OCONEE NUCLEAR STATION

RADIOACTIVE WASTE VOLUME REDUCTION INCINERATOR

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1.0 DESCRIPTION

1.1 INTRODUCTION

The Oconee Nuclear Station's Radwaste Facility is designed to process both liquid and solid radioactive waste. The wastes will include miscellaneous liquid waste (radioactive equipment drains and floor drains, etc.), degassed reactor coolant bleed, resins, waste oil, and miscellaneous radioactive trash (gloves, paper, etc.). The liquid waste will be processed by an appropriate combination of equipment (filters, demineralizers, evaporator, etc) in the Liquid Waste and Recycle System (LW). Powdered resin used in the Condensate Polishing Demineralizers will be collected and monitored in the Resin Recovery System (RR). Solid waste will be processed by an appropriate combination of equipment which includes an incinerator. The incinerator which is part of the Oconee Radwaste Solidification System (VR), is described in detail in the Aerojet Energy Conversion Company (AECC) Topical Report No. AECC-3-P (reference 1). A list of station specific exceptions is provided in Attachment 1. The VR System is composed of three subsystems, the Concentrated Waste Collection Subsystem, the Waste Packaging Subsystem, and the Volume Reduction Subsystem (not to be confused with the VR system), which contains the incinerator to be licensed.

1.2 PURPOSE OF INCINERATOR

The primary purpose of the incinerator is to volume reduce certain low level radioactive wastes (LLW) prior to disposal. This concept is consistent with the policy of the U.S. Nuclear Regulatory Commission (NRC) as published in the Federal Register on Oct. 16, 1981 (Vol. 46, No. 200, pp. 51100-51101). This

policy statement encourages the use of volume reduction (VR) techniques to conserve existing burial space and to decrease radioactive waste shipments. Incineration provides the maximum VR factor for certain large volume LLW streams (e.g., dry active waste (DAW)). It generally reduces combustible waste streams to more fundamental chemical compounds which are inherently more chemically stable and environmentally compatible.

1.3 VOLUME REDUCTION SUBSYSTEM

The Volume Reduction Subsystem, as shown in figure 1.2-1, is designed to volume reduce radioactive waste prior to packaging for disposal. The Volume Reduction Subsystem which includes a fluid bed dryer, a fluid bed incinerator, off-gas handling components, a trash shredder, a wet solids feed skid, and a contaminated oil handling skid, will be used to further concentrate wet wastes via the fluid bed dryer and/or incinerate combustible wastes via the fluid bed incinerator.

The fluid bed incinerator shares a common off-gas cleanup system with the fluid bed dryer. Exhaust from each is directed to a gas/solids separator. The heavy solids fall out and are transferred to the solidification equipment contained in the Waste Packaging Subsystem. Fines from both exhausts are removed in a pH- and concentration-controlled, wet scrubber/preconcentrator loop. The scrubber/preconcentrator loop provides a constant feed for the fluid bed dryer and receives waste from the Concentrated Waste Collection Subsystem. Gases and vapors from the scrubber/preconcentrator loop are directed through a secondary scrubber, an off-gas condenser, and then discharged through the off-gas filters.

The product which will result from the use of this system will be a dry, free-flowing mixture of salt granules and ash. This material will be transferred to the Waste Packaging Subsystem where it will be solidified and packaged to meet DOT, NRC, and licensee requirements.

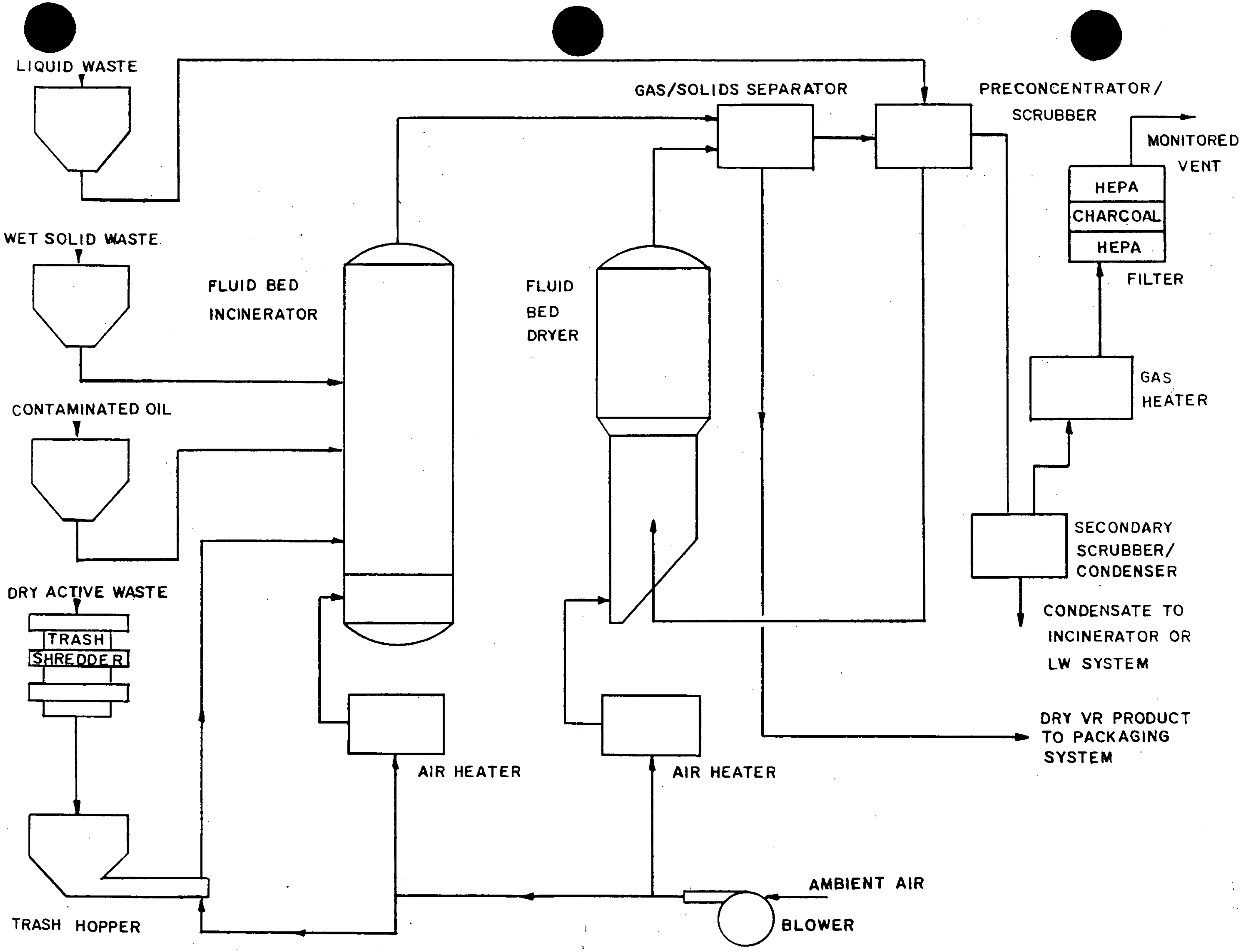

FIGURE 1.2–1 VOLUME REDUCTION SUBSYSTEM

1.3.1 SOLID WASTE ASH TRANSPORT

All solid waste ash transport is accomplished pneumatically. The incinerator bed may be dumped to the bed storage hopper and returned to the incinerator. By this means either component may be emptied to minimize radiation exposure. Incinerator ash is separated from exhaust gas by a cyclone separator. This ash drops by gravity into the Waste Packaging Subsystem.

1.3.2 INCINERATOR INTERFACES

The incinerator may receive waste via several interfaces including the Trash Storage Hoppers, the Contaminated Oil Skid, and the Resin Batch Tank (RBT) (contained in the Concentrated Waste Collection Subsystem). These components are all housed by the Radwaste Facility.

Contaminated DAW will be collected from other areas of the station and brought to the Radwaste Facility where it will be fed into the shredder described in the AECC Topical Report. The shredded DAW will be transported by enclosed conveyers to the Trash Storage Hoppers which feed the incinerator.

