September 1, 1982

Docket No. 50-29
LS05-82-09-007

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

Dear Mr. Kay:

SUBJECT: SEP TOPIC XV-2, SPECTRUM OF STEAM SYSTEM PIPING FAILURES INSIDE AND OUTSIDE CONTAINMENT (RADIOLOGICAL CONSEQUENCES) - YANKEE NUCLEAR POWER STATION

Enclosed is the staff's draft evaluation of SEP Topic XV-2 for the Yankee Plant. This evaluation is based upon an analysis performed by the staff using data in the Yankee Final Hazards Summary Analysis Report, Technical Specifications and assumptions made by the staff.

You are requested to examine the facts and assumptions upon which the staff has based its draft evaluation and respond either by confirming that they are correct, or by identifying errors and supplying the corrected information. We encourage you to supply any other material that might affect the staff's evaluation of this topic or be significant in the integrated assessment of your facility.

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 this topic complete.

SEO4
DSA USG(11)

Sincerely,

Original signed by:

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

Enclosure:
As stated

cc w/enclosure:
See next page

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YANKEE ROWE NUCLEAR POWER STATION

XV-2 SPECTRUM OF STEAM SYSTEM PIPING FAILURES INSIDE AND OUTSIDE CONTAINMENT (RADIOLOGICAL CONSEQUENCES)

I. INTRODUCTION

Rupture of a steam line outside containment will allow radioactivity contained in the primary and secondary coolant to escape to the environment. SEP Topic XV-2 is intended to review the radiological consequences of such failures. The review will encompass those design features which limit the release of radioactivity in the released coolant and the amount of primary to secondary leakage.

II. REVIEW CRITERIA

Section 50.34 of 10 CFR Part 50 requires that each applicant for a construction permit or operating license provide an analysis and evaluation of the design and performance of structures, systems, and components of the facility with the objective of assessing the risk to public health and safety resulting from operation of the facility. The steam line break accident is one of the postulated accidents used to evaluate the adequacy of these structures, systems, and components with respect to the public health and safety.

In addition, 10 CFR Part 100.11 provides dose guidelines for reactor siting against which calculated accident dose consequences may be compared.

III. RELATED SAFETY TOPICS

Topic II-2.C, "Atmospheric Transport and Diffusion Characteristics for Accident Analysis" provides the meteorological data used to evaluate the offsite doses. Topic III-5.A, "Effects of Pipe Breaks on Structures,

Systems and Components Inside Containment," and Topic III-5.B, "Pipe Break Outside Containment" will cover the dynamic effects of the postulated pipe failure inside and outside containment.

IV. REVIEW GUIDELINES

The review of the radiological consequences of these failures was conducted in accordance with the Appendix of Standard Review Plan 15.1.5, "Radiological Consequences of Main Steam Line Failures Outside Containment." This review determines the effects of fuel damage, iodine spiking and primary to secondary steam generator tube leakage on Exclusion Area Boundary (EAB) and Low Population Zone (LPZ) Boundary doses after a steam line break for two hours or the course of the accident, respectively, and then compares these doses to the dose guideline values in 10 CFR Part 100. The plant is considered adequately designed against steam line failures if the calculations show that the resulting offsite doses are less than a small fraction (10%) of the 10 CFR Part 100 exposure guidelines for the case of an accident-induced iodine spike, and are within the exposure guidelines of 10 CFR Part 100 for the case of a preaccident iodine spike or one rod held out of the core.

V. EVALUATION

The licensee did not provide an evaluation of the radiological consequences following a postulated main steam line break accident; therefore, the staff has performed such an evaluation using what are believed to be conservative assumptions as outlined below.

1) Release of activity following this accident is via the secondary system, but consists of activity originally contained in the secondary system and that which passes from the primary system through steam generator tube leaks.

2) The licensee's current technical specifications incorporate the (primary coolant) activity limits specified in the Westinghouse Standard Technical Specifications and the staff used these values in its analyses.

