14.23 WASTE PROCESSING SYSTEM INCIDENT

14.23.1 GENERAL

In the event of a seismically-induced failure of the reactor coolant Waste Processing System, it is hypothesized that the contents of some components in the system will be released. The release of the contents of the Waste Processing System is analyzed to the site boundary dose limits specified in 10 CFR 20.1301(a)(1).

14.23.2 METHOD OF ANALYSIS

The analysis was performed using the following methodology:

a. The fuel fission product source term is calculated for the most limiting assemblies using the SAS2H depletion sequence of the SCALE code system. The reactor coolant source term is determined based on 1% failed fuel damage, which is consistent with the source term used in UFSAR Sections 14.13 through 14.16.

b. The Alternative Source Term (AST) methodology of 10 CFR 50.67 and Regulatory Guide 1.183 is used to calculate doses due to a waste processing incident. Only noble gasses, halogens (iodine), and tritium are considered in the dose analysis. Site boundary Total Effective Dose Equivalent (TEDE) doses due to the waste processing incident are calculated using the RADTRAD computer code. The waste processing system incident model is constructed assuming that failure of all waste processing system components occurs at time, t = 0. The decay and daughter product options of RADTRAD are utilized. The rate of escape of activity to the environment is assumed to occur within a matter of minutes and is transported to the site boundary via appropriate atmospheric dispersion coefficients.

c. Dose consequences are calculated (Reference 1) for simultaneous failure of some Waste Processing System components downstream of the containment isolation valves (1/2-CV-4260).

14.23.3 ASSUMPTIONS

a. Feed to the Waste Processing System is assumed to be reactor coolant with 100/Ebar µCi/gm noble gas equilibrium activities (Reference 2) which are more limiting than the 1% failed fuel noble gas activities and are based on the Technical Specification limit. The reactor coolant iodine equilibrium activities are based on 1% failed fuel. A reactor coolant equilibrium tritium concentration of 3.5 µCi/cc is used.

b. Credit for processing prior to each Waste Processing System component is assumed. Decontamination factors are consistent with the original evaluation for the evaporators, with Reference 3, and are listed in Table 14.23-1. Contrary to the original evaluation for the evaporators, a decontamination factor of unity is assigned to the degasifier to bound actual plant system performance levels.

c. For the evaporator failure, it is assumed that the evaporator feed tanks and associated piping are filled with processed reactor coolant source term. Contrary to the original evaluation for the evaporators, this analysis does not postulate a concentrated liquid waste due to evaporator operation. This assumption applies to an evaporator system that is no longer operational, but is still physically connected to the Waste Processing System and therefore the feed tanks are postulated to contain activity due to leakage. Since the evaporator feed tanks are at 160°F, no flashing is assumed, and 10% of each evaporator feed tank volume is assigned to evaporate. The following release fractions are assumed:

   1. 10^{-3} of all of the iodine in solution is assumed to come out of solution;

2. All noble gases are released;
3. All of the iodine and tritium in the evaporated portion of the evaporator feed tanks is released.

The release is conservatively treated as an instantaneous puff release.

d. For other components of the Waste Processing System, no flashing of the continued fluid is assumed since piping design temperatures are < 180°F, and release fractions for tritium, iodine, and noble gases are assumed to be 10%, 10.1%, and 100%, respectively. Upon failure of an ion exchanger, 10% of the equilibrium halogen inventory on the resin is assumed to instantaneously and non-mechanistically transfer to the water. The rate of escape of all radionuclide activity to the environment is assumed to occur within a matter of minutes.

e. The ventilation stack-to-site boundary 0-2 hour atmospheric dispersion coefficient is 1.44×10^{-4} sec/m^3 (UFSAR Section 2.3.6).

f. A breathing rate of 3.5×10^{-4} m^3/sec is assumed.

g. Doses were computed using the dose conversion factors from Federal Guidance Report (FGR) Nos. 11 and 12.

h. The following components are postulated to fail due to a seismic event in the Waste Processing System incident:
   1. Spent Resin Metering Tank
   2. Miscellaneous Waste Monitor Tank
   3. Reactor Coolant Evaporator Feed Tanks (2)
   4. Reactor Coolant Evaporator System Piping

14.23.4 RESULTS

The calculated control room and offsite doses are as follows:

Dose, REM (TEDE)		
Control Room	EAB	LPZ
0.153	0.031	0.007

14.23.5 CONCLUSIONS

In the event of a failure of the reactor coolant Waste Processing System, the total radioactivity released to the atmosphere and carried to the site boundary will be less than the maximum allowable limits of 0.1 REM (TEDE) specified in 10 CFR Part 20.1301(a)(1).

The control room dose consequence due to this event is less than the allowable limit specified in 10 CFR 50.67.

14.23.6 REFERENCES

1. J.R. Massari, “Waste Processing Incident for Alternate Source Term,” CA06608, Revision 0000
2. CA06422, “Primary and Secondary Isotopic Calculations,” Revision 0000
3. T. Chandrasekaran, J.Y. Lee, C.A. Willis, “Calculation of Releases of Radioactive Materials in Gaseous and Liquid Effluents from Pressurized Water Reactors,” U.S. Nuclear Regulatory Commission, NUREG-0017, Revision 1, April 1985
4. ECP-14-000889-004-CN-001 CA06608-0000, "Waste Processing System Incident for Alternate Source Term," Revision 0000

TABLE 14.23-1

SUMMARY OF COMPONENT DECONTAMINATION FACTORS AND AMOUNT OF PRIOR PROCESSING CREDITED FOR EACH WASTE PROCESSING SYSTEM COMPONENT

Pre-Component Processing DFs	CVCS IX	Degasifier	RCW IXs 11 & 12	Process Skid or RCW IXs 13 & 14	Total Pre-Component DF Used (NG/H/T)
Noble Gas (NG) DF	1	1	1	1	
Halogen (H) DF	10	1	10	10	
Tritium (T) DF	1	1	1	1	
Pre-Processing Credited (indicated by √) for Each Waste Processing System Component					
RCW Evaporators	√	√	√		1/100/1
RCW Processing Skid	√	√	√		1/100/1
RCW Receiver Tank & MW Tanks	√	√	√		1/100/1
RCW Monitor Tanks	√	√	√	√	1/1E3/1
RCW IXs (11 & 12)	√	√			1/10/1
RCW IXs (13 & 14)	√	√	√		1/100/1
RCW Degasifiers	√	√			1/10/1
RCW Filters	√				1/10/1
System Piping	√				1/10/1
MW Monitor Tank	N/A	N/A	N/A	N/A	4/4/4