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May 8, 1980

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

Subject: Zion Station Units 1 and 2
Response to IE Bulletin No. 80-04
"Analysis Of A PWR Main Steam
Line Break With Continued Feedwater
Addition"
NRC Docket Nos. 50-295 and 50-304

Reference: February 8, 1980 letter from J. G. Keppler to C. Reed transmitting IE Bulletin No. 80-04

Dear Mr. Keppler:

Reference (a) transmitted IE Bulletin No. 80-04, "Analysis of a PWR Main Steam Line Break with Continued Feedwater Addition." This Bulletin required action to be taken by Commonwealth Edison Company with regard to its Zion Station. Attachment A to this letter contains Commonwealth's response to this Bulletin for this station.

Please address any questions that you might have concerning this matter to this office.

Very truly yours,

W. F. Naughton
for D. L. Peoples
Director of
Nuclear Licensing

DLP:WFN:rap

attachment

cc: NRC Office of Inspection and
Enforcement -Division of Reactor
Operations Inspection

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Attachment A

Response To Items 1-3 of IE Bulletin No. 80-04

1. Review the containment pressure response analysis to determine if the potential for containment overpressure for a main steam line break inside containment included the impact of runout flow from the auxiliary feedwater system and the impact of other energy sources, such as continuation of feedwater or condensate flow. In your review, consider your ability to detect and isolate the damaged steam generator from these sources and the ability of the pumps to remain operable after extended operation at runout flow.

Response

Commonwealth Edison has reviewed the containment pressurization analysis for main steam line break and the inclusion of additional water sources does not significantly contribute to the pressure response. At Zion Station, both the feedwater regulator valves (including the bypass valves) and the feedwater isolation valves close from a safety injection signal which, for this case, comes from steam line conditins and containment pressures. This isolation prevents any water from the condensate and main feedwater systems from entering the steam generator. The only water injected will be from the auxiliary feedwater system. All three auxiliary feedwater pumps have a combined runout capacity of approximately 2960 gpm, although the valves are currently throttled in the lines so that run outflow will not be achieved. Following a containment pressurization from a steam line break, the operator checks for high radiation, etc. to determine that it is not a main coolant break. Then he checks the four steam generators for wide range level and pressure to determine the broken loop. The operator then isolates the auxilary feedwater to that loop. Simulator training indicates that this will normally be accomplished in less than one minute and should always be accomplished in much less than ten (10) minutes. Commonwealth Edison has determined that the increase in pressre due to the entire throttled auxiliary feedwater flow being injected for 10 minutes and the maximum feedwater flow for the 10 seconds prior to feedwater isolation will, at most, be 2 psi. Based on the above, Commonwealth Edison has determined that the total pressure including the auxiliary feedwater addition would be at most 40 psig which is substantially below the containment design pressure of 47 psig.

2. Review your analysis of the reactivity increase which results from a main steam line break inside or outside containment. This review should consider the reactor cooldown rate and the potential for the reactor to return to power with the most

reactive control rod in the fully withdrawn position. If your previous analysis did not consider all potential water sources (such as those listed in 1 above) and if the reactivity increase is greater than previous analysis indicated the report of this review should include:

a. The boundary conditions for the analysis, e.g. the end of life shutdown margin, the moderator temperature coefficient, power level and the net effect of the associated steam generator water inventory on the reactor system cooling, etc.,

b. The most restrictive single active failure in the safety injection system and the effect of that failure on delaying the delivery of high concentration boric acid solution to the reactor coolant system,

c. The effect of extended water supply to the affected steam generator on the core criticality and return to power,

d. The hot channel factors corresponding to the most reactive rod in the fully withdrawn position at the end of life, and the Minimum Departure from Nucleate Boiling Ration (MDNBR) values for the analyzed transient.

Response

Commonwealth Edison has reviewed the assumptions made for main and auxiliary feedwater flow as they apply to steamline break transients. The transient analysis was performed using the following assumptions:

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

2. For the Condition IV breaks, i.e., double-ended rupture of a main steam pipe, 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.

Based on the manner in which the analysis is performed for Zion Station, the core transient results are very insensitive to auxiliary feedwater flow. The first minute of the transient is dominated entirely by the steam flow contribution to primary-secondary heat transfer, which is the forcing function for both the reactivity and thermal-hydraulic transients in the core. The effect of auxiliary feedwater runout (or failure of runout protection where applicable) is minimal. Greater feedwater flows during the large steamline breaks serve to reduce secondary pressures, accelerating the automatic safeguards actions, i.e. steamline isolation, feedwater isolation and safety injection. The assumptions described above are therefore appropriate and conservative for the short-term aspect of the steamline break transient.

The auxiliary feedwater flow becomes a dominant factor in determining the duration and magnitude of the steam flow transient during later stages in the transient. However, the limiting portion of the transient occurs during the first minute, both due to higher steam flows inherently present early in the transient and due to the introduction of boron to the core via the safety injection system.

In conclusion, Commonwealth Edison and its vendor, Westinghouse have evaluated the effect of runout auxiliary feedwater flows in the core transient for steamline break, and based on this evaluation, have determined that the assumptions presently made are appropriate for use as a licensing basis. The concerns outlined in the introduction to this bulletin, IE Bulletin 80-04, relative to, 1) limiting core conditions occurring during portions of the transient where auxiliary feedwater flow is a relevant contributor to plant cooldown; and 2) incomplete isolation of main feedwater flow, are not representative of the Westinghouse NSSS designs and associated Balance of Plant requirements.

3. If the potential containment overpressure exists or the reactor-return-to-power response worsens, provide a proposed corrective action and a schedule for completion of the corrective action. If the unit is operating, provide a description of any interim action that will be taken until the proposed corrective action is completed.

Response:

Commonwealth Edison has determined that the potential for containment overpressure does not exist and the return-to-power response is very insensitive to the addition of auxiliary feedwater. Therefore, no corrective action is required.