TENNESSEE VALLEY AUTHORITY
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400 Chestnut Street Tower II

December 11, 1981

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Director of Nuclear Reactor Regulation
Attention: Ms. E. Adensam, Chief
Licensing Branch No. 4
Division of Licensing
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Dear Ms. Adensam:

In the Matter of the Application of) Docket Nos. 50-390
Tennessee Valley Authority) 50-391

Enclosed for NRC review is TVA's revised response to NRC question 450.1 on Watts Bar Nuclear Plant. This revised response provides additional information requested by the NRC during a telephone conference call on November 10, 1981. This information will be included in Amendment 47 of the Watts Bar Final Safety Analysis Report.

If you have any questions concerning this matter, please get in touch with D. P. Ormsby at FTS 858-2688.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

M R Wisenburg

M. R. Wisenburg
Nuclear Engineer

Sworn to and subscribed before me
this 11th day of Dec. 1981
Bryant M. Lowery
Notary Public
My Commission Expires 4/4/82

Enclosure

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ENCLOSURE

WATTS BAR NUCLEAR PLANT UNITS 1 AND 2
REVISED TVA RESPONSE TO NRC QUESTION 450.1

450.1 (15.6.2) Question

In evaluating the radiological consequences of the failure of small lines carrying primary coolant outside the containment, provide the following:

a. size and type of all small lines carrying primary coolant outside containment (including CVCS letdown line);

b. mass of primary system iodine released during accident;

c. summary of primary system iodine activity during the accident and its effects on the calculated accident consequences;

d. iodine transport mechanism and release path from the leak point to the environment;

e. isolation valve closure time and leakage rate;

f. detailed and chronological description of primary system response, including system response time, operator action, valve closure times, etc.;

g. figure indicating primary system pressure and temperature as a function of time during an accident;

h. figure indicating leak rate from the failure of small lines as a function of time.

RESPONSE

A. Size and type of all small lines carrying primary coolant outside containment (including CVCS letdown line):

1. Four 3/4" normally isolated (two normally closed inboard isolation valves and a normally closed outboard isolation valve on each) sampling lines.

2. 2" CVCS letdown line. There are three inboard isolation valves (FCV-62-72, -73, and -74) in parallel and one outboard isolation valve (FV-62-77) in series.

3. 4" CVCS excess letdown and seal water return line. The inboard isolation valve is FCV-62-61 and the outboard isolation valve is FCV-62-63.

4. Four 2″ seal water supply lines. Two check valves in each line prevent backflow in these lines.

5. 3″ normal charging line. Inside containment, this line contains three parallel check valve/flow control valve combinations in series with another check valve to prevent backflow in this line.

B. Mass of reactor coolant released during accident:

1. The sample lines are normally isolated and are only opened up to allow flow out of containment when a sample is being taken. If a line was broken, the operator would not be able to obtain a sample and would realize a problem existed and isolate the line precluding further inventory loss. Assuming the operator required 30 minutes to isolate the line, an ideal orifice, and full power operating conditions, the flow rate out of the break is 65 gpm and the total mass released is 1950 gallons.

2. Break of the CVCS letdown line. The normal letdown flow rate is 75 gpm (WBN FSAR Table 9.3-4). Assume the letdown=charging=75 gpm when the CVCS letdown line breaks downstream of the letdown heat exchanger (HTX). It is assumed that the flow out the break is limited to 75 gpm by the letdown orifice (ID of the orifice is 0.272 ±.002 inch). The inventory loss is seen in the volume control tank (VCT). Assume the VCT was at the high level alarm setpoint (29' increasing) before the break. At 5' decreasing, the VCT will be isolated (FCV-62-132 and -133 close) from charging pump suction. Suction is switched to the RWST. The mass lost from the VCT before isolation is 5400 pounds.

   On VCT low level, the operating instructions require the operator to isolate letdown. Assume the operator takes 10 minutes to isolate letdown charging flow from the RWST. The inventory lost is isolated is 6100 pounds before operator action. From the draft WBN tech specs the maximum isolation time for the letdown isolation valves is 10 seconds, therefore, 100 pounds is lost during valve transition time. The associated piping would also empty. For conservatism, assume 500' of piping is involved. Piping downstream of the letdown HTX is 3'. Approximately 1500 pounds drains from the piping. Total mass of reactor coolant lost = 5400 lbs + 6100 lbs + 100 lbs + 1500 lbs = 13100 lbs.

3. The excess letdown line is used to provide additional letdown capability during the final stages of plant heatup. This path removes some of the excess reactor coolant due to system expansion as a result of the RCS temperature increase. The excess letdown is normally diverted to the tritiated drain tank. The excess letdown flow path also serves as an alternate letdown path from the RCS in the event that the normal letdown path is inoperable. When the

normal letdown line is not available, the normal purification path is also not in operation. This alternate condition would allow continued power operation for a limited period of time, dependent on RCS chemistry and activity. Thus, the probability of a break of the excess letdown line while in use is significantly less than the probability of a letdown line break during letdown.

4 & 5. A break in the seal water supply lines or in the normal charging line will not result in a direct loss of reactor coolant from inside containment because of the check valves which prevent backflow in these lines. The flow out these breaks will be coolant which has passed through the CVCS, including the mixed bed demineralizers, the reactor coolant filter, and the volume control tank. Therefore, the specific activity of the coolant released through these breaks will be much less than normal reactor coolant.

Doses have been computed for releases from the 3/4' sample line break, item 1, and the 2' CVCS letdown line break, item 2 and are shown in Table 450.1-1.

