August 27, 1982

Docket No. 50-213
LS05-82-08-053

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

Dear Mr. Counsil:

SUBJECT: HADDAM NECK - SEP TOPIC XV-19, LOSS-OF-COOLANT ACCIDENTS RESULTING FROM SPECTRUM OF POSTULATED PIPING BREAKS WITHIN THE REACTOR COOLANT PRESSURE BOUNDARY (RADIOLOGICAL CONSEQUENCES)

Enclosed is the staff's final evaluation of SEP Topic XV-19 (Radiological Consequences). The evaluation is based on our review of your topic safety assessment report of September 30, 1981, and an independent analysis performed by the staff. The staff has determined that off-site doses from a postulated design basis loss-of-coolant accident at Haddam Neck are within the guidelines of 10 CFR 100.11 under the assumptions made in the review. However, for the reasons set forth in the evaluation the operation of the containment spray system for this event will be considered in the integrated assessment of your facility.

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,

SEO 4
DSU 0SG(08)
AND:
S. BROWN

Dennis M. Crutchfield, Chief
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8209010008 820827
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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
SURNAME	TMichaels:dk	SBrown	CGrimes	WRussell	CTropf	DCrutchfield	TIppolito
DATE	8/23/82	8/27/82	8/23/82	8/27/82	8/24/82	8/ /82	8/25/82

Mr. W. G. Counsil

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LOSS OF COOLANT ACCIDENTS RESULTING FROM A SPECTRUM OF PIPING BREAKS WITHIN THE REACTOR COOLANT PRESSURE BOUNDARY

I. INTRODUCTION

Loss-of-coolant accidents (LOCA's) are postulated breaks in the reactor coolant pressure boundary resulting in a loss of reactor coolant at a rate in excess of the capability of the reactor coolant makeup system. A LOCA will result in excessive fuel damage or melt unless coolant is replenished. Excessive fuel damage can result in significant radiological consequences to the environment via leakage from the containment. SEP Topic XV-19 is intended to assure that the radiological consequences of a design basis LOCA from containment leakage and leakage from engineered safety features outside containment are within the exposure guideline values of 10 CFR Part 100.

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 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 Structure, Systems, and Components Inside Containment," ensures that the ability to safely shut down or mitigate the consequences of an accident is maintained. Various other related topics cover containment integrity and isolation, post-accident chemistry, ESF systems, combustible gas control, and control room habitability.

IV. REVIEW GUIDELINES

The review of the radiological consequences of a LOCA was conducted in accordance with the Appendices A and B to Standard Review Plan 15.6.5, Standard Review Plan 6.5.3, Regulatory Guide 1.4, and TID-14844. The plant is considered adequately designed against a LOCA, and the dose mitigating features are acceptable, if the resulting doses at the Exclusion Area Boundary and the outer boundary of the Low Population Zone are within the guideline values of 10 CFR Part 100.

V. EVALUATION

The staff reviewed the licensee's submittal for evaluation of the loss-of-coolant accident (LOCA). The licensee determined that the total radiological consequences of such an accident meet the exposure guidelines of 10 CFR Part 100.11 with respect to the adequacy of the distances to the Exclusion Area Boundary and the Low Population Zone outer boundary. The analysis included the contributions from containment leakage and from post-LOCA leakage from ESF systems outside containment.

The staff reviewed this analysis and performed an independent analysis of the radiological consequences from the two pathways mentioned above. The containment recirculation fan coolers and filtration units are

relied upon to reduce containment pressure and to remove fission products. In addition, a non-safety grade containment spray system is included in the plant design as a back-up to the fan-cooler/filtration units. The licensee's analysis included the assumption of fission product removal by the filtration units, but did not include any credit for the containment spray system.

The validity of the staff evaluation is dependent on the assumptions listed in Table 1 for containment leakage, recirculation fan cooler filter efficiency, and primary auxiliary building filter efficiency. These assumptions include the technical specifications the licensee has proposed for containment leakage and recirculation fan cooler filter efficiency (Connecticut Yankee Atomic Power Company letter to NRC, March 21, 1978), and the technical specifications for the primary auxiliary building filters recommended by the staff (W. Gammill memo to Crutchfield, April 21, 1982).

