WASTE DISPOSAL SYSTEM PERFORMANCE DATA

Plant Design Life	40 years
Normal process capacity, liquids	15 gpm
Evaporator load factor	32%
Annual approximate liquid discharge [1]	
Volume (2 units)	2,415,000 gal.
Tritium Activity [2] (2 units)	2.0×10^3 curies
Other (2 units)	1.125 curies/year
Annual gaseous discharge	
Activity (2 units)	11,957 curies/year
Annual drummed solids shipped for burial [3]	27,624 ft^3/year

[1] Estimate based on Table 11.1-4, equilibrium cycle.
[2] Volume is an annual average based on actual shipments for two units from 1979 through 1988.
[3] Quantity based on approximate actual discharge for 1986.

WASTE DISPOSAL COMPONENTS CODE REQUIREMENTS[1]

COMPONENT	CODE
Chemical Drain Tank	No code
Reactor Coolant Drain Tanks	ASME III, [2] Class C
Sump Tanks	No code
Waste Holdup Tank	No code
Waste Evaporator Condensate Tank	No code
Laundry and Hot Shower Tank	No code
Waste Evaporator(s)	No code
Waste Filters	ASME III,(2) Class C
Piping and Valves	USAS-B31.1[3], Section 1 ASME III Appendix F [4]
Gas Decay Tank	ASME III,(2) Class C
Spent Resin Storage Tank	ASME III,(2) Class C
Waste Evaporator Condensate Demineralizer	ASME III,(2) Class C
Waste Evaporator Condensate Filter	ASME III,(2) Class C
Waste Evaporator Bottoms Storage Tank	No code

[1] Repairs and replacements for pressure retaining components within the code boundary, and their supports, are conducted in accordance with ASME Section XI

[2] ASME III American Society of Mechanical Engineers, Boiler and Pressure Vessel Code, Section III, Nuclear Vessels.

[3] USAS-B31.1 American Standards Association Code for pressure piping and special nuclear cases where applicable.

[4] The evaluation criteria of ASME III Appendix F (faulted conditions) is applicable to 1) piping from normally closed PRT drain line isolation valve and the RCDT drain line check valve inside containment to the normally closed isolation valve outside containment (U-1 & U-2); and 2) piping between containment sump pump discharge check valves inside containment and discharge isolation valve outside containment (U-1 only).

COMPONENT SUMMARY DATA

TANKS	QUANTITY	TYPE	VOLUME	DESIGN PRESSURE	DESIGN TEMP.°F	MATERIAL (1)
Reactor Coolant Drain (per unit)	1	Horiz	350 gal	25 psig	267	ss
Laundry & Hot Shower	2 (2)	Vert	600 gal	Atm	180	ss
Chemical Drain	1 (2)	Vert	600 gal	Atm	180	ss
Clean Sump	1 (2)	Vert	600 gal	Atm	180	ss
Station Drainage Sump	1 (2)	Vert	525 gal	Atm	180	ss
Waste Holdup	2 (2)	Horiz	24,700 gal	Atm	180	ss
Waste Condensate	2 (2)	Vert	6,450 gal	Atm	180	ss
Gas Decay	8 (2)	Vert	600 ft^3	150 psig	180	cs
Waste Evaporator Bottoms Storage	1 (2)	Vert	4,000 gal	Atm	250	ss
Spent Resin Storage	1 (2)	Vert	300 ft^3	100 psig	180	ss

PUMPS	QUANTITY	TYPE	FLOW gpm	HEAD ft.	DESIGN PRESSURE psig	DESIGN TEMP °F	MATERIAL (1)
Reactor Coolant Drain (A) (per unit)	1	Horiz canned	50	175	150	300	ss
Reactor Coolant Drain (B) (per unit)	1	Horiz canned	150	175	150	300	ss
Chemical Drain	1 (2)	Horiz	20	100	150	180	ss
Laundry & Hot Shower	1 (2)	Horiz (3)	20	100	150	180	ss
Sump Tank	2 (2)	Horiz (3)	20	100	150	180	ss
Waste Evaporator	2 (2)	Horiz	20	100	150	180	ss
Waste Condensate	2 (2)	Horiz (3)	150	200	150	180	ss
Waste Evaporator Bottoms	1 (2)	Horiz (3)	20	60	150	180	ss