Oil drained from pump motors or skimmed from station sumps may be slightly contaminated. If so, it will be collected and moved to the Radwaste Facility, transferred into the Contaminated Oil Tank, and burned in the incinerator, as described in the AECC Topical Report.

Resin slurries will be fed into the incinerator from the concentrated Waste Collection Subsystem via the incinerator resin pump which takes suction off the

recirculation loop of the Resin Batch Tank. Resins, such as contaminated Condensate Polishing Demineralizer resin from the station, will be transferred to the RBT so that they can be either incinerated or packaged for burial according to DOT, NRC, and licensee requirements.

1.4 OPERATION

The Volume Reduction Subsystem is one portion of the total radwaste processing scheme at Oconee. The equipment in the Radwaste Facility will be controlled and operated by dedicated personnel whose sole responsibility is radwaste processing. These personnel are members of a distinct and permanent radwaste group at the station.

The radwaste group is made up of technicians, supervisors and staff support. These personnel are trained and qualified on each component and procedure required for the completion of all the tasks under their purview. This training is part of a formal Employee Training and Qualification Program which includes classroom and on-the-job skill development. The normal training program for radwaste has been expanded to incorporate the vendor training and materials associated with the new equipment. Beside the vendor classroom instruction, which has been videotaped for future use, the vendors provided in-the-field training and on-site consulting during start-up testing.

In addition to a technical understanding of the actual processes involved, the Duke training program develops a general ALARA philosophy, a specific awareness of environmental, regulatory, and technical specification requirements, and an awareness of the political/economical impact that

radwaste disposal has on the company. This technical background coupled with a well-defined career path with specific goal-oriented milestones, engenders a professional attitude in the radwaste personnel and an effort to obtain optimal performance from equipment.

2.0 EFFLUENT TREATMENT

2.1 EXPECTED VOLUMES AND SPECIFIC ACTIVITIES

The expected annual station volumetric production and maximum expected activity feed rates of waste to be input to the Radwaste Volume Reduction Subsystem are summarized in Table 2.1.1. Specific activities by radionuclide for each of the input waste streams are presented in Table 2.1.2. The information contained in these tables is based on recent Oconee Nuclear Station operating experience and on studies reported in ONWI-20 (Reference 3) and NUREG-0782 (Reference 4).

TABLE 2.1.1

WASTE GENERATION SUMMARY

WASTE TYPE	STATION GENERATION[a]			
	VOLUME		ACTIVITY	
	(Ft^3/Yr)	(M^3/Yr)	(Ci/M^3)	(Ci/Yr)
Evaporator Concentrates	15,000[b]	425	1.2	5.1(+2)
Combustible Trash[c] (Density 10 lb/ft^3)	70,000	1,982	2.9(-2)	5.7(+1)
Powdex Resins	3,800[d]	108	9.8(-2)	1.1(+1)
Contaminated Oils	400	11.3	3.0(-4)	3.4(-3)
TOTALS	89,200	2,526	-----	5.78(+2)

[a] Total volumes and activity generation for station (i.e., 3 Units).

[b] Non-solidified volume, based on 12 wt% H_3BO_3 concentration.

[c] Consists of paper, cloth, plastics, PVC's, rubber, wood and other combustibles.

[d] Dewatered, Non-Solidified volume.

Note: This analysis conservatively assumes incineration of all trash, powdex resin and oil. To the extent that this will not be done, airborne effluents will be reduced and solid shipments will increase.

TABLE 2.1.2

RADIONUCLIDE ACTIVITY FOR INFLOW WASTE STREAMS (Ci/M^3)

ISOTOPE	CONCENTRATES	TRASH	POWDEX	OILS
TOTAL	1.2	2.7(-2)	9.7(-2)	3.0(-4)
H3	3.5(-3)	3.0(-4)	2.7(-3)	-
C14	1.3(-4)	1.1(-5)	9.7(-5)	-
Mn54	6.2(-3)	1.6(-4)	4.5(-4)	3.1(-7)
Fe55	2.3(-2)	6.0(-3)	2.3(-3)	-
Ni59	2.7(-5)	7.1(-6)	2.8(-6)	-
Co58	3.3(-1)	1.5(-3)	1.9(-2)	-
Co60	5.0(-2)	1.2(-2)	4.5(-3)	3.4(-6)
Ni63	8.4(-3)	2.2(-3)	8.6(-4)	-
Nb94	8.6(-7)	2.3(-7)	8.8(-8)	-
Sr90	2.5(-4)	2.2(-5)	1.9(-4)	-
Tc99M	1.3(-3)	-	-	-
Tc99	1.1(-6)	9.4(-8)	8.2(-7)	-
Mo99	1.4(-3)	-	-	-
I129	3.2(-6)	2.8(-7)	2.4(-6)	-
I131	2.4(-1)	-	-	-
I133	6.2(-3)	-	-	-
I134	6.2(-3)	-	-	-
Cs134	1.9(-1)	2.1(-3)	2.4(-2)	9.8(-5)
Cs135	1.1(-6)	9.4(-8)	8.2(-7)	-
Cs137	3.3(-1)	3.1(-3)	4.3(-2)	2.0(-4)

2.2 DECONTAMINATION FACTORS

2.2.1 General

Decontamination factors (DF's) across the total Volume Reduction Subsystem are necessary to estimate radionuclide releases from the system to the atmosphere during operation. For the purpose of this discussion, total Volume Reduction Subsystem DF is defined as the ratio of Volume Reduction Subsystem activity input rate to the rate of activity release to the atmosphere. Non-volatile radionuclides present in the waste feed streams to the Volume Reduction Subsystem will remain with the dry product generated in the fluid bed dryer and incinerator ash generated in the incinerator as demonstrated in tests conducted at the Idaho Falls Waste Calcining Facility (Reference 6). However, radioactive iodine is partially volatile at the temperatures of operation and will be present in the gas phase throughout the Volume Reduction Subsystem. Tests were conducted to determine the DF's for particulates and iodine for the various modes of Volume Reduction Subsystem operation. The results of these tests, as reported in References 1 and 7, are provided in Tables 2.2.1, 2.2.2, and 2.2.3. These test data support the use of design basis total Volume Reduction Subsystem DF's of 1.0E+6 and 1.0E+4 for particle borne and iodine radionuclides respectively.

2.2.2 Test Data: Applicability

2.2.2.1 Decontamination Factor for Particulate

Data reported in Tables 2.2.1 and 2.2.2 were generated from tests conducted on

the full-scale AECC-1-P (NP) fluid bed dryer system (Reference 7). This full-scale test system was basically similar to the fluid bed dryer portion of the Oconee Volume Reduction Subsystem except that the fluid bed dryer system at that time 1) did not include the preconcentrator feature, 2) recycled a large portion of its off-gas flow back through the dryer, and 3) did not include the excess bed material off-gas injection feature. Except for the off-gas injection feature, the design modifications made subsequent to the initial tests were demonstrated to enhance the overall fluid bed dryer system decontamination capabilities.

Table 2.2.3 particulate DF (excluding HEPA's) data were generated from tests conducted on a modified full-scale Volume Reduction system which included the preconcentrator feature and no off-gas recycle. A comparison of Table 2.2.3 "Dryer Only" mode measured DF's to particulate DF's reported in Table 2.2.1 demonstrates that the modifications either maintained or increased particulate decontamination efficiency for the total fluid bed dryer system.

The design modification which replaced the original AECC-1-P (NP) fluid bed dryer excess bed material conveyor with an off-gas injection accelerator is not expected to significantly impact the total system particulate DF for fluid bed dryer operation for two reasons. First, excess bed material is composed of sodium borate salts with a large mean particle size of approximately 350 micron. The cyclone gas/solids separator is extremely effective (>99.9%) in removing large particles form the off-gas. Secondly, removal of excess bed material from the fluid bed dryer vessel is expected to occur once every four hours of operation. The transfer of this excess bed material from the dryer to the cyclone gas solids separator to the product hopper will be complete within two

minutes. Impacts on system particulate DF due to this modification are, therefore, considered insignificant.

