August 31, 1982

Docket No. 50-29
LS05-82-08-073

Mr. James A. Kay
Senior Engineer - Licensing
Yankee Atomic Electric Company
1671 Worcester Road
Framingham, Massachusetts 01701

Dear Mr. Kay:

SUBJECT: YANKEE NUCLEAR POWER STATION - SEP TOPIC XV-16, RADIOLOGICAL CONSEQUENCES OF FAILURE OF SMALL LINES CARRYING PRIMARY COOLANT OUTSIDE CONTAINMENT

Enclosed is the staff's evaluation of SEP Topic XV-16 for the Yankee Plant. This evaluation is based on our review of your topic safety assessment report submitted by letter dated February 1, 1982, and additional information submitted on June 15, 1982.

The staff made an independent assessment of this topic, for reasons given in the evaluation, and found that the doses exceed the acceptance criteria. You are requested to review the staff's evaluation and comment on the appropriateness of the assumptions used in the analysis. Your response is requested within 30 days of receipt of this letter. If no response is received within that time, we will assume that you have no comments or corrections and will consider the topic complete.

The enclosed safety evaluation will be a basic input to the integrated safety assessment for your facility unless you identify changes needed to reflect the as-built condition of your facility. The assessment may be revised in the future if your facility design is changed or if NRC criteria relating to this topic are modified before the integrated assessment is completed.

SE04 Add: M Boyle

Sincerely,

DSU use Ex (11)

Ralph Caruso, Project Manager
Operating Reactors Branch No. 5
Division of Licensing

Enclosure: As stated

cc w/enclosure: See next page

OFFICE	SEPB:DL	SEPB:DL	SEPB:DL	SEPB:DL	ORB#5:PM	ORB#5:BC	AD:SA:DL
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DATE	8/24/82	8/25/82	8/24/82	8/27/82	8/30/82	8/26/82	8/26/82

NOTE 8/31/82

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XV-16 RADIOLOGICAL CONSEQUENCES OF FAILURE OF SMALL LINES CARRYING PRIMARY COOLANT OUTSIDE CONTAINMENT

I. INTRODUCTION

Rupture of lines carrying primary coolant outside containment can allow primary coolant and the radioactive material in it to escape to the environment. SEP Topic XV-16 is intended to review the radiological consequences of such failures. The review of this topic included those lines which carry primary coolant outside containment during power operation, including those lines that are not normally expected to be open to the primary system but can be opened during power operation (i.e., reactor coolant sample lines, instrument lines, etc.).

II. REVIEW CRITERION

All small lines carrying primary coolant outside containment were reviewed to ensure that the dose from any release of radioactivity from their postulated failure was a small fraction of 10 CFR Part 100 exposure guidelines. Small fraction is defined in the Standard Review Plan to be no more than 10% of the guideline values.

III. RELATED SAFETY TOPICS AND INTERFACES

Lines which were excluded from the review included lines for which failure outside containment is not postulated, for this review topic, or lines for which interlocks prevent opening during power operation (e.g., the PWR residual heat removal lines). The review also did not consider the release of radioisotopes from large pipes carrying primary system fluid prior to automatic isolation of such lines, (e.g., the main steam and feedwater lines). The consequences from failure in these lines are considered in SEP Topic XV-18, "Radiological Consequences of Main Steam Line Failure Outside Containment."

Topic II-2.C, "Atmospheric Transport and Diffusion Characteristics for Accident Analysis," provides the meteorological data used for calculating the offsite dose consequences (these data are included in Table 1).

IV. REVIEW GUIDELINES

The review was conducted in accordance with Standard Review Plan (SRP) 15.6.2. The staff requested the licensee to provide an assessment of this topic, including plant-specific information such as the identification of lines covered by this topic, the size of these lines, break locations, flow rates, and means for isolating the leak. The licensee responded to this request in a letter dated February 1, 1982, and supplied additional requested information on June 15, 1982.