The staff's analysis was performed according to SRP 15.6.5. The radiological source term was based on the assumptions of Regulatory Guide 1.4 and included the assumed release of 100% of the noble gases and 25% of the iodine to the containment atmosphere. The staff's analysis included an assessment of the operability and effectiveness of the ESF filtration system, according to SRP 6.5.3, which requires a determination "that each system can perform its function as claimed to reduce the fission product release following a postulated design basis accident." The licensee's design basis for the ESF filtration system is the release of fission products (including solids) assumed in TID-14844 (see Facility Description and Safety Analysis (FDSA), Page 3.6-40). The TID-

14844 fission product release includes the assumption of one percent of the solid fission products uniformly distributed in the containment atmosphere, in addition to the noble gases and iodines discussed above. One estimate of this release would represent a total of about 20 kg of airborne solid fission products, in addition to the condensing steam, as the environment in which the filter has to function. The filter units include moisture separators, high efficiency particulate air filters, and charcoal adsorber units to achieve its design basis function in this environment.

The staff's evaluation of the filter effectiveness of these units indicates that effective operation of this system would be expected, based upon a R.G. 1.4 source term. The filter efficiencies, as well as other input assumptions used in our dose calculations, are shown in Table 1. The atmospheric dispersion factors used are those developed as a result of the review of Topic II-2.C, "Atmospheric Transport and Diffusion Characteristics for Accident Analysis." The results of our calculations, shown in Table 2, demonstrate that the off-site doses at the Exclusion Area Boundary and at the outer boundary of the Low Population Zone are within the guideline values of 10 CFR 100.11. It should also be noted that the contributions to the calculated doses by direct shine from the full TID-14844 source term is negligible because of the shielding afforded by the reinforced concrete containment at Haddam Neck.

It should be noted that Haddam Neck is the only SEP Phase II plant that relies upon containment recirculation filters without containment sprays for fission product removal. Since current designs do not employ such

systems, current licensing criteria have not been structured to deal specifically with the question of the adequacy of the postulated accident characterization, i.e., a TID release as a design basis for these systems. A question arises as a result of the fact that an assumed dispersal of 1% of the fission product solids into the containment atmosphere would also be accompanied by a dispersal of non-fission product solids whose combined mass would exceed that of the fission product solids. This could reduce or negate the effectiveness of an internal filter system. Plants which utilize spray systems for fission product removal would not be adversely affected by the non-radioactive particulate releases associated with the release of solid fission products.

The staff has not evaluated effectiveness of the Haddam Neck containment spray system. Based upon experience in the evaluation of other facilities' containment spray systems, it is the staff's judgement that greater assurance of the effective fission product removal could be achieved by operation of the spray system for a short period of time.

VI. CONCLUSIONS

Based on our review of the licensee's analysis and our independent evaluation, we conclude that the off-site doses from a postulated design basis loss-of-coolant accident at Haddam Neck are within the guidelines of 10 CFR 100.11, given the assumptions stated in Table 1.

We recommend, however, for the reasons set forth above, that the operation of the containment spray system to assure the effectiveness of the

internal filter system be considered in the integrated assessment of this plant.

Table 1

Assumptions Used in Analysis of the Offsite Doses Following a LOCA

(Recirculation filters fully effective, no spray actuation)

1.	Reactor power level	1825 MWt
2.	Containment volume	2,230,000 cubic feet
3.	Containment leak rate	0.18 %/day (first 24 hours) 0.09 %/day (after 24 hours)
4.	Atmospheric dispersion coefficients in sec/cubic meter	0-2 hours EAB* 8.4 E-04*** 0-8 hours LPZ** 7.6 E-05 8-24 hours LPZ 5.4 E-05 24-96 hours LPZ 2.6 E-05 4-30 days LPZ (.0 E-06
5.	Fission product release, as fraction of equilibrium core inventory	25% of iodines 100% of noble gases
6.	Iodine split between chemical/physical forms	91% elemental 4% organic 5% particulate
7.	Containment air recirculation filter efficiencies for iodine	90% removal for elemental 30% removal for organic 95% removal for particulate
8.	Total containment air recirculation flow rate	0-15 minutes: 50,000 cfm after 15 minutes: 150,000 cfm
9.	RHR system leakage	1.6 gallons/hour (as soon as RHR in operation) 50 gallons/minute, for 30 minutes, starting 24 hours after accident
10.	Release from RHR leakage	10% of iodine becomes airborne, 90% of this is filtered out by primary auxiliary building filters.

*Exclusion Area Boundary (10 CFR 100)
**Outer boundary of Low Population Zone (10 CFR 100)
***8.4E-04 = 8.4 x 10-4 = .00084

Table 2

CALCULATED OFFSITE LOCA DOSES
ASSUMING UNIMPARED OPERATION OF FILTERS

	Exclusion Area Boundary		Low Population Zone (0-30 days)	
	Rems Thyroid	Rems Whole Body	Rems Thyroid	Rems Whole Body
Containment Leakage	290	6.0	265	1.4
ESF Leakage	3	Negligible	29	Negligible
Total LOCA Dose	293	6.0	294	1.4