The decontamination effectiveness of the dual scrubber process gas treatment system (excluding HEPA's) was also tested for incinerator operation. The results of these tests are also summarized in Table 2.2.3. As expected, the smaller size distribution of incinerator ash solids resulted in slightly reduced decontamination efficiency for incinerator operation. However, all tests conducted on either the original dryer-only/single scrubber system or the current incinerator/dryer/dual scrubber system indicate a particulate DF of 1.0E+4 is justified upstream of the HEPA filters.

2.2.2.2 Decontamination Factor for Iodine

The DF for iodine radionuclides was measured for the original dryer/single scrubber Volume Reduction system in a test utilizing radioactive I-131. Test results are summarized in Table 2.2.2. As expected, the measured iodine DF of 1.3E+2 upstream of the carbon adsorber was roughly a factor of 100 to 1000 times lower than that measured for particulate.

The venturi scrubbers are designed to perform a similar stripping function as radwaste evaporator demisters and adsorption towers. The wet surfaces within the venturi scrubber function similar to evaporator wire mesh demisters and adsorption tower horizontal trays. The test results referenced above are consistent with radwaste evaporator operating experience (Reference 9). Experience indicates that for single-stage evaporators iodine DR's can be expected to be a factor of 10 to 100 lower than those expected for nonvolatile

species under alkaline conditions. An additional factor of 10 reduction can be expected, if organic materials are mixed with aqueous waste as was the case with the iodine tracer tests referenced above.

The design modifications previously discussed with respect to particulate removal efficiency must also be addressed with respect to iodine. The significant difference between the original test configuration and the Oconee Volume Reduction Subsystem with respect to iodine removal is the addition of the preconcentrator feature.

The addition of the scrubber/preconcentrator to the process gas treatment system is expected to significantly improve the iodine decontamination efficiency for the total system. A preconcentrator scrub solution pH of 11 is maintained during Volume Reduction Subsystem operation. The caustic scrub solution improves venturi scrubber iodine stripping efficiency and significantly reduces the evolution of organic iodine when the preconcentrated solution is calcined in the dryer. The iodine tracer test configuration represented a worst-case situation for organic iodine production within the dryer system. Aqueous concentrates mixed with oils and organic solvents were input directly to the high temperature/high residence time dryer. Organics content in evaporator feed will be controlled at Oconee. Should trace quantities of organics enter the system, caustic chemical addition will reduce the evolution of gaseous organic iodine species within the dryer by providing abundant aqueous sodium to scavenge elemental iodine. Sodium iodide (NaI), a highly stable salt at all temperatures present within the Volume Reduction Subsystem, is efficiently removed from the system as a solid.

The addition of the incinerator to the original system will not impact the total system iodine decontamination efficiency. Incinerator feed is not expected to contain significant iodine activity. Additionally, the incinerator will not be a source of iodine DF reducing organics since the incinerator is designed to efficiently oxidize organics.

In summary, a design basis iodine DF of 1.0E+2 is justified for the Volume Reduction Subsystem upstream of the carbon adsorber. This iodine DF is supported by AECC full-scale iodine tracer test data and radwaste evaporator operating experience.

2.2.3 DECONTAMINATION FACTORS FOR FILTER/ADSORBER ASSEMBLY

A DF of 100 is assumed to be valid for HEPA filter particle borne activity removal. Likewise, a DF of 100 is assumed through the 6-inch deep carbon adsorber for removal of iodine activity. Multiplying the assumed filter/adsorber assembly DF by the corresponding DF documented for upstream portions of the Volume Reduction Subsystem yields a total Volume Reduction System DF as defined in Section 2.2.1.

TAB[illegible].2.1

SUMMARY OF TESTS ON THE FULL-SCALE AECC FLUID BED DRYER-ONLY VR SYSTEM

Time Period	Oper. Time Hrs.	Liquid Waste Processed: Type of Dissolved or Suspended Solids	Liquid Waste Processed: Solids Conc., % Wt.	Solids Production Rate, lb/hr	System DF for Particulates (excluding HEPAs)
SYSTEM WITHOUT PRECONCENTRATOR FEATURE					
5/22/74 - 11/19/75	676	Na_2SO_4	14.3 - 26.9	20 - 46	3.3×10^4 - 4.6×10^5
2/20/75 - 11/19/75	142	Na_2SO_4 + misc. additives[1]	20.6 - 26.0	32 - 38	~1.3×10^4
1/23-31/75	53	Na_2SO_4 + Na Borates (80/20 & 60/40 mixtures)	25.4 - 26.0	42 - 44	~5.3×10^5
7/24/74 - 10/9/74	106	Na Phosphates (Na_3PO_4 or Na_2HPO_4)	15.0 - 26.5	20 - 34	2.0×10^4 - 4.7×10^4
8/12/74 - 10/3/74	48	Na Borates ($NaBO_2$ and/or $Na_2B_4O_7$)	17.3 - 21.7	13 - 20	2.0×10^4 - 7.5×10^4
	1025				
SYSTEM WITH PRECONCENTRATOR FEATURE					
1/6/76 - 9/25/78	279	Na_2SO_4	8.3 - 15.8	20 - 37	---
1/13/76 - 11/4/76	224	Na_2SO_4 + misc. additives[2]	6.3 - 10.6	25 - 49	---
3/3-25/76	160	$Na_2SO_4/NaBO_2$ (68/32) + additives[3]	8.8 - 10.1	41 - 43	---
3/19/75 - 4/22/76	200	Na Borates ($NaBO_2$ and/or $Na_2B_4O_7$)	4.5 - 10.3	17 - 21	---
9/11-21/78	244	$NaBO_2/Na_2SO_4$ (80/20)	~10	21.4	---
10/16/76 - 11/12/76	78	Na Borates + additives[4]	5.4 - 5.9	23 - 24	---
10/12-16/76	94	Na Borates/Na_2SO_4 (84/16) + additives[5]	4.6 - 5.1	20 - 22	---
	1279				

[1] One or more of the following: laundry detergent, antifoam agent, diatomaceous earth, lube oil, transmission fluid, Solkafloc, KI, Na_3PO_4, $NaHCO_3$, I-131 (as NaI).

[2] One or more of the following: Turco Plaudit, laundry detergent, antifoam agent, diatomaceous earth, $NaHCO_3$, $MgSO_4$, $(NH_4)_2SO_4$, Na_3PO_4, CaO, Fe_2O_3.

[3] Lube oil or Turco Plaudit.

[4] Lithium borates and/or diatomaceous earth.

[5] One or more of the following: decontamination agents (Turco 4306D and Turco 4324NP), Turco Plaudit, diatomaceous earth, lube oil, $NaHCO_3$, $MgSO_4$, $(NH_4)_2SO_4$, Na_3PO_4, CaO, Fe_2O_3.

TABLE 2.2.2

Iodine Tracer Tests Summary
I-131 Activity Balance During Final 45.3 Hours of Operation

		Activity, μCi
I-131 Input		
Feed		3.66×10^3
Initial Bed		0.37×10^3
Initial Scrub Solution		0.41×10^3
	TOTAL INPUT	4.44×10^3
I-131 Output		
Product		1.35×10^3
Final Bed		0.38×10^3
Unaccounted Product*		0.07×10^3
Condensate		1.66×10^3
Final Scrub Solution		0.63×10^3
Charcoal Adsorber		27
Exit Gas		$<4 \times 10^{-3}$
	TOTAL OUTPUT	4.12×10^3

I-131 Closure = 4.12/4.44 = 92.8%$^+$

Total System DF (excluding adsorber) = $3.66 \times 10^3/27 = 136$

*Determined from a solids mass balance.

$^+$Apparent loss of 7.2% of total iodine activity input attributed to sampling errors (particularly in dry product), measurement accuracy, and internal surface deposition.