(1) Material contacting fluid
(2) Shared by Units 1 and 2
(3) Mechanical seal provided
(2) Shared by Units 1 and 2
(3) Mechanical seal provided

Storage Tank							

MISCELLANEOUS EQUIPMENT	QUANTITY	CAPACITY	TYPE
Waste Evaporator	1(2)	15 gpm	Forced Circulation Flash (Incoloy - 825 tubes)
Boric Acid/Waste Evaporator	1(2)	15 gpm	Submerged Tube (Incoloy - 825 tubes)
Waste Gas Compressors	2(2)	40 CFM	Liquid piston rotary(3)

	QUANTITY	TYPE	CAPACITY	DESIGN PRESSURE psig	DESIGN TEMP. °F	MATERIAL (1)
Waste Evaporator Condensate Filter	1(2)	Disposable cartridge	20 gpm	150	180	ss
Waste Evaporator Condensate Demineralizer	1(2)	Flushable	30 ft^3	100	250	ss

ESTIMATED LIQUID DISCHARGE TO WASTE DISPOSAL SYSTEM

SOURCE	TOTAL ANNUAL (Gal)
Laundry and Shower	390,000
Equipment drains, leaks, laboratory	1,950,000
Decontamination	75,000
Totals	2,415,000
Load Factor[1]	32%

[1] Based on 15 gpm Radwaste Evaporator Capability.

ESTIMATED LIQUID RELEASE BY ISOTOPE

(Two Units)

ISOTOPE	ANNUAL RELEASE µCi	ISOTOPE	ANNUAL RELEASE µCi
Sr 89	6.12E2	Cs 134	2.78E4
Sr 90	1.54E1	Cs 136	5.36E3
Y 90	1.49E1	Cs 137	1.69E5
Sr 91	3.19E1	Cs 138	3.24E-12
Y 91	1.13E3	Te 132	3.10E4
Sr 92	5.93E-2	I 132	1.72E1
Y 92	4.52E-1	Te 134	6.36E-10
Zr 95	1.29E2	Ba 140	5.92E2
Nb 95	1.25E2	La 140	1.49E2
Mo 99	3.38E5	Ce 144	7.55E1
I 133	2.11E5	I 134	5.04E-6
I 131	3.27E5		
I 135	1.31E4		

Notes: Other waste disposal 11.25E5 µCi/yr.
All Isotopes with total activity per year <1.0E-12 were ignored.)

ESTIMATED ANNUAL GASEOUS RELEASE BY ISOTOPE

ISOTOPE	ACTIVITY TO ENVIRONMENT (Ci/Yr)
Kr 85	10,808
Kr 85m, 87, 88	Negligible
Xe 133	1149
Xe 133m, 135, 135m, 138	Negligible
Total	**11,957**

PLANT ZONE CLASSIFICATIONS

ZONE	ACCESS CONDITIONS	MAXIMUM EXPOSURE RATE (1% failed fuel) mrem/hr.
1	Unlimited	<0.25
2	Occupational	0.25 - 2.499
3	Periodic	2.5 - 4.999
4	Limited	5.0 - 100
5	Restricted	>100

PRIMARY SHIELD DESIGN PARAMETERS, NEUTRON AND GAMMA FLUXES

DESIGN PARAMETERS	
Core thermal power	3391 MW
Active core height	144 in.
Effective core diameter	132.7 in.
Baffle wall thickness	1.125 in.
Barrel wall thickness	2.25 in.
Thermal shield wall thickness	2.75 in.
Reactor vessel I.D.	173.0 in.
Reactor vessel wall thickness	8.625 in.
Reactor coolant cold leg temperature	536°F
Reactor coolant hot leg temperature	600°F
Maximum thermal neutron flux exiting primary concrete	8.4×10^3 n/cm^{2}sec.
Reactor shutdown dose exiting primary concrete	<15 mrem/hr

