November 10, 1982

Docket No. 50-245
LS05-82-11-029

Mr. W. G. Counsil, Vice President
Nuclear Engineering and Operations
Northeast Nuclear Energy Company
Post Office Box 270
Hartford, Connecticut 06101

Dear Mr. Counsil:

SUBJECT: SEP TOPIC XV-16, FAILURE OF SMALL LINES CARRYING PRIMARY COOLANT OUTSIDE CONTAINMENT - MILLSTONE UNIT 1

Enclosed is a copy of a revised safety evaluation report for Topic XV-16 for Millstone Unit 1. This evaluation has been revised from the previous safety evaluation report dated November 3, 1981, to provide analysis to support the Integrated Assessment and to resolve differences noted between the analysis of your facility and two other similar plants.

The analysis of November 3, 1981, found that this topic met acceptance criteria on the assumption that the event was terminated by operator action in 30 minutes. However, that assumption is not consistent with current licensing criteria and, as a result of the reevaluation, the exclusion area boundary dose to the thyroid of 370 rem exceeds acceptance criteria.

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

Sincerely,

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James Shea, Project Manager
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Enclosure:
As stated

cc w/enclosure:
See next page

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Mr. W. G. Counsil

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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 radioactivity contained therein to escape to the environment. SEP Topic XV-16 is intended to review the radiological consequences of such failures. The review of this topic encompassed those lines which carry primary coolant outside containment.

The scope included 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 should be reviewed to ensure that any release of radioactivity from their postulated failure is a small fraction of the 10 CFR Part 100 exposure guidelines. Small fraction is defined in the SRP to be no more than 10% of the 10 CFR Part 100 exposure guidelines.

III. RELATED SAFETY TOPICS AND INTERFACES

Lines which were excluded from this review included lines for which failure outside containment is not postulated, such as lines with isolation valves inside containment, or lines for which interlocks prevent opening during power operation. 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 failures in these lines are considered in SEP Topic XV-18, "Radiological Consequences of Main Steam Line Failure Outside Containment."

IV. REVIEW GUIDELINES

The review was conducted in accordance with SRP 15.6.2. The licensee was requested to provide plant specific information such as the identification of lines covered by this Topic, the size of these lines, break locations and flow, etc. The licensee responded to this request in a letter dated June 30, 1981.

V. EVALUATION

In the submittal, the licensee analyzed the release from a break of the sample line as the worst case for this topic. The staff has reviewed the licensee's submittal and based on the information available, has postulated a break in an instrument line (instead of the sample line) as the limiting case for this topic. The staff has postulated the break takes place on the instrument line outside the containment between the outboard manual isolation valve and the excess flow check valve. The staff also assumed that isolation by use of the manual isolation valve is prevented by the environmental conditions posed by a break occurring in the near proximity of the valve. Because the break cannot be isolated, primary coolant would be lost until the primary system is depressurized (which is assumed to take four hours).

The Millstone primary coolant technical specification limit for iodine activity consists of a single shutdown value of 20 μCi/gm of gross iodine activity. This limit conflicts with the two-tier (equilibrium and spike) dose equivalent (D.E.) I-131 limits found in the BWR standard technical specifications (STS) and also with the Standard Review Plan Section 15.6.2. However, assuming that the shutdown limit is composed of entirely I-131 and using this single shutdown limit as the equilibrium limit, the calculated doses well exceed the dose guidelines of 10 CFR Part 100. The doses listed in Table 2, however, were calculated assuming the STS equilibrium value for primary coolant iodine activity. Implementation of the STS significantly reduce the calculated radiological consequences of this accident.

The staff has estimated that approximately 200,000 pounds(mass) of primary coolant was released during this acident. The primary coolant release rate was based on a decreasing flow rate due to reactor depressurization. The method used by the staff to calculate the coolant release deviates from the SRP which states that the flow is estimated "with the reactor coolant fluid enthalpy corresponding to the normal reactor operating conditions." The time dependent, decreasing flow rate is justified because the proper response to this accident would be to shutdown the plant to affect repairs.

In the staff's analysis 37% of the reactor coolant released through the break was assumed to flash to steam and then be released to the environment without credit for SGTS filtration or plateout in the reactor building. The staff has further assumed that an iodine spike occurs during the reactor shutdown producing an increase in the iodine release rate from the fuel by a factor of 500.

VI CONCLUSION

The results in Table 2 show that even with the adoption of the BWR STS D.E. I-131 reactor coolant equilibrium activity limit of 0.2 uCi/gm, the EAB thyroid dose of 370 rem exceeds the SRP guideline value of 30 rems.

Because the calculated thyroid dose is directly proportional to the D.E. I-131 reactor coolant equilibrium activity, the guideline value of 30 rems, thyroid, can be achieved by reducing this activity from 0.2 uCi/gm to 0.016 uCi/gm, D.E. I-131. Similarly, using 0.16 uCi/gm D.E. I-131 for the equilibrium iodine concentration results in a dose corresponding to 10 CFR Part 100 exposure guideline value of 300 rems, but not the Standard Review Plan guideline.

It should be noted that the evaluation performed by the staff was based on the SRP Section 6.2.3 guidance in Branch Technical Position 6-3 that "Whenever the pressure in the secondary containment volume exceeds -0.25 inches w.g. (water gage), the leakage prevention function of the secondary containment is assumed to be negated." However, some credit may be justified for the Standby Gas Treatment System (SGTS) in mitigating the radiological consequences of this accident by consideration of 1) the integrity of the secondary containment under the positive pressurization caused by the line break, and 2) the location of the broken line with respect to both potential leakage paths through the boundary of the secondary containment and the intake(s) to the SGTS. Such credit could be pursued through the integrated assessment and has the potential for considerable reduction in the calculated doses.

TABLE 1

Assumptions Used in the Radiological Consequences of Instrument Line Break Outside Containment at Millstone

1.	Mass of reactor coolant in vessel-mixing volume (lbm)	456,000
2.	RWCS cleanup rate (gpm)	715
3.	Condensate demineralizer cleanup rate (carryover fraction x feedwater flow rate) (gpm)	216
4.	Iodine spiking factor	500
5.	Flash fraction (percent)	37
6.	Duration of accident (hours)	4
7.	X/Q values	
	Ground level values (sec/m^3)	
	0-2 hr, EAB	6.1×10^{-4}
	0-4 hr, LPZ	1.9 x 10-5
8.	Reactor coolant concentration (uCi/gm)	0.2

9. Discharge rate of reactor coolant from break

Time After Break hours	Discharge Rate lbm/hr
0-0.5	96,000
0.5-1.0	87,000
1.0-1.5	69,000
1.5-2.0	53,000
2.0-2.5	37,000
2.5-3.0	25,000
3.0-3.5	14,000
3.5-4.0	9,000

10. No Credit for Standby Gas Treatment System filtration

11. RWCS continues to function during the accident

12. No cleanup from condensate demineralizer following the break

TABLE 2

Radiological Consequences of the Instrument Line Break Outside Containment at Millstone

	Thyroid Dose (Rem)	Whole Body Dose (Rem)
0-2 hour, EAB	370	0.06
0-4 hour, LPZ	17	0.003