TABLE 2.2-3

SUMMARY OF TESTS ON THE FULL-SCALE AECC

COMBINED FLUID BED DRYER/FLUID BED INCINERATOR VR SYSTEM

Time Period	Oper. Time Hrs.	System Operating Mode	Liquid Waste Processed: Type of Dissolved or Suspended Solids	Liquid Waste Processed: Conc. % wt	Combustible Wastes Processed: Type of Combustible Waste	Combustible Wastes Processed: Feed Rate (dry basis) lb/hr	Total Solids Prod. Rate, lb/hr	System DF for Particulates (excluding HFPAs
6/27/79-12/20/79	184	Dryer Only	Na_2SO_4	10-16	-	-	33-46	-
1/14/80-4/30/80	316	Dryer Only	Na_2SO_4	10-19	-	-	37-94	-
4/28-29/80	21	Dryer Only	Na_2SO_4 + misc. additives (1)	~19	-	-	72	-
8/15-17/79	53	Dryer Only	$NaBO_2/Na_2SO_4$ (80/20)	~11	-	-	24	-
5/12/80-8/7/80	226	Dryer Only	$NaBO_2/Na_2SO_4$ (80/20)	12-20	-	-	24-64	$\sim 2 \times 10^5$
3/10/81-4/29/81	199	Dryer Only	$NaBO_2/Na_2SO_4$ (80/20)	11-16	-	-	38-49	$7 \times 10^4 - 2 \times 10^5$
5/17-19/80	44	Dryer Only	$NaBO_2/Na_2SO_4$ (80/20) + misc. additives (2)	~14	-	-	21-29	-
5/6-9/80	31	Dryer Only	$NaBO_2$ + misc. additives (2)	~14	-	-	29-53	-
10/5-6/81	35	Dryer Only	$NaBO_2$	8-11	-	-	44	-
10/7-9/81	42	Dryer Only	$NaBO_2$/Seawater salts (50/50)	9-14	-	-	32	3×10^5
	1151							
8/4/79-10/4/79	313	Dryer + Incin.	Na_2SO_4	11-15	Waste Paper Products (WPP)	30-60	26-37	-
2/1-20/80	117	Dryer + Incin.	Na_2SO_4	10-13	WPP	60-100	23-59	-
9/6-9/80	67	Dryer + Incin.	$Na_2SO_4/NaBO_2$ (89/11)	~16	WPP + Resin Slurry	75-3	56	2×10^4
8/26-31/79	157	Dryer + Incin.	$NaBO_2/Na_2SO_4$ (80/20)	11-14	WPP	~50	~26	-
5/14/80-8/8/80	42	Dryer + Incin.	$NaBO_2/Na_2SO_4$ (80/20)	~14	WPP	~80	30-55	-

Time Period	Oper. Time Hrs.	System Operating Mode	Liquid Waste Processed: Type of Dissolved or Suspended Solids	Liquid Waste Processed: Conc. % wt	Combustible Wastes Processed: Type of Combustible Waste	Combustible Wastes Processed: Feed Rate (dry basis) lb/hr	Total Solids Prod. Rate, lb/hr	System DF for Particulates (excluding HFPAs
4/6/81-8/7/81	190	Dryer + Incin.	$NaBO_2/Na_2SO_4$ (80/20)	7-15	WPP	73-125	24-44	-
7/28-30/81	58	Dryer + Incin.	$NaBO_2/Na_2SO_4$ (80/20)	10-14	Diesel (#2)	25-38	~30	-
10/19-22/81	83	Dryer + Incin.	$NaBO_2/Na_2SO_4$ (80/20)	15-17	WPP or Diesel (#2)	~80 or ~40	59	2×10^4
10/22-28/81	12	Dryer + Incin.	$NaBO_2/Na_2SO_4$ (80/20)	~16	WPP + Plastic (50/50)	~50	59	-
5/27-28/80	22	Dryer + Incin.	$NaBO_2/Na_2SO_4$ (80/20) + misc. additives (3)	10-12	WPP	≈70	21	-
11/4-5/81	12	Dryer + Incin.	$NaBO_2$	~15	Diesel (#2)	~36	~56	-
11/5-6/81	35	Dryer + Incin.	$NaBO_2$	15-17	Resin Slurry + WPP or Diesel	(19-37) + 85 or 20	~56	2×10^4
11/16-20/81	88	Dryer + Incin.	$NaBO_2$	14-17	Resin Slurry + WPP or Diesel	(17-42) + 40 or 20	39	2×10^4
11/20/81	6	Dryer + Incin.	$NaBO_2$	~17	WPP + Plastic (50/50)	~25	39	-
	1292							
8/2-26/79	111	Incinerator Only	-	-	Waste Paper Products (WPP)	~50	0.6	-
4/1-30/80	30	Incinerator Only	-	-	WPP	60-100	Undefined	-
3/25/81	11	Incinerator Only	-	-	WPP	~125	Undefined	-
7/23-25/81	52	Incinerator Only	-	-	Diesel (#2)	35-40	~0	-
	204							

(1) Additives include: diatomaceous earth, Fe_2O_3, $(NH_4)_2HPO_4$, $MgCO_3$, and $CaCO_3$.

(2) Additives include: lithium borates, diatomaceous earth, and Pe_2O_3.

(3) Additives include: decontamination agents (Turco 4306D & Turco 4324NP), Turco Plaudit, diatomaceous earth, lube oil, Pe_2O_3.

2.3 RADIOLOGICAL RELEASES FROM NORMAL OPERATIONS

2.3.1 AIRBORNE RELEASE

Total Volume Reduction Subsystem DF's (including filter/adsorber assembly) of 10^6 for particulate and 10^4 for iodine are used for the purpose of estimating airborne radiological releases resulting from normal system operation. Table 2.3.1 summarizes, by radionuclide, the estimated activity available for processing and release by the Volume Reduction Subsystem on an annual basis.

The release rates listed in Table 2.3.1 are used to estimate Maximum Exposed Individual annual dosage and Exclusion Area Boundary (EAB) annual average radionuclide concentrations resulting from the operation of the Volume Reduction Subsystem. Table 2.3.2 summarizes the Maximum Individual dose results as well as the 10 CFR 50, Appendix I dose objectives for Oconee Nuclear Station. Table 2.3.3 lists the maximum EAB isotopic concentrations along with 10 CFR 20, Appendix B, Table II, Column 1 concentration limits for unrestricted areas.

Radionuclide release rates were also calculated for a second, more conservative, set of design basis total Volume Reduction Subsystem DF's. A worst case total DF of 100 was assumed for both particle borne and iodine radionuclide removal efficiency (i.e., no decontamination credit assumed for Volume Reduction Subsystem upstream of the process gas filter/adsorber assembly). The calculated Maximum Individual annual doses offsite for this limiting routine release case are 6.3 mrem/year total body and 18.6 mrem/year maximum organ (infant thyroid). The calculated total MPC fraction using

10CFR20, Appendix B, Table II, Column 1 maximum permissible concentrations is 2.3E-4 for this limiting routine release case at the maximum location offsite.

2.3.2 LIQUID RELEASE

There will be no liquid effluent released as a direct result of Volume Reduction Subsystem operation. The only liquid product generated by Volume Reduction Subsystem operation is the secondary scrubber condenser condensate. The condensate may contain a small amount of radioactivity, but this stream is used to supply the incinerator sprays or is returned to the plant liquid waste system.