CALCULATED NEUTRON FLUXES		
ENERGY GROUP	**INCIDENT FLUXES (n/cm^2 - sec)**	**LEAKAGE FLUXES (n/cm^2 - sec)**
E 1 Mev	7.7×10^8	2.5×10^1
5.3 Kev $\leq$ E $\leq$ 1 Mev	1.3×10^{10}	5.6×10^1
.625 ev $\leq$ E $\leq$ 5.3 Kev	7.8×10^9	9.5×10^1
E < .625 ev	2.0×10^9	8.4×10^3

CALCULATED GAMMA FLUXES		
ENERGY GROUP	**INCIDENT FLUXES (γ/cm^2 - sec)**	**LEAKAGE FLUXES (γ/cm^2 - sec)**
E = 7.5 Mev	4.5×10^9	4.4×10^5
E = 4.0 Mev	1.2×10^9	3.1×10^5
E = 2.5 Mev	2.2×10^9	3.4×10^5
E = 0.8 Mev	7.6×10^8	2.8×10^4

SECONDARY SHIELD DESIGN PARAMETERS

Core power density @ 3391 MWt	103.9 w/cc
Reactor coolant liquid volume	12,600 ft^3 [1]
Reactor coolant transit times:	
Core	0.8 sec.
Core exit to steam generator inlet	2.1 sec.
Steam generator inlet channel	0.7 sec.
Steam generator tubes	3.7 sec.
Steam generator tubes to vessel inlet	2.1 sec.
Vessel inlet to core	2.2 sec.
Total Out of Core	10.8 sec.
Total power dose rate outside secondary shield	<1 mrem/hr

[1] This value has been conservatively chosen for the purpose of shield design. Actual best-estimated reactor coolant systems volumes can be obtained from the current Westinghouse IMP databases.

ACCIDENT SHIELD DESIGN PARAMETERS

TID-14844 RELEASE	
Core thermal power	3391 MW
Minimum full power operating time	650 days
Equivalent fraction of core melting	1.0
Fission product fractional releases:	
Noble gases	1.0
Halogens	0.5
Remaining fission product inventory	0.01
Clean-up rate following accident	0
Maximum integrated dose (infinite exposure) in the control room	<1 rem
GAP ACTIVITY RELEASE	
Core Thermal Power, MW	3391
Minimum full power operating time, days	650
Equivalent fraction fuel rod failure	1.0
Fraction of gap activity absorbed by sump water:	
Noble Gases	0.0
All Other	1.0
Cleanup rate following accident	0.0
Sump water volume, ft^3: Reactor Coolant 12,560 Refueling Water 46,800 Accumulators 4,000 **Total 63,360 ft^3**	

ORIGINAL REFUELING SHIELD DESIGN PARAMETERS [1]

Total number of fuel assemblies	193
Minimum full power exposure	1000 days
Minimum time between shutdown and fuel handling	100 hours
Maximum exposure rate adjacent to spent fuel pit	1.0 mrem/hr
Maximum exposure rate at water surface	2.5 mrem/hr

[1] These parameters are kept for historical reasons. The dose rates are no longer applicable since the design of the spent fuel pit has been changed.

PRINCIPAL AUXILIARY SHIELDING

Design parameters for the auxiliary shielding include:	
Core thermal power	3391 MWt
Fraction of fuel rods containing small clad defects	0.01
Reactor coolant liquid volume	12600 ft.^{3} [1]
Letdown flow (normal purification)	75 gpm
Cesium purification flow (intermittent)	75 gpm
Cut-in concentration deborating demineralizer	100 ppm
Dose rate outside auxiliary building	<1 mrem/hr
Dose rate in the building outside shield walls	<2.5 mrem/hr

COMPONENT	CONCRETE SHIELD THICKNESS Ft. - In.
Mixed Bed Demineralizers	4 - 0
Charging pumps	2 - 6
Liquid holdup tanks	2 - 8
Volume control tank	3 - 9
Reactor Coolant filter	2 - 6
Boric Acid Evaporator	2 - 4
Gas decay tanks	3 - 3
Waste Gas Compressors	2 - 8
Waste Evaporator	2 - 0
Liquid Waste Holdup Tank	2 - 0
Spent Resin Storage Tank	4 - 0

[1] This value has been conservatively chosen for the purpose of shield design. Actual best-estimated reactor coolant systems volumes can be obtained from the current Westinghouse IMP databases.

