November 10, 1982

Docket No. 50-237
LS05-82-11-030

Mr. L. DelGeorge
Director of Nuclear Licensing
Commonwealth Edison Company
Post Office Box 767
Chicago, Illinois 60690

Dear Mr. DelGeorge:

SUBJECT: SEP TOPIC XV-16, FAILURE OF SMALL LINES CARRYING PRIMARY COOLANT OUTSIDE CONTAINMENT - DRESDEN UNIT 2

Enclosed is a copy of a revised safety evaluation report for Topic XV-16 for Dresden Unit 2. This evaluation has been revised from the previous safety evaluation report dated October 20, 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.

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,

Dennis M. Crutchfield, Chief
Operating Reactors Branch #5
Division of Licensing

SE04
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Enclosure:
As stated

cc w/enclosure:
See next page

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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 during power operation. 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 were reviewed to ensure that any release of radioactivity from their postulated failure was 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 (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 of a BWR).

The consequences from failure 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 August 18, 1980.

V. EVALUATION

In the submittal, the licensee indicated that an analysis of the consequences of a 1-inch instrument line break was performed in Amendment 22 to the Final Safety Analysis Report (FSAR) for Unit 3, which, the licensee stated, was virtually identical to the Dresden 2 design.

For Dresden 3, the licensee assumed that a break occurs outside the primary containment, but upstream of the check valve, in a 1-inch pipe penetrating the drywell. This break was postulated not to be isolated until after the reactor was shutdown and depressurized in four hours.

In estimating the amount of primary coolant released, the discharge rate from the break was assumed to decrease during the accident, as action is taken by the control room operator to cool and depressurize the reactor. This 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.

The staff also assumed that 37% of the discharge fluid flashes to steam and is released to the environment without credit for Standby Gas Treatment System (SGTS) filtration or plateout in the reactor building. In addition, an iodine spike was assumed to occur as a result of the reactor shutdown or depressurization of the primary system. The spike was modelled by increasing the equilibrium iodine release rate from the fuel by a factor of 500. These assumptions are in accordance with the Standard Review Plan.

The Dresden primary coolant technical specification limit for iodine activity consists of a single shutdown value of 20 μCi/gm 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 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 reduces the calculated radiological consequences of this accident.

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 μCi/gm, the

EAB dose to the thyroid is 128 Rem which exceeds the SRP guideline value of 30 rem.

Because the calculated thyroid dose is directly proportional to the D.E. I-131 reactor coolant equilibrium activity, the SRP guideline value of 30 rems, thyroid, can be achieved by reducing this activity from 0.2 μCi/gm to 0.047 μCi/gm, D.E. I-131. In any case, use of the STS value results in doses which are less than the guideline values of 10 CFR Part 100.

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 Dresden Unit 2

1. Mass of reactor coolant in vessel-mixing volume (lbm) 590,000

2. RWCS cleanup rate (gpm) 600

3. Condensate demineralizer cleanup rate (carryover fraction x feedwater flow rate) (gpm) 263

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	2.6×10^{-4}
0-4 hr, LPZ	1.1×10^{-5}

8. Reactor coolant concentration (μCi/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 Dresden Unit 2

	Thyroid Dose (Rem)	Whole Body Dose (Rem)
0-2 hour, EAB	128	0.02
0-4 hour, LPZ	9	0.002