TABLE 2.3.1

RADIONUCLIDE ACTIVITY PROCESSED AND RELEASED

ISOTOPE	ACTIVITY (Ci/Yr)	
	PROCESSED	RELEASED
H3	2.4	2.4
C14	8.8(-2)	8.8(-2)
Mn54	3.0	3.0(-6)
Fe55	2.2(+1)	2.2(-5)
Ni59	2.6(-2)	2.6(-8)
Co58	1.5(+2)	1.5(-4)
Co60	4.6(+1)	4.6(-5)
Ni63	8.0	8.0(-6)
Nb94	8.3(-4)	8.3(-10)
Sr90	1.7(-1)	1.7(-7)
Tc99M	5.5(-1)	5.5(-7)
Tc99	7.4(-4)	7.4(-10)
Mo99	6.0(-1)	6.0(-7)
I129	2.2(-3)	2.2(-7)
I131	1.0(+2)	1.0(-2)
I133	2.6	2.6(-4)
I134	2.6	2.6(-4)
Cs134	8.8(+1)	8.8(-5)
Cs135	7.4(-4)	7.4(-10)
Cs137	1.5(+2)	1.5(-4)

TABLE 2.3.2

BREAKDOWN BY PATHWAY OF SIGNIFICANT NUCLIDE CONTRIBUTION TO MAXIMUM(1)

TOTAL BODY AND CRITICAL ORGAN DOSES FOR AIRBORNE EFFLUENTS

	Maximum Total Body: Child			Maximum Critical Organ: Infant Thyroid		
Pathway	Dose (mrem/yr)	Isotope	% of Total Pathway Dose	Dose (mrem/yr)	Isotope	% of Total Pathway Dose
Milk	---	---	---	1.8(-1)	I131	99.9%
Vegetable	9.1(-4)	C14 H3	65.3% 10.2%	----	---	---
Meat Ingestion	1.1(-4)	C14	82.0%	----	---	---
Air Inhalation	2.9(-5)	H3	89.5%	4.4(-4)	I131	98.4%
Ground Contamination	4.7(-4)	Cs137 Co60	47.0% 30.2%	1.0(-4)	Cs137 Co60	47.0% 30.2%
TOTAL	1.5(-3)			1.8(-1)		
Appendix I ONS	3.0(+1)			4.5(+1)		

(1)Total body doses evaluated at a location where the highest radiation dose to the whole body of an individual from all applicable pathways has been estimated. Maximum organ doses evaluated for worst goat location at 3.0 miles NNE.

TABLE 2.3.3

SITE BOUNDARY CONCENTRATIONS FROM NORMAL OPERATIONS

ISOTOPE	RELEASE RATE	CONCENTRATION LIMIT[a]	BOUNDARY CONCENTRATION[b]
	(Ci/Yr)	(pCi/M^3)	(pCi/M^3)
H3	2.4	2.0(+5)	3.1(-2)
C14	8.8(-2)	1.0(+5)	1.1(-3)
Mn54	3.0(-6)	1.0(+3)	4.2(-8)
Fe55	2.2(-5)	3.0(+4)	3.1(-7)
Ni59	2.6(-8)	2.0(+4)	3.8(-10)
Co58	1.3(-4)	2.0(+3)	2.2(-6)
Co60	4.6(-5)	3.0(+2)	6.5(-7)
Ni63	8.0(-6)	2.0(+3)	1.1(-7)
Nb94	8.3(-10)	1.0(+2)	1.2(-11)
Sr90	1.7(-7)	3.0(+1)	2.2(-9)
Tc99M	5.5(-7)	5.0(+5)	7.1(-9)
Tc99	7.4(-10)	2.0(+3)	9.6(-12)
Mo99	6.0(-7)	7.0(+3)	7.8(-9)
I129	2.2(-7)	2.0(+1)	2.9(-9)
I131	1.0(-2)	1.0(+2)	1.3(-4)
I133	2.6(-4)	4.0(+2)	3.4(-6)
I134	2.6(-4)	6.0(+3)	3.4(-6)
Cs134	8.8(-5)	4.0(+2)	1.1(-6)
Cs135	7.4(-10)	3.0(+3)	9.6(-12)
Cs137	1.5(-4)	5.0(+2)	1.9(-6)

Total 10CFR20 MPC Fraction = 1.5E-6

[a]10 CFR 20, Appendix B, Table II, Column 1 concentration limits for unrestricted areas.

[b]Maximum location at 3.5 miles; S sector (X/Q = 4.1(-7) S/M^3).

2.4 CORRODIVE OR TOXIC MATERIAL CONTROL

2.4.1 INTRODUCTION

Aerojet has determined that undesirable chemicals may be produced in the off-gas system when certain materials are incinerated in sufficient quantities. These chemicals are undesirable because they are corrosive, toxic, incompatible with the off-gas filter train and/or they reduce the effective volume reduction factors. In general, materials containing significant compounds of sulfur and/or halogens will be controlled to prevent unacceptable concentration of SO_2 and HCL in the off-gas stream. The small concentrations that do enter the off-gas will be neutralized by the pH controlled scrub loop liquid. The following list represents the type of materials that might be found in normal nuclear station waste and require control:

- Polyvinylchloride (PVC)
- Teflon
- Fluorocarbons
- Polysulfones
- Fluorosilicones
- Chlorosulfonated Polyethylene

2.4.2 LIMITS FOR OPERATION

Aerojet has performed tests to determine limits for chemical inputs to the incinerator based on economics, materials of construction, regulatory limits for gaseous effluents, and carbon filter operation. Results of these tests are

recorded in Topical Reports 2 and 3, Topical Report No. AECC-2-P, Amendment 1 and other Aerojet documents.

In general, the Aerojet limits for undesirable contaminants provide adequate assurance that incidental quantities of these materials will not jeopardize the engineered safety features, or decrease the material integrity of the incinerator and its off-gas system. Any toxic gases produced will be diluted and/or removed by the off-gas treatment system to such an extent that any effluents will be well within the normal regulatory limits for air pollutants resulting from incinerator operation. [Confirmed with the South Carolina Dept. of Health and Environmental Control - Bureau of Air Quality Control - Engineering Services Division]

2.4.3 CONTROLS

Materials identified and limited by Aerojet and industry literature can be controlled to acceptable levels by the following means;

a. Some incompatible materials can be administratively eliminated from the station's materials supply inventory. This can be accomplished by revising the purchase specifications to explicitly minimize concentrations of contaminants.

b. Incompatible supplies for which substitution is not feasible may be segregated in the trash handling procedures.

c. When appropriate, chemical analyses will be performed to determine acceptable feed rates and the need for dilution or chemical addition to meet established limits.

d. Parts of the piping system which are suspected to be high erosion/ corrosion areas will be monitored on scheduled basis (i.e., ultrasonic testing).

3.0 ACCIDENT ANALYSIS

3.1 MAXIMUM CREDIBLE ACCIDENT

The choice of a Maximum Credible Accident for the incinerator was made after the radiological consequences of a spectrum of Radwaste Solidification (VR) System failure events were analyzed. Subsystems and components of the VR System which may contain radioactive materials in significant quantities were identified and separated for analysis purposes as follows:

1. Contaminated oil storage and feed systems.

2. Wet solids storage and feed system.

3. Dry active waste storage and feed system.

4. Fluid bed process vessels.

5. Bed material storage and transfer hoppers.

6. Scrubber Preconcentrator and scrub liquor recirculation circuit.

7. Product Storage Hopper.

8. Process Filter/Adsorber Assembly.

The basis for analyzing the above components for accident consequences was the presence of activity alone. Although attempts were made to postulate mechanisms by which releases could originate, the main factor in choosing worst case accidents to be analyzed in detail was the radiological consequence potential independent of the likelihood of occurrence. Four accidents were identified as worst case accidents requiring further analysis: (1) The Process Gas Filter Assembly was analyzed because of the long term collection of particulate activity on the HEPA filters and iodine on the carbon adsorber. (2) The rupture of the Product Storage Hopper[1] was analyzed due to the large amount of high specific activity product ash collected within the hopper. (3) The Scrubber Preconcentrator scrub liquor circuit failure was analyzed due to the buildup of radioactive iodine which may recirculate in the scrub circuit. (4) A fire involving the flammable contaminated trash was also analyzed since significant volumes of these contaminated wastes may accumulate in storage areas prior to incineration.

Since the predicted annual radioactivity feed rate to the incinerator itself is less than 18% of the total Volume Reduction Subsystem annual curie throughput, this analysis considers all high source term components of the Radwaste Facility which could be affected by postulated fires or incinerator transients.

[1] The product surge hopper and product storage hopper are included in the Waste Packaging Subsystem. Incinerator ash leaving the cyclone separator drops by gravity into the product surge hopper which is provided to isolate the incinerator from the product storage hopper. Ash is transferred from the product surge hopper to the product storage hopper, to the enclosed polymer drumming station and solidified.

3.1.1 PROCESS GAS CARBON ADSORBER RELEASE

This postulated accident involves the release of iodine activity collected on the process gas carbon adsorber. A fire of undetermined origin involving the process gas carbon adsorber section is the postulated release mechanism.

3.1.1.1 Detection of an Accident

High temperatures in the carbon bed would be detected by the operator who could initiate the fire protection system as necessary. The loss of differential pressure across the filter/adsorber assembly would also alert the operator to the accident.