CORE AND GAP ACTIVITIES

Assumptions: Operation at 3391 MWt for 650 days.
Temperature Distribution Specified in Table 11.2-9

Isotope	Curies in the Core ($\times 10^7$)	Percent of Core Activity in the Gap	Curies in the Gap ($\times 10^5$)
I-131	8.26	2.3	19.0
I-132	12.65	0.26	3.29
I-133	18.76	0.79	14.82
I-134	21.92	0.16	3.51
I-135	17.02	0.43	7.32
Xe-133	18.00	1.85	33.30
Xe-133m	0.45	1.27	0.57
Xe-135	5.31	0.54	2.87
Xe-135m	5.22	0.086	0.45
Kr-85	0.095	21.57	2.05
Kr-85m	4.30	0.29	1.25
Kr-87	7.79	0.20	1.56
Kr-88	10.60	0.29	3.07

INSTANTANEOUS RADIATION SOURCES RELEASED TO THE CONTAINMENT

FOLLOWING TID-14844 ACCIDENT RELEASE - MEV/SEC

GAMMA ENERGY (MEV/PHOTON)							
TIME AFTER RELEASE	**0.4**	**0.8**	**1.3**	**1.7**	**2.2**	**2.5**	**3.5**
0 HR	2.94×10^{18}	1.42×10^{19}	3.29×10^{18}	1.51×10^{19}	1.24×10^{19}	6.24×10^{18}	6.31×10^{18}
0.5 HR	2.82×10^{18}	1.17×10^{19}	2.51×10^{18}	1.57×10^{18}	8.10×10^{18}	5.09×10^{18}	2.34×10^{17}
1 HR	2.74×10^{18}	9.97×10^{18}	2.18×10^{18}	1.32×10^{18}	6.48×10^{18}	4.24×10^{18}	1.20×10^{17}
2 HR	2.61×10^{18}	7.46×10^{18}	1.68×10^{18}	1.01×10^{18}	5.15×10^{18}	3.01×10^{18}	3.56×10^{16}
8 HR	2.04×10^{18}	2.76×10^{18}	5.70×10^{17}	3.16×10^{17}	2.21×10^{18}	5.53×10^{17}	1.19×10^{15}
1 DY	1.15×10^{18}	1.28×10^{18}	1.00×10^{17}	1.30×10^{17}	3.63×10^{17}	3.08×10^{16}	4.27×10^{14}
1 WK	4.41×10^{17}	2.15×10^{17}	6.07×10^{15}	8.04×10^{16}	1.66×10^{15}	7.39×10^{15}	3.29×10^{14}
1 MO	2.76×10^{17}	1.41×10^{17}	2.25×10^{15}	2.63×10^{16}	1.58×10^{15}	2.41×10^{15}	1.13×10^{14}

CORE TEMPERATURE DISTRIBUTION

% of Core Fuel Volume Above the Given Temperature	Local Temperature, °F
0.0	4100
0.2	3700
1.8	3300
7.0	2900
14.5	2500

CONCENTRATION OF IODINE ISOTOPES IN THE RECIRCULATION LOOP

ISOTOPES	RECIRCULATION LOOP CONCENTRATION (c/cc)
I-131	$1.06X10^{3}$
I-132	$1.83X10^{2}$
I-133	$8.26X10^{2}$
I-134	$1.96X10^{2}$
I-135	$4.08X10^{2}$

The radiation sources circulating in the residual heat removal loop are shown in Table 11.2-11 and are used for whole body radiation doses in the auxiliary building.

The radioactivity in the containment also would be additional source of radiation to the auxiliary building following a loss-of-coolant accident.