V. EVALUATION

The staff reviewed the licensee's submittal and disagreed with some of the assumptions and bases used in their calculation. The licensee did not provide enough detail to permit a step-by-step critique of the licensee calculative method. The staff independently evaluated postulated breaks in two lines to determine the resultant doses. The first is a break in an instrument line which cannot be isolated until reactor shutdown and cooldown. The largest instrument line has an inner diameter of 0.305 inches, and the flow out the postulated break was conservatively estimated, assuming critical flow, to be 127 gallons per minute. (The critical mass flux was determined by the Reactor Systems Branch. SRP 15.6.2 specifies that critical flow be assumed.) This flow was assumed to persist for four hours, which includes time for operators to identify the problem (they would be alerted by an alarm in the control room when a second charging pump starts), and time for a controlled cooldown. The staff assumed that the initial coolant iodine concentration was the maximum allowed by technical specifications, 1 microcurie per gram dose-equivalent I-131, and that an iodine spike occurred because of the change in power level, and that all the iodine in the flashed fraction of the

leaked liquid was released to the environment. Table 1 is a summary of the assumptions for the dose calculations. The results of the dose calculations are presented in Table 2.

A break in a small line that would result in the largest leak rate of reactor coolant outside containment, but which could be isolated, was also evaluated. This line is the letdown line. The flow out a break in this line is limited by pressure breakdown orifices inside containment. The flow through these orifices following a break is essentially the same as the normal flow, because the differential pressure would change negligibly. The total flow through the two orifices in use is at most 100 gallons per minute; it is normally lower because a vari-orifice is throttled down and/or one of the orifices in parallel is valved out. The operators would be alerted by an alarm in the control room when one or two additional charging pumps start, to maintain pressurizer level. The flow can be stopped by closing the isolation valve. The staff assumes that the identification of the leaking line and the isolation of it would require 30 minutes. During this time, the leak is assumed to continue at 100 gallons per minute. Additional assumptions for this case are presented in Table 1, and the results of the dose calculations are in Table 2.

VI. CONCLUSIONS

Based on the above evaluation, the instrument line break is the limiting case for offsite doses. The calculated offsite doses exceed 10% of 10 CFR Part 100 guidelines (i.e., 30 rem thyroid) and, therefore, do not meet the criteria of SRP 15.6.2. Therefore, the staff recommends that the Technical Specification limit for dose-equivalent I-131 should be reduced (to approximately 0.1 microcurie per gram) or some equivalent corrective action should be taken to limit the radiological consequences to less than the specified acceptance criteria.

Table 1

Assumptions Used in Offsite Dose Calculations for Small Line Break

Leak rate (instrument line break)	127 gpm
Leak rate (letdown line break)	100 gpm
Duration of leak (instrument line)	4 hours
Duration of leak (letdown line)	30 minutes
Initial coolant iodine activity, Iodine-131 equivalent (based on technical specification for equilibrium coolant activity concentration)	1 microcurie/gram
Increase in iodine release rate from core to coolant, over equilibrium release rate at technical specifications iodine activity	Factor of 500
Flashing fraction (fraction of iodine that is airborne)	0.33
Atmospheric Dispersion Coefficients	
0-2 hour Exclusion Radius	2.8 E-4* sec/cubic meter
0-8 hour Low Population Zone outer boundary	2.8 E-5 "
8-24 hour "	1.9 E-5 "
24-96 hour "	1.6 E-5 "
4-30 days "	1.1 E-5 "

* 2.8 E-4 means 0.00028

Table 2

Calculated Offsite Doses Resulting From Postulated Small Line Break

	Doses, Rems	
	Thyroid	Whole Body
Instrument Line Break		
0-2 hour Exclusion Area Boundary	270	0.046
0-30 day Low Population Zone Outer Boundary	99	0.017
Letdown Line Break		
0-2 hour Exclusion Area Boundary	14	0.0024
0-30 day Low Population Zone Outer Boundary	1.4	0.00024