3.1.1.2 Radiological Consequences

It was conservatively assumed that all iodine activity input to the Volume Reduction Subsystem is collected on the carbon adsorber and that the adsorber was in service for six months prior to the event. Credit for iodine decay was taken and a 95 percentile accident X/Q[1] of 2.2(-4) s/m^3 was used in the dose analysis. The resulting maximum whole body dose offsite for this event was calculated to be 1.9 mrem. The maximum organ dose was found to be 1020 mrem to the thyroid of an individual breathing air[2] at the site boundary during the event.

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1 See section 3.2 for a discussion on dispersion factor derivation. This value is used for all accident doses quoted in this submittal.

2 A maximum individual breathing rate of 3.47 (-4) m^3/s assumed in all accident inhalation doses calculated.

3.1.2 PRODUCT HOPPER RUPTURE

The rupture of a loaded Product Hopper would result in the release of dry product ash to the surrounding cubicle. Ventilation systems serving the cubicle could transport this ash to the outside environment; resulting in offsite exposure.

A Product Hopper rupture could result from natural phenomena, such as an earthquake, or an overpressure transient from an undetermined source within the system.

3.1.2.1 Detection of Accident

The postulated causes (i.e., explosion or earthquake) of a Product Hopper rupture would be readily detected by the operator at the onset of any such event; resulting in immediate VR System shutdown. In any case, where a rupture occurred unnoticed, the operator would be alerted by high radioactivity concentrations in the HVAC exhaust flow, hopper pressure change, and area monitors.

3.1.2.2 Radiological Consequences

It was conservatively assumed that 100% of the product ash contained in a fully loaded hopper escapes unfiltered via the cubicle ventilation system. Worst case product ash nuclide concentrations were calculated based on calcined concentrates with an assumed volume reduction factor of 11. The resulting particulate plume was assumed to be transported undepleted to the site boundary. The resulting maximum whole body dose offsite was calculated to be 85 mrem. The

maximum organ dose was determined to be 860 mrem to the thyroid of an individual breathing air at the site boundary during the event.

3.1.3 SCRUB LIQUOR CIRCUIT FAILURE

The postulated failure of the preconcentrator scrub liquor circuit would result in the spillage of concentrated liquid containing iodine. The concern here will be the evolution of gaseous radioactive iodines which could be transported offsite in air. Any liquid released from the scrub circuit will be contained within the facility and should not be available for transport in ground or surface waters offsite.

The release of the scrub inventory could result from a rupture of either the Scrubber Preconcentrator vessel or recirculation piping.

3.1.3.1 Detection of Accident

The loss of a significant quantity of scrub liquor would result in the lowering of the scrub liquor level in the Scrubber Preconcentrator sump. This would be noticed by the operator. If no operator action is taken or the sump inventory is lost rapidly, the process would automatically shutdown due to loss of fluid flow to the venturi.

3.1.3.2 Radiological Consequences

It was assumed that all the scrub solution in the Scrubber Preconcentrator sump and recirculation piping is spilled. Iodine recirculation and decay within the

dryer/off-gas loop is analyzed assuming an iodine DF of 2 for the dryer/cyclone. Maximum activity releases are calculated for each isotope. The postulated release assumes 100% of the calculated maximum buildup activity is available for transport offsite. The resulting maximum whole body dose offsite was calculated to be 0.04 mrem. The maximum organ dose was determined to be 20 mrem to the thyroid of the individual breathing at the site boundary during the event.

A groundwater transport analysis was also analyzed for this postulated worst case liquid release event. The saprolite soil characteristic of the Oconee site is an effective natural barrier to the migration of radionuclides. The movement of radionuclides released in this postulated worst case event would be so extremely slow that concentrations resulting at the nearest potable intake would be well below 10CFR20, Appendix B, Table II, Column 2 maximum permissible concentration values.

3.1.4 TRASH FIRE

A fire involving contaminated trash being stored prior to incineration would result in offsite exposure from activity transported along with other combustion products through the air. A fire could result from accidental causes.

3.1.4.1 Detection of Accident

Facility smoke detectors would assure prompt detection of any fire in the storage areas. The visible smoke resulting from a fire would provide a secondary means for detection of this postulated accident.

3.1.4.2 Radiological Consequences

It was conservatively assumed that as much as 80 cubic meters of contaminated trash activity is released and transported offsite due to the fire. The resulting maximum whole body dose was calculated to be 0.3 mrem. The maximum organ dose was determined to be 5.7 mrem to the bone of an individual breathing air at the site boundary during the fire.

3.1.5 ACCIDENT ANALYSIS SUMMARY

Table 3.1.1 summarizes the activity release by nuclide for each of the worst case accidents analyzed. The doses estimated for each accident case are summarized on Table 3.1.2. The doses calculated and presented in this section were derived with conservative assumptions and were found to be below 10 CFR 20 normal operation annual dose limits. This demonstrates that the systems may properly be considered "Non-Nuclear Safety."

TABLE 3.1.1

ACTIVITY RELEASES - WORST CASE ACCIDENTS (Ci)

Nuclide	Carbon Adsorber Fire	Product Hopper Rupture	Scrub Circuit Failure	Trash Fire
Total	9.0	3.7(+1)	1.4	2.2(-1)
H3	0	-	-	2.4(-3)
C14	-	4.0(-3)	-	8.8(-5)
Mn54	-	1.9(-1)	-	1.3(-3)
Fe55	-	7.2(-1)	-	4.8(-2)
Ni59	-	8.4(-4)	-	5.7(-5)
Co58	-	1.0(+1)	-	1.2(-2)
Co60	-	1.6(+0)	-	9.6(-2)
Ni63	-	2.6(-1)	-	1.8(-2)
Nb94	-	2.7(-5)	-	1.8(-6)
Sr90	-	7.8(-3)	-	1.8(-4)
Tc99m	-	4.0(-2)	-	-
Tc99	-	3.4(-5)	-	7.5(-7)
Mo99	-	4.4(-2)	-	-
I129	1.1(-3)	1.1(-4)	1.4(-6)	2.2(-6)
I131	9.0(+0)	7.5(+0)	1.7(-1)	-
I133	2.5(-2)	2.5(-2)	3.9(-3)	-
I134	1.0(-3)	1.0(-3)	8.5(-4)	-
Cs134	-	5.9(+0)	-	1.7(-2)
Cs135	-	3.4(-5)	-	7.5(-7)
Cs137	-	1.0(+1)	-	2.5(-2)

TABLE 3.1.2

ACCIDENT DOSES

Accident	Whole Body Dose (mrem)	Maximum Organ Dose (mrem)	Maximum Organ
Carbon Adsorber Fire	1.9	1020	Thyroid
Product Hopper Rupture	85	860	Thyroid
Scrub Liquor Circuit Failure	0.04	20	Thyroid
Trash Fire	0.3	5.7	Lung
Maximum Credible[1] Accident Doses	85	1020	Thyroid

[1] Highest dose value listed in each column. Whole body dose Maximum Credible Accident is Product Hopper rupture; maximum organ dose Maximum Credible Accident is Filter/Adsorber Assembly release.

3.2 ATMOSPHERIC TRANSPORT CONDITIONS

In evaluating diffusion of short-term accidental releases from the plant, a ground level release with a building wake factor, cA, of 1270 square meters was assumed. The wind speeds at the 150-foot level of the station meterological tower were multiplied by 0.8 to achieve a representation of the winds appropriate to a ground level release. The relative concentration (x/Q) which is exceeded 5% of the time was calculated to be 2.2×10^{-4} seconds per cubic meter at the exclusion radius of 1609 meters. This relative concentration was equivalent to dispersion conditions produced by Pasquill type F stability with a wind speed of 1 meter per second.

4.0 RADIATION PROTECTION

4.1 FACILITY SHIELDING

Table 4.1.1 shows shield wall thicknesses, maximum dose rates and zone designations during design based operation for the incinerator and subsystem components. The zone designations are defined as follows:

Zone I - Where members of the station staff are expected to work continuously, for conservatism, the limiting dose rate is 0.5 mrem/hr. This is comparable to the criteria given in 10CFR20.105b for unrestricted areas.