GAP ACTIVITY CIRCULATING IN RESIDUAL HEAT REMOVAL LOOP, MEV/CC-SEC

GAMMA ENERGY (MEV/PHOTON)							
TIME AFTER RELEASE	**0.4**	**0.8**	**1.3**	**1.7**	**2.2**	**2.5**	**3.5**
0 HR	1.63×10^{7}	1.31×10^{8}	8.54×10^{6}	4.90×10^{6}	4.61×10^{6}	1.70×10^{6}	4.50×10^{5}
0.5 HR	1.51×10^{7}	1.23×10^{8}	7.56×10^{6}	4.16×10^{6}	4.16×10^{6}	1.61×10^{6}	3.78×10^{5}
1 HR	1.39×10^{7}	1.14×10^{8}	6.18×10^{6}	3.46×10^{6}	3.67×10^{6}	1.20×10^{6}	2.78×10^{5}
2 HR	1.28×10^{7}	1.03×10^{8}	4.59×10^{6}	2.53×10^{6}	3.01×10^{6}	8.24×10^{5}	2.00×10^{5}
8 HR	1.11×10^{7}	7.75×10^{7}	7.16×10^{5}	4.16×10^{5}	5.61×10^{5}	1.30×10^{5}	2.51×10^{4}
1 DY	1.03×10^{7}	6.99×10^{7}	4.84×10^{4}	1.82×10^{4}	1.75×10^{5}	7.07×10^{3}	9.96×10^{1}
1 WK	9.54×10^{6}	4.88×10^{7}	1.16×10^{2}	2.93×10^{2}			
1 MO	1.21×10^{6}	4.69×10^{7}					
6 MO	4.16×10^{4}	1.56×10^{7}					
1 YR	1.22×10^{3}	1.31×10^{7}					

DOSE RATE (REM/HR) RHR OR CONTAINMENT SPRAY

Time	Pump Room	Heat Exchanger Room	Safety Injection Pump Room
0	2.8	22.7	37.6
0 - 5 hr	2.3	18.6	32.2
1 hr.	2.0	16.3	27.4
2 hr.	1.6	13.4	22.1
8 hr.	0.83	6.6	10.5
1 day	0.18	1.5	2.6
1 week	0.02	0.2	0.41
1 month	0.008	0.08	0.18

Under the assumptions of: (1) increased sump dilution by melted ice,

(2) core and halogen releases in accordance with Safety Guide No. 4 (in effect on September 1971), and

(3) washdown of 50% of the core halogens to the sump occurs as a result of the action of the containment sprays.

Radiation Monitoring System Channel Sensitivities and Detecting Medium

Monitor Name	Channel Number	Medium	Typical Range	Detected Isotopes
U1 Containment-Air Particulate U2 Containment-Air Particulate	ERS-1301, 1401 ERS-2301, 2401	Air	$1x10^{-4}$ to 10 µCi	Cs^{137}, Radioactive Particulates
U1 Containment-Air Iodines U2 Containment-Air Iodines	ERS-1303, 1403 ERS-2303, 2403	Air	$2x10^{-4}$ to 3 µCi	I^{131}, Radioiodine
U1 Containment Normal Range Noble-Gas U2 Containment Normal Range Noble-Gas	ERS-1305, 1405 ERS-2305, 2405	Air	$9x10^{-7}$ to $5x10^{-2}$ µCi/cc	Xe^{133}, Noble Gases
U1 Steam Jet Air Ejector Normal Range Gas U2 Steam Jet Air Ejector Normal Range Gas	SRA-1905-A, 1905-B SRA-2905-A, 2905-B	Air	$9x10^{-7}$ to $5x10^{-2}$ µCi/cc	Xe^{133}, Noble Gases
U1 Steam Jet Air Ejector Accident Range Gas U2 Steam Jet Air Ejector Accident Range Gas	SRA-1909 SRA-2909	Air	$1x10^{-2}$ to $9x10^{4}$ µCi/cc $1x10^{-2}$ to $9x10^{4}$ µCi/cc	Xe^{133}, Noble Gases
U1 Component Cooling Loop Liquid	1-CRA-415 & 1-CRA-425	Water	$1x10^{-5}$ to $1x10^{-2}$ µCi/cc	Co^{60}, Mixed Fission Products
U2 Component Cooling Loop Liquid	2-CRA-415 & 2-CRA-425	Water	$1x10^{-5}$ to $1x10^{-2}$ µCi/cc	Co^{60}, Mixed Fission Products