Two cases have been evaluated and both assume that no fuel failures occur as a result of the accident. The first case (Case 1) assumes that the primary coolant activity is at the maximum technical specification limit permitted in the plant technical specifications, 60 µCi/gram dose equivalent Iodine-131 (DEI-131). All the primary-to-secondary leakage is assumed to occur in the affected steam generator and is assumed to continue at the technical specification rate of 1.0 gallon per minute for a period of 8 hours, after which the leakage is assumed to cease. All the iodine in the primary-to-secondary leakage is assumed released to the environment. Because the licensee did not provide an estimate of the steam released during the plant cooldown, the staff estimated the amount of steam dumped to the environment from the secondary side for Yankee Rowe and conservatively assumed that all the steam released had an iodine specific activity equal to 0.25 µCi/gram DEI-131 as assumed in the licensee's FSAR steam line break analysis. (Note: this is reasonable because the licensee's technical specification limit for iodine in the secondary coolant is 0.20 µCi/ml iodine 131; most of the iodine in the secondary coolant will be I-131.) The appropriate values used in the staff calculations are presented in Table XV-2-1 of this evaluation.

Using these conservative assumptions, and the atmospheric dispersion factors generated under SEP Topics II-2.C, as shown in Table XV-2-2 the resultant offsite radiological consequences are less than the guideline values of 10 CFR Part 100.

In the second case (Case 2), the staff evaluated the radiological consequences of a main steam line break event assuming that the accident initiates an iodine spike which increases the specific activity of iodine in the primary coolant at the rate of 50 μCi/gram DEI-131 per hour. The spike is assumed to increase the primary coolant activity over a period of 4 hours after which the coolant activity is assumed to remain constant at the 4 hour value. For this case the staff assumed that the primary coolant has an initial specific activity of 1.0 μCi/gram DEI-131. Using the conservative assumptions summarized in Table XV-2-1 of this evaluation, the calculated offsite radiological consequences are less than a small fraction of the 10 CFR Part 100 guideline values.

The staff's estimates of the offsite radiological consequences at the Exclusion Area and Low Population Zone boundaries are presented in Table XV-2-2. The whole body doses are expected to be small, and because they do not approach the acceptance criteria, they are not presented in the table.

VI. CONCLUSION

Based upon the staff's evaluation which used the licensee's coolant iodine activity values as given in the plant technical specifications, the potential radiological consequences following a main steam line break at the Exclusion Area and Low Population Zone Boundaries are less than the acceptance criteria

given in SRP Section 15.1.5 Appendix A and the guideline values of 10 CFR Part 100. However, the staff's analyses were based upon certain assumptions regarding the design and operation of the Yankee Rowe facility (i.e., amount of steam dump following loss of offsite power, iodine spiking factor, and secondary coolant iodine activity). The staff recommends that the licensee confirm that the plant-specific assumptions used in the staff's analyses of a main steam line break accident with a loss of offsite power are bounding for the Yankee Rowe facility. Upon receipt of such confirmation, this particular topic for the Yankee Rowe facility is completed.

TABLE XV-2-1

ASSUMPTIONS MADE IN ANALYSES OF THE RADIOLOGICAL

CONSEQUENCES OF THE MAIN STEAM LINE BREAK

OUTSIDE CONTAINMENT ACCIDENT

1. Reactor power = 618 MWth

2. Loss of offsite power following the accident

3. Iodine decontamination factor of 1 between water and steam for primary to secondary leakage (steam generator is dry).

4. No additional fuel failure is assumed.

5. Primary to secondary leak rate of 1.0 gpm to the affected steam generator for a period of 8 hours.

6. Primary coolant specific activity prior to the accident

   Case 1: 60 µCi/gm DEI-131.

   Case 2: 1.0 µCi/gm DEI-131.

7. Secondary coolant specific activity prior to the accident of 0.25 µCi/gram of DEI-131

8. Iodine spiking factor in the primary coolant of 50 µCi/gram-hrs DEI-131 for the first four hours (Case 2, an accident-induced iodine spike).

9. Atmospheric dispersion factors (sec/cubic meter) from SEP

   Topic II-2.C:

   Exclusion Area Boundary (0-2 hour) = 2.84 E-4

   Low Population Zone Boundary (0-8 hours) = 2.84 E-5

10. Total secondary coolant assumed to be released to the environment:

    0 - 2 hour = 73,000 lbs

    0 - 8 hours = 148,000 lbs

TABLE XV-2-2

THYROID DOSES FOLLOWING A MAIN STEAM LINE BREAK ACCIDENT

Case	Thyroid Doses (Rem) Exclusion Area Boundary	Low Population Zone Boundary
Case 1 (PCA* = 60 µCi/gram DEI-131)	6	1.7
Case 2 (PCA* = 1 µCi/gram DEI-131 with a concurrent iodine spike)	5.7	3.2

* PCA = Primary Coolant Activity