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May 2, 1984

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Subject: Byron Generating Station Units 1 and 2
Braidwood Generating Station Units 1 and 2
Reactor Coolant Pump Transients
NRC Docket Nos. 50-454, 50-455, 50-456 and 50-457

Reference (a): June 7, 1982 letter from T. R. Tramm to
H. R. Denton.

Dear Mr. Denton:

This letter provides additional information regarding postulated reactor coolant pump locked rotor and shaft break transients for the Byron/Braidwood units. Review of this information should close Confirmatory Issue 34 of the Byron SER.

In reference (a) we indicated that during a locked rotor transient, steam releases associated with the a stuck open steam generator relief valve, safety valve or dump valve would not pose a radiological hazard. In telephone discussions with the NRC Staff it was noted that the existing transient analysis predicts that a small percentage of the fuel rods will experience departure from nucleate boiling (DNB) during a locked rotor transient. Westinghouse predicted that none of the fuel rods would fail during such a transient. The NRC is, however, not able at present to endorse the technial basis for that fuel failure analysis. Any fuel rods which experience DNB should be presumed to fail. In the locked rotor transient substantial offsite releases would be predicted for the case involving a stuck open secondary side valve, design basis steam generator leakage, and coincident loss of offsite power.

The locked rotor transient has now been reanalyzed for the Byron/Braidwood units. The new analysis shows that no fuel rods will experience DNB and no fuel rods will fail. The offsite releases for this case would therefore be well within the 10 CFR 100 limits.

Appropriate changes to the FSAR will be made to document this analysis. Enclosed are advance copies of FSAR sections 15.3.3 and tables 15.3-3, 15.3-4, 15.0-9 and 15.0-10. Offsite doses tabulated in tables 15.0-11 and 15.0-12 are still being recalculated but they are expected to decrease. These changes will be incorporated into the FSAR at the earliest opportunity.

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Please direct further questions regarding this matter to this office.

One signed original and fifteen copies of this letter and the enclosures are provided for NRC review.

Very truly yours,

T. R. Tramm

T. R. Tramm
Nuclear Licensing Administrator

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Enclosures

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15.3.3.3 Radiological Consequences

The evaluation of the radiological consequences of a postulated seizure of a reactor coolant pump rotor (Locked Rotor Accident-LRA) assumes that the reactor has been operating with a small percent of defective fuel and leaking steam generator tubes for sufficient time to establish equilibrium concentrations of radionuclides in the reactor coolant and in the secondary coolant.

As a result of the accident, radionuclides carried by the primary coolant to the steam generators, via the leaking tubes, are released to the environment via the steam line safety or power operated relief valves.

The major assumptions and parameters used in the analysis are itemized in Table 15.3-3.

15.3.3.3.1 Source Term

The concentration of nuclides in the primary and secondary system, prior to and following the accident are determined as follows:

a. The iodine concentrations in the reactor coolant will be based upon preaccident and accident initiated iodine spikes.

    1. Accident Initiated Spike - The reactor trip associated with the LRA creates an iodine spike in the primary system which increases the iodine release rate from the fuel to the primary coolant to a value 500 times greater than the release rate corresponding to the maximum equilibrium primary system iodine concentration of 1 μCi/gram of Dose Equivalent (D.E.) I-131. The duration of the spike is assumed to be 2.5 hours.

    2. Preaccident Spike - A reactor transient has occurred prior to the LRA and has raised the primary coolant iodine concentration to 60 μCi/gram of Dose Equivalent I-131.

b. The noble gas concentrations in the primary coolant are based on 1 percent defective fuel.

c. The secondary coolant activity is based on the D.E. of 0.1 μCi /gram of I-131.

15.3.3.4 Conclusions

a. Since the peak reactor coolant system pressure reached during any of the transients is less than that which would cause stresses to exceed the faulted condition stress limits, the integrity of the primary coolant system is not endangered.

b. Since the peak clad surface temperature calculated for the hot spot during the worst transient remains considerably less than 2700°F the core will remain in place and intact with no loss of core cooling capability.

c. The radioactivity released to the environment as the result of a postulated LRA is presented in Table 15.3-4. The resulting thyroid and whole body doses at the exclusion area boundary and at the low-population zone outer boundary are presented in Tables 15.0-11 and 15.0-12.

15.3.3.5 Locked Rotor With A Concurrent Power Operated Relief Valve (PORV) Failure

A locked rotor event with a concurrent PORV failure was also evaluated. In evaluating the radiological consequences of this event, water level in the effected steam generator is assumed to be lost and hence, no credit for iodine partitioning is taken. The consequences for this event are bounded by the steam line break consequences presented in Section 15.1.5.