Radiation Monitoring System Channel Sensitivities and Detecting Medium

Monitor Name	Channel Number	Medium	Typical Range	Detected Isotopes
Waste Disposal System Liquid Effluent	RRS-1001-A RRS-1001-B	Water	$1x10^{-7}$ to $4.43x10^{-2}$ µCi/cc	Co^{60}, Mixed Fission Products
U1 Steam Generator Blowdown Liquid U2 Steam Generator Blowdown Liquid	1-DRA-300 2-DRA-300	Water	$2x10^{-6}$ to $2x10^{0}$ µCi/cc	Cs^{137},Mixed Fission Products Co^{60}, Mixed Fission Products
U1 Essential Service Water Liquid	1-WRA-713	Water	$1x10^{-5}$ to $4x10^{-1}$ µCi/cc	Cs^{137},Mixed Fission Products Co^{60}, Mixed Fission Products
U2 Essential Service Water Liquid	2-WRA-714	Water	$1x10^{-5}$ to $4x10^{-1}$ µCi/cc	Cs^{137},Mixed Fission Products Co^{60}, Mixed Fission Products
Turbine Room Sump	Compositor	Water	Not Applicable	Not Applicable

Radiation Monitoring System Channel Sensitivities and Detecting Medium

Monitor Name	Channel Number	Medium	Typical Range	Detected Isotopes
U1 Steam Generator Blowdown Treatment System Liquid U2 Steam Generator Blowdown Treatment System Liquid	1-DRA-353 2-DRA-353	Water	$1x10^{-6}$ to $2x10^{-1}$ µCi/cc	Co^{60}, Mixed Fission Products
U1 Unit Vent Air Particulate U2 Unit Vent Air Particulate	VRA-1501 VRA-2501	Air	$1x10^{-4}$ to 10 µCi	Cs^{137}, Radioactive Particulates
U1 Unit Vent Radioiodine U2 Unit Vent Radioiodine	VRA-1503 VRA-2503	Air	$2x10^{-4}$ to 3 µCi	I^{131}, Radioiodine
Unit Vent Normal Noble Gas	VRS-1505-A, 1505-B, 2505-A, 2505-B	Air	$9x10^{-7}$ to $5x10^{-2}$ µCi/cc	Xe^{133}, Noble Gas
Unit Vent Accident Noble Gas	VRS-1509	Air	$1x10^{-4}$ to $9x10^{4}$ µCi/cc	Xe^{133}, Noble Gas
Unit Vent Accident Noble Gas	VRS-2509	Air	$1x10^{-4}$ to $9x10^{4}$ µCi/cc	Xe^{133}, Noble Gas
Gland Seal Condenser Exhaust Monitor	SRA-1805, 2805	Air	$9x10^{-7}$ to $5x10^{-2}$ µCi/cc	Xe^{133}, Noble Gas

Radiation Monitoring System Channel Sensitivities and Detecting Medium

Monitor Name	Channel Number	Medium	Typical Range	Detected Isotopes
	SRA-1809	Air	$1x10^{-2}$ to $9x10^{4}$ µCi/cc	Xe^{133}, Noble Gas
	SRA-2809	Air	$1x10^{-2}$ to $9x10^{4}$ µCi/cc	Xe^{133}, Noble Gas
U1 Essential Service Water Liquid	1-WRA-717	Water	$1x10^{-5}$ to $1x10^{-2}$ µCi/cc	Co^{60}, Mixed Fission Products
U2 Essential Service Water Liquid	2-WRA-718	Water	$1x10^{-5}$ to $1x10^{-