident Inspector
Director, Office of Inspection & Enforcement


UPPER CURVE: Containment structures and cooling systems capability to absorb energy additions without exceeding design pressure.
LOWER CURVE: Energy addition to containment for steam line break with continued auxiliary feedwater flow as calculated by DYNODE/P.
Note: Curve is extrapolated from 1 to 10 seconds. Integrated energy calculated @ 10 seconds.
1200
1000
800
600
400
200
0
ENERGY 10^6 BTU
1
10
100
1000
10000
TIME (SECONDS)