B/B-FSAR

TABLE 15.3-3

ASSUMPTIONS USED FOR THE LOCKED ROTOR ACCIDENT

	EXPECTED	DESIGN
Power	3565	3565
Fraction of Fuel with Defects	0.0012*	See Text, Section 15.3.3.3
Reactor Coolant Activity Prior to Accident	ANS-N237	See Text, Section 15.3.3.3
Secondary Coolant Activity Prior to Accident	ANS-N237	See Table 15.0-9
Total Steam Generator Tube Leak Rate During Accident and Initial 8 Hours	0.009 gpm	1 gpm
Activity Released to Reactor Coolant from Failed Fuel		
Noble Gas	0.0% of core inventory	0.0% of core inventory
Iodine	0.0% of core inventory	0.0% of core inventory
Iodine Partition Factor Prior to the Accident	0.1	0.01
Duration of Plant Cooldown by Secondary System After Accident, hr	8	8
Steam Release from 4 Steam Generators	**	561,979 lb (0-2 hr) 936,100 lb (2-8 hr)
Feedwater Flow to 4, Steam Generators	793,091 (0-2 hr) 1,024,438 (2-8 hr)	793,091 lb (0-2 hr) 1.024,438 lb (2-8 hr)
Offsite Power	Available	Lost

* Per ANS-237, American National Standard Source Term Specification.

** Condenser available, steam released through condenser off-gas system at 60 SCFM.

TABLE 15.3-4

ACTIVITY RELEASES TO ATMOSPHERE FROM LOCKED ROTOR ACCIDENT

			CONSERVATIVE ANALYSES RELEASES (Ci)			
REALISTIC ANALYSIS ACTIVITY RELEASE (Ci)			PRE-ACCIDENT IODINE SPIKE		ACCIDENT INITIATED IODINE SPIKE	
Isotope	0-2 Hr	2-8 Hr	0-2 Hr	2-8 Hr	0-2 Hr	2-8 Hr
I-131	6.8 (-4)	1.3 (-3)	2.5 (-1)	9.7 (-1)	2.0 (-1)	1.0 (+0)
I-132	8.9 (-5)	7.2 (-5)	6.6 (-1)	8.0 (-1)	9.1 (-1)	4.3 (+0)
I-133	7.1 (-4)	1.3 (-3)	3.9 (-1)	1.3 (+0)	3.3 (-1)	1.9 (+0)
I-134	9.2 (-6)	2.9 (-6)	2.8 (-2)	7.5 (-3)	6.1 (-2)	1.3 (-1)
I-135	2.2 (-4)	3.6 (-4)	2.0 (-1)	5.1 (-1)	2.0 (-1)	1.2 (+0)
Xe-133	1.9 (-2)	5.7 (-2)	1.71 (+1)	5.1 (+1)		
Xe-133m	3.9 (-4)	1.1 (-3)	3.5 (-1)	9.9 (-1)		
Xe-135	1.1 (-3)	2.3 (-3)	9.9 (-1)	2.1 (+0)		
Xe-135m	9.9 (-6)	NEGLIGIBLE	8.9 (-3)	---	Xe and Kr Isotopes Same As Pre-Accident Spike Case	
Xe-138	3.6 (-5)	NEGLIGIBLE	3.2 (-2)	---		
Kr-85	2.7 (-5)	8.1 (-5)	2.4 (-2)	7.3 (-2)		
Kr-85m	3.3 (-4)	5.5 (-4)	3.0 (-1)	5.0 (-1)		
Kr-87	1.4 (-4)	6.9 (-5)	1.3 (-1)	6.2 (-2)		
Kr-88	5.9 (-4)	7.0 (-4)	5.3 (-1)	6.3 (-1)		

Note: $6.8(-4) = 6.8 \times 10^{-4}$

TABLE 15.0-9

SECONDARY COOLANT EQUILIBRIUM IODINE ACTIVITY Based ~~USED IN ACCIDENT DOSE ANALYSIS~~ on 0.1 μCi/gram of D.E I-131

Isotope	Concentration (μCi/gm)
I-131	~~0.0784~~ 0.066
I-132	~~0.01~~ 0.239
I-133	~~0.0717~~ 0.106
I-134	~~0.00096~~ 0.016
I-135	~~0.0195~~ 0.058

TABLE 15.0-10

REACTOR COOLANT EQUILIBRIUM IODINE AND NOBLE GAS ACTIVITIES USED IN ACCIDENT DOSE ANALYSES

ISOTOPE	ACTIVITY (μCi/gm)
I-131	39.76
I-132	14.31
I-133	63.62
I-134	9.54
I-135	34.99
Xe-133	398.03
Xe-133m	4.39
Xe-135	8.92
Xe-135m	0.283
Xe-138	0.992
Kr-85	12.46
Kr-85m	2.97
Kr-87	1.70
Kr-88	5.24

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Reactor Coolant Iodine Activity Based on 60 μCi/gm of D.E. I-131 and Reactor Coolant Noble Gas Inventory Based on 1 % Fuel Defects

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