bc: Messrs. Williams/Lindblad, Broehl, Durham, Withers, Heider
Yundt, Lentsch, Zimmerman, Christensen, Gaidos, Sullivan,
L. Damon (Bechtel), L. Cunningham (W), L. Weislogel (PP&L),
D. Axtell (EWEB), R. Nyland (BPA), M. Axelrad, A. Schwencer,
C. Trammell, M. Malmros, LIS, Reading File, TNP:GOV REL F:
NRC, IE Bulletins, Chrono

PGE Portland General Electric Company

Charles Goodwin, Jr. Assistant Vice President

8005060 150

April 30, 1980

Trojan Nuclear Plant
Docket 50-344
License NPF-1

Mr. R. H. Engelken, Director
U. S. Nuclear Regulatory Commission
Region V
Suite 202, Walnut Creek Plaza
1990 N. California Blvd.
Walnut Creek, CA 94596

Dear Sir:

Attached is our response to IE Bulletin 80-04, involving review of the main steam line break analyses for the Trojan Nuclear Plant. We have reviewed both the Containment pressure and core response portions of the main steam line break accident and have concluded that in both cases, the analyses reported in the Trojan FSAR are sufficiently conservative to account for the concerns identified in Positions 1 and 2 of IE Bulletin 80-04. Position 3 of the bulletin requested proposed corrective action in the event these analyses proved to be nonconservative. Since we have concluded that the analyses are conservative, this position is not applicable to Trojan.

Sincerely,

CG

C. Goodwin, Jr.
Assistant Vice President
Thermal Plant Operation and
Maintenance

CG/DIH/CJP/4mg6B18
Attachment

c: Mr. Lynn Frank, Director
State of Oregon
Department of Energy

U. S. Nuclear Regulatory Commission
Office of Inspection and Enforcement
Division of Reactor Operations Inspection

G. A. Zimmerman

J. W. Lentsch

A001
s
1/1

ATTACHMENT

PGE Response to Positions 1 and 2 of IE Bulletin 80-04

NRC Position 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:

The Trojan Containment pressure response analysis, as described in FSAR Section 6.2.1.1.2.4, considered four postulated main steam line break accident conditions. Runout flow from the Auxiliary Feedwater System (AFS) can be of concern only for Case E: a steam line break with failure of an associated auxiliary feedwater isolation valve. The mass/energy release to the Containment for this, as well as the other three cases, was computed using the conservative Westinghouse Standard Analysis Procedure 12.2, Rev. 0 (proprietary) which is briefly described in FSAR Section 6.2.1.1.2.4. As can be seen from FSAR Table 6.2-2b, the largest blowdown mass/energy release is predicted for Case B: a steam line break with failure of the associated steam line check valve. For this worst-case steam line break, a CONTEMPT-PS analysis indicates that the peak Containment pressure is predicted to occur at about 140 seconds. Thus, unless the impact of potential runout AFS flow occurs before this time, the peak Containment overpressure will not be affected.

At the time of peak pressure for Case B, the integrated energy release rate for Case E is only about 75 percent of that for Case B. In addition, as can be seen from an examination of FSAR Figure 6.2-57b and Sheet 3 of Table 6.2-2b, continued AFS flow to the affected steam generator is important only for the period of time from 150-600 seconds. At 10 min., manual isolation of the AFS is assumed to occur by operator action. During this time, one auxiliary feedwater pump is assumed to operate with the design rated flow of 880 gpm all going to the break. Even though this assumption may not exactly represent pump runout conditions, the worst-case FSAR Containment pressure response analysis will not be affected because (1) Case E is the only postulated break affected by AFS pump runout conditions and it is not the most severe steam line break accident, and (2) potential runout AFS flow only occurs after the time of predicted peak Containment pressure, and thus would not affect the peak value since the Containment Heat Removal Systems would be effective in maintaining the pressure decrease.

The continuation of feedwater or condensate flow is taken into account during the steam line break accident analyses until termination by the closure of one of two redundant feedwater isolation valves, as discussed in FSAR Section 6.2.1.1.2.4. The ability to detect and isolate the affected steam generator from auxiliary feedwater and feedwater flow sources is described in FSAR Sections 6.6.3 and 15.4.2.1.1. We judge that the auxiliary feedwater pumps are in no danger of significant degradation at runout flow conditions for the assumed 10 min. of operation until manual action because there should be sufficient cooling provided to keep the pumps from overheating.

NRC Position 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 Ratio (MDNBR) values for the analyzed transient.

Response

The core response portion of the main steam line break analysis for Trojan is described in FSAR Section 15.4.2.1. Although a major steam line rupture is a Condition IV event for which DNB would not necessarily be unacceptable, the Trojan analyses demonstrate that in fact no DNB occurs for any rupture assuming the most reactive control rod assembly is stuck in its fully withdrawn position. We have reviewed the Trojan analyses relative to the concerns identified in the introduction to IE Bulletin 80-04; namely, (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. The conclusion of our review is that the concerns identified are not applicable to Trojan and the existing analyses are sufficiently conservative.

Relevant assumptions used in the core analyses are summarized in FSAR Section 15.4.2.1.2. The following additional assumptions are made regarding main and auxiliary feedwater flow:

1. Full main feedwater flow is assumed from the beginning of the transient at a very conservative cold temperature (80°F).

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

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

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

In the Trojan design, main feedwater flow is isolated on a steam line break from safety signals as described in FSAR Section 15.4.2.1.1. Redundant isolation capability is provided. That is, in addition to the normal control action which closes the main feedwater control valves, a Safety Injection Signal rapidly closes all feedwater control and isolation valves and trips the main feedwater pumps. The Trojan Auxiliary Feedwater System (AFS), described in FSAR Section 6.6, contains provisions to preclude runout AFS flow to a broken steam generator. Each AFS line is provided with a flow sensing circuit and isolation valve to stop flow if a runout condition is indicated.

The analyses are done with the reactor initially at hot shutdown conditions, at the minimum allowable shutdown margin. These assumptions serve to conservatively bound the most limiting cooldown transients. For each of the limiting breaks analyzed, FSAR Table 15.4-5 gives statepoints around the time at which minimum DNBR occurs. The table data demonstrate that minimum DNBR, the limiting consideration for this accident, occurs within the first approximately 60 sec. of the transient. During this time period, primary-secondary heat transfer, which is the forcing function for both the reactivity and thermal-hydraulic transients in the core, is dominated entirely by the steam flow contribution. The effect of auxiliary feedwater runout flow, assuming the most limiting single failure in the Trojan AFS runout protection system, would be minimal during this early portion of the transient. The qualitative effect of increased auxiliary feedwater flow during the early portion of a large steam line break would be to more rapidly reduce secondary pressures and therefore accelerate the automatic safeguards actions, i.e., steam line isolation, feedwater isolation and safety injection. Therefore, the assumptions outlined above are conservative for modeling the short-term aspects of the steam line break accident.

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, as described above, the limiting portion of the transient occurs during the first minute; both in terms of minimum DNBR and return to criticality. This is due both to the higher steam flows inherently present early in the transient and the introduction of boron to the core via the Safety Injection System. Therefore, it is concluded that runout flow accompanying a single failure in the runout flow protection system of the AFS would have negligible effect on the main steam line break analyses described in the Trojan FSAR.