Zone II - Where staff occupancy is expected to be periodic rather than continuous, the dose rate limit of 2.0 mrem/hr is chosen. An employee could, however, remain in the areas continuously (40 hrs/week) and not exceed the occupational dose limits.

Zone III - Infrequently occupied work locations where the dose rate exceeds continuous occupational levels but access need not be physically restricted are limited to 100 mrem/hr.

Zone IV - All areas of the facility where the dose rate exceeds 100 mrem/hr are physically restricted and health physics surveillance is required for occupancy.

TABLE 4.1.1

OCONEE RADWASTE FACILITY

RADIATION ZONE INFORMATION

	COMPONENT	DOSE RATE INSIDE/OUTSIDE	ZONE DESIGNATION	SHIELDING CONCRETE
1.	Trash Hopper Room	2mR/Hr	II	None
2.	Fluid Bed Incinerator Hopper	600 mR/Hr/<2mR/Hr	IV	3 ft
3.	Fluid Bed Dryer Hopper	91 R/Hr/<2mR/Hr	IV	3 ft
4.	Exhaust Gas Condenser	110 mR/Hr/<2mR/Hr	IV	2 ft
5.	Exhaust Gas Filters	1 R/Hr/<2mR/Hr	IV	2 ft
6.	Scrubber/Preconcentrator	4 R/Hr/<2mR/Hr	IV	2½ ft
7.	Storage Hopper	58 R/Hr/<2mR/Hr		2½ ft
	Gas-Solids Separator	800 mR/Hr/<2mR/Hr	IV	
8.	Fluid Bed Dryer	4 R/Hr/<2mR/Hr	IV	2 ft
9.	Fluid Bed Incinerator	150 mR/Hr/<2mR/Hr	IV	2 ft

4.2 INCINERATOR DESIGN FEATURES

In accordance with guidelines in Regulatory Guide 8.8, the incinerator and its associated components are housed in separate shielded cubicles to reduce the dose rates during normal operation to acceptable levels and also reduce the radiation exposure received by workers during maintenance. The incinerator is operated remotely from the Radwaste Control Room which is located in a low radiation area. All local readouts for instrumentation are located in low radiation areas. Mechanical components such as pumps and blowers are located in areas separate from the nonmechanical components such as the incinerator which is likely to contain significant radioactivity during operation. This allows mechanical components to be decontaminated and have maintenance performed on them without decontaminating the entire system. When maintenance is required on the incinerator, the bed material can be remotely transferred from the vessel into a bed storage hopper. The incinerator brick lining can be decontaminated by burning uncontaminated trash (i.e., by the abrasive action of the bed material and ash). The decontamination nozzles provided in all the major components may be used to further reduce the dose rates prior to maintenance.

4.3 VOLUME REDUCTION SUBSYSTEM OPERATING AND MAINTENANCE PERSON-REM ESTIMATION

Table 4.3.1 provides an estimate of the annual exposure (person-rem) associated with scheduled maintenance, inspection, and normal operations. Included are the predicted radiation fields (R/hr) associated with all components and

cubicles of the VR subsystem where personnel may require access to perform the above mentioned functions. These estimates assume that the components have been isolated and decontaminated prior to access.

Also included are the estimated occupancy times (hrs/yr) required in each of these locations (AECC-2-P, Amendment 1, Table 32), and the exposure (person-rems/yr) received for each function and/or location.

TABLE 3.1

ANNUAL DOSE FROM MAINTENANCE, INSPECTION, AND OPERATION

Component	Maintenance/ Inspection Task	Frequency	Units	Total Man-Hours Required	Average Radiation Level, R/Hour	Annual Dose, Person-Rem
Total System	Decontamination.	1/Year	1	60	0.002	0.120
Pumps, P-2, P-3, P-4, P-5, P-6A, P-6B, P-7, P-8, P-9, P-10	Check shaft runout. Change oil. Check seals Check alignment. Inspect impeller. Replace rotor and stator. Change oil.	1/Year	10	16	0.005	0.080
Air Blower, C-1	Check & lubricate bearings, seals, & drive coupling. Adjust packing.	1/Year	1	1	0.005	0.005
Filters, F-1A, F-1B	Inspect gaskets, seals & valves.	1/Year	2	1	0.002	0.002
	Change HEPA filters F-1A/B.	2/Year	2	6	0.02	0.12
	Change HEPA filter F-4.	4/Year	1	8	0.02	0.16
	Inspect gaskets, seals & valves.	1/Year	2	1	0.002	0.002
	Change charcoal adsorber media.	2/Year	-	4	0.02	0.08
Air Heaters, E-2 & E-4	Check elements and controls	1/Year	2	1	0.005	0.005

TABLE 4.[illegible]cont'd)

ANNUAL DOSE FROM MAINTENANCE, INSPECTION, AND OPERATION

Component	Maintenance/ Inspection Task	Frequency	Units	Total Man-Hours Required	Average Radiation Level, R/Hour	Annual Dose, Person-Rem
Process Vessels, R-3	Inspect vessel and nozzles.	1/Year	1	1	0.05	0.05
Off-Gas Cleanup System components, S-1, S-2, S-3 and S-4	Inspect vessel and nozzles.	1/Year	4	2	0.02	0.04
Hoppers H-2, H-3A, H-3B, and H-4	Inspect and service valves, drive motors and seals.	1/Year	4	20	0.03	0.60
Trash Shredder, G-2	Inspect and service per manufacturer's schedule.	1/Year	1	160	0.001	0.16
Trash Elevator, G-1	Inspect and service per manufacturer's schedule.	1/Year	1	4	0.001	0.004
Metal Detector, G-3	Inspect and service per manufacturer's schedule.	1/Year	1	2	0.0005	0.001
Control Panels, CP-1 CP-2, and CP-3	Inspect and calibrate.	1/Year	3	40	0.0005	0.02
					Subtotal Annual Dose from Maintenance and	1.449

Person-Rem

TABLE 4.[illegible] (cont'd)

ANNUAL DOSE FROM MAINTENANCE, INSPECTION, AND OPERATION

Component	Operating Task	Frequency	Units	Total Man-Hours Required	Average Radiation Level, R/Hour	Annual Dose, Person-Rem
TOTAL SYSTEM	Startup/Shutdown	N/A	1	120	<0.0005*	0.060**
TOTAL SYSTEM	Steady-state Operation	N/A	1	6400	<0.0005*	3.200**
Trash Shredder G-2	Normal Operation	N/A	1	1067	<0.0005*	0.533
				Subtotal Annual Dose from Operation.		3.793 Person-Rem
				Total Annual Dose from Maintenance, Inspection and Operation		5.242 Person-Rem

*Dose rate in control room and shredder area based on maximum credible source terms.
**Total system operation including surveillance, sampling, materials handling and control room operations.

5.0 RADWASTE FACILITY STRUCTURE

The Oconee Radwaste Facility consists of two separate adjoining structures, separated by a 3 inch expansion joint, both supported by poured-in-place reinforced concrete mats. One structure is primarily of reinforced concrete construction with structural walls serving also as shielding for radioactive components or materials. The other structure is primarily of braced structural steel construction with floors of reinforced concrete on metal deck and conventionally formed reinforced concrete columns and floors supporting large tanks. Exterior walls are insulated metal siding on steel girts. Interior walls are gypsum wallboard on metal studs and concrete masonry.

All structural design bases including consideration of design loads and load combinations are consistent with applicable FSAR requirements, in addition to industry standards including ACI and AISC requirements.

6.0 SITE CHARACTERISTICS

Site environmental conditions which include topographical, geological, meteorological, and hydrological data; usage of ground and surface waters in the general area; and the nature and location of other potentially affected facilities are briefly discussed in this section per 10CFR §20.302.

6.1 TOPOGRAPHICAL DATA

Oconee Nuclear Station is located in eastern Oconee County, South Carolina, approximately 8 miles northeast of Seneca, South Carolina. The station is located within an exclusion area of one mile radius. This area is owned in full by Duke Power, except for a small rural church lot, a highway right-of-way, and approximately 9.8 acres included in the Hartwell Project.