C. The normal makeup system can maintain pressurizer level and Reactor Coolant System pressure for a break through a 0.375 inch diameter hole resulting in a loss of approximately 17.5 lb/sec (WBN FSAR 15.3.1.1). Breaks in the small lines carrying primary coolant outside containment identified in part A of this question, result in loss rates less than or equal to the normal makeup flow. Loss rates due to breaks in the CVCS are assumed to be limited to 75 gpm by the letdown orifice located inside containment. Since all the breaks are isolated in 30 minutes or less there will be no affect on the primary system iodine activity during the accident. It is assumed that the iodine activity will be at tech spec limits during the entire course of the accident. Therefore, there will be no effect on the calculated accident consequences due to changes in the primary system iodine activity.

D. The coolant released through sample line breaks will be at high temperature and pressure (650^{o}F and 2458 lb/in^{2}g) and therefore, most of it will flash to steam. Essentially all of the iodine released through this break will become airborne in the auxiliary building. The iodine will flow through the auxiliary building into the normal ventilation system and released to the environment through the auxiliary building vent. Coolant released through the CVCS line breaks downstream of the letdown heat exchanger will be at a low temperature and pressure (150^{o}F and 200 lb/in^{2}g) therefore, it will not flash to steam. A small fraction of the iodine will become airborne due to partition from the liquid being released into the auxiliary building, and will be released to the environment through the auxiliary building vent.

E. Isolation valve closure time and leakage rate:

Valve No.	Function	Max Isol. Time (sec)	Valve Size(in)	Max Leak Rate
FVC-43-22	Sample RC Outlet Hdrs	10[1]	3/4	0.0038 cfh[3]
FVC-43-23	Sample RC Outlet Hdrs	10[1]	3/4	0.0038 cfh[3]
FVC-43-11	Sample PRZR Liquid	10[1]	3/4	0.0038 cfh[3]
FVC-43-12	Sample PRZR Liquid	10[1]	3/4	0.0038 cfh[3]
FVC-43-75	Boron Analyzer	5[1]	3/4	0.0038 cfh[3]
FVC-43-77	Boron Analyzer	5[1]	3/4	0.0038 cfh[3]
FCV-62-72	Letdown Line	10[1]	2	0.0010 cfh[3]
FCV-62-73	Letdown Line	10[1]	2	0.0010 cfh[3]
FCV-62-74	Letdown Line	10[1]	2	0.0010 cfh[3]
FCV-62-77	Letdown Line	10[1]	2	0.0010 cfh[3]
FCV-62-61	RCP Seals	10[1]	4	0.0200 cfh[3]
FCV-62-63	RCP Seals	10[1]	4	0.0200 cfh[3]
FCV-62-132	VCT Outlet Isol Vlv	10[2]	4	*
FCV-62-133	VCT Outlet Isol Vlv	10[2]	4	*

[1] Values come from the July 15, 1981, WBN draft tech specs
[2] Values come from Westinghouse drawing 115E001
[3] Values come from the Preop Test TVA-2C

*The Westinghouse valve specs require these valves to be tested to meet the leakage criteria of 3 cc/hr/nominal inch valve diameter (.0004 cfh) before being shipped and installed. No other values are available.

F,G,H.

The line sizes provided in the response to part A of this question have been evaluated in terms of primary system response. The range of line sizes are from 3/4 inch to 4 inches. Detailed and chronological descriptions of primary behavior and system response to small breaks of these sizes are included in Westinghouse Topical Report WCAP-9600, 'Report on Small Break Accidents in Westinghouse NSSS.' Specifically, Section 3.1 of WCAP-9600 includes a detailed description of primary behavior as well as transient plotted information such as primary system pressure and temperature, leak flow rate, and numerous other plant parameters. WCAP-9600, section 3.1, includes this information for a number of break sizes. The plant analyzed for the WCAP-9600 cases was a 4-loop, 3411 MW, non-UHI plant. The applicability of these transients for UHI plants (e.g. Watts Bar) is extensively discussed in WCAP-9639, 'Report on Small Break Accidents for Westinghouse NSSS with Upper Head Injection.' For breaks greater than 2 inches, UHI plant transients analyzed in WCAP-9639 apply. The one inch diameter case described in WCAP-9600 is applicable to the 3/4 inch sampling line failure.

The 2-inch diameter case in WCAP-9600 is applicable to failure of the CVCS letdown lines. The 4 inch diameter case provided in WCAP-9600, section 3.1, plus the applicability discussion and transient analyzed in WCAP-9639, section 2.1, is generally applicable to the expected primary behavior for both the 3-inch charging line and the 4-inch CVCS excess letdown line failure scenarios. It should be noted that these cases are extremely conservative since loss rate will be limited by the letdown orifice located in the CVCS letdown line inside containment (see discussion in part C of this question).

TABLE 450.1-1

DOSES DUE TO RELEASES FROM SMALL LINE BREAKS

3/4" Sample Line Break 1950 Gallons Released, 100% Iodine Airborne				2" CVCS Letdown Line Break 13100 lbs Released, 10% Iodine Airborne			
EAB Doses		LPZ Doses		EAB Doses		LPZ Doses	
Gamma (rad)	Thyroid (rad)	Gamma (rad)	Thyroid (rad)	Gamma (rad)	Thyroid (rad)	Gamma (rad)	Thyroid (rad)
3.85×10^{-2}	1.00×10^{1}	8.90×10^{-3}	2.31×10^{0}	1.26×10^{-2}	8.06×10^{-1}	2.91×10^{-3}	1.86×10^{-1}