The site area is on a moderately sloping, northwest trending topographic ridge which forms a drainage divide between the Little and Keowee Rivers, located approximately 0.5 miles to the west and east respectively.

The incinerator will be housed in the Oconee Radwaste Facility which is located adjacent to the South end of Duke's Oconee Nuclear Station powerhouse structures. The Radwaste Facility will be inside the security fence in the powerhouse yard at Elevation 796 ft. mean sea level.

6.2 GEOLOGICAL DATA

The Radwaste Facility site is located south of the Unit 3 Turbine & Auxiliary Buildings. The test borings encountered a profile of materials consisting from the ground surface of fill, residual soil, partially weathered rock and finally rock or refusal material. The thickness of fill varied from 18 to just over 70 feet within the proposed facility. The fill soils classify primarily as micaceous silty sands which include clayey layers of low to moderate plasticity.

The fill is relatively well compacted based on standard penetration tests. The standard penetration resistances are predominantly between 12 and 30 blows per foot.

Below the fill soils, residual materials weathered from the parent bedrock were encountered. The residual profile consists of a variable thickness of soil underlain by partially weathered rock. The residual soils primarily are silty sands or sandy silts. Beneath the fill and residual soils, the test borings encountered refusal materials at depths of 30 to 85 feet below the present surface.

The nature of the refusal materials was investigated by rock coring procedures. The rock is a granitic gneiss that contains interlayered biotite - hornblende gneiss. A complete description of the geologic features and other relevant information of the site can be found in Section 2.5 of the Oconee FSAR.

6.3 METEOROLOGICAL DATA

Western South Carolina is far south of major storm tracks but experiences higher precipitation amounts than the east coast due to its location in the lee of the Appalachian Mountains. A semi-permanent belt of high pressure usually influences the regional climate. During the fall season, the area has a high probability of experiencing atmospheric stagnation during which the dilution rate for effluents is low due to low wind speeds.

The Oconee plant site is situated on Lake Keowee which was established to provide cooling for the three existing Oconee Nuclear units and future steam generating units as well as storage for Jocassee (pumped storage) and Keowee (conventional) hydroelectric stations. The topography in the vicinity of the site is hilly and the local air flow is influenced to some extent by the contour of the lake. The prevailing winds are divided between the southwest and northeast quadrants due to the lake orientation and large scale pressure effects.

A complete description of regional and local wind data, including normal and extreme parameters can be found in Section 2.3 of the FSAR. The parameters which form the bases of the information regarding normal and accident releases found in Sections 2 and 3 of this submittal are taken from the Oconee Nuclear Power Station Offsite Dose Calculation Manual, Appendix A and the Oconee Nuclear Power Station Safety Evaluation Report, Section 3.2.4.

6.4 HYDROLOGICAL DATA

The main hydrologic features influencing the plant are the Jocassee and Keowee Reservoirs. Lake Jocassee was created in 1973 with the construction of the Jocassee Dam on the Keowee River. The lake provides pump storage capacity to the reversible turbine-generators of the Jocassee Hydroelectric Station, located approximately 11 miles north of the plant. At full pond, elevation 1110 ft. msl, Lake Jocassee has a surface area of 7565 Ac, a shoreline of approximately 75 mi, a volume of 1,160,298 Ac-ft., and a total drainage area of about 148 sq. mi.

Lake Keowee was created in 1971 with the construction of the Keowee Dam on the Keowee River and the Little River Dam on the Little River. Its primary purpose is to provide cooling water for the plant and water to turn the turbines of the Keowee Hydroelectric Station. At full pond, elevation 800 ft. msl, Lake Keowee has a surface area of 18,372 Ac, a shoreline of approximately 300 mi., a volume of 955,586 Ac-ft., and a total drainage area of about 439 sq mi. The Jocassee and Keowee Reservoirs and the hydroelectric stations located at these reservoirs are owned and operated by Duke.

6.5 USAGE OF GROUND AND SURFACE WATERS IN THE GENERAL AREA

The completed field survey of approximately 30 wells determined that groundwater usage is almost entirely from the permeable zones within the saprolite with only minor amounts obtained from the underlying fractured bedrock. Yields from these shallow wells are low, generally less than 5 gpm, and are used to supply domestic water for homes and irrigation of lawns, gardens, and limited amounts

for livestock. With only a few exceptions, the wells are hand dug, equipped with bucket lift and/or jet pump, and 40 to 60 feet deep. At present, there is no industrial demand for groundwater within the area. The only appreciable groundwater draft observed is being supplied by eight wells for Keowee High School, located four miles west of the site.

The area presently provides for a few raw (surface) water users. The City of Greenville and the Town of Seneca take their raw water supplies from Lake Keowee. The Town of Anderson, the Town of Clemson, the Town of Pendleton, Clemson University, and several industrial plants take their raw water supplies from Hartwell Reservoir.

Greenville's raw water intake is located approximately 4 miles north of the plant on Lake Keowee. Seneca's raw water intake is located approximately 7 miles south of the plant on the Little River Arm of Lake Keowee. Anderson raw water intake is located approximately 40 river miles downstream of the Keowee tailrace. The Clemson-Pendleton raw water intake is located approximately 14 river miles downstream of the Keowee tailrace.

Agricultural use of waters of Keowee and Little Rivers and Hartwell Reservoir is very limited. Irrigation is not widely used. Livestock watering is accomplished using tributary streams more often than main rivers.

Hartwell Reservoir and Keowee and Jocassee Lakes are used for recreation and sport fishing. There is no commercial fishing in the area except for small scale trapping of catfish and other rough fish varieties.

For additional information, see FSAR Section 2.4

6.6 THE NATURE AND LOCATION OF OTHER POTENTIALLY AFFECTED FACILITIES

There are no railroads, industrial or military facilities or activities within 5 miles of Oconee. There are no oil or gas pipelines within 5 miles of the site. There are no other potentially affected facilities in the vicinity of the Oconee Station. Other than the ground and surface water users described in Section 6.5., no other air or water users have been identified.

Attachment 1

Exceptions to Topical Report No. AECC-3-NP

1. The waste source term, decontamination factors, and expected effluent releases in the Topical Report do not apply at Oconee and are presented separately.

2. 575 VAC is used in place of 480 VAC.

3. The General Arrangement of equipment in the Topical Report is not used at Oconee but there are recognizable similarities.

4. The components T1, P1, F3, and CP5 were not provided by AECC for Oconee but similar equipment is used to fulfill these functions.

5. The interface of VR system product to the Solidification System is accomplished by the Dry Product Storage and Transfer System built by Stock Equipment Co. Therefore Oconee has no H1 or R4.

6. Taps are provided to test each filter assembly in place but not to test each element individually.

7. The SS-1 skid was dismantled and rearranged to enhance ALARA considerations.

REFERENCES

1. Aerojet Energy Conversion Company, "Radioactive Waste Volume Reduction System Combined Incinerator/Dryer," Topical Report No. AECC-3-P, December 15, 1981.

2. Duke Power Company, Oconee Nuclear Station, Final Safety Analysis Report.

3. U.S. Department of Energy, "Waste Inventory Report for Reactor and Fuel - Fabrication Facility Wastes," ONWI-20-NUS-3314, March, 1979.

4. U.S. Nuclear Regulatory Commission, Draft Environmental Impact Statement on 10CFR61 "Licensing Requirements for Land Disposal of Radioactive Waste," NUREG-0782, September, 1981.

5. Aerojet Energy Conversion Company, "Radioactive Waste Volume Reduction System," Topical Report No. AECC-2-P, Amendment 1.

6. U.S. Atomic Energy Commission, "Operation of the Waste Calcining Facility with Highly Radioactive Aqueous Waste," IDO-14662, June, 1966.

7. Aerojet Energy Conversion Company, "Radioactive Waste Volume Reduction System," Topical Report No. AECC-1-A, February 21, 1975.

8. Oak Ridge National Laboratory, "Use of Evaporation for the Treatment of Liquids in the Nuclear Industry," H. B. Godbee, ORNL-4790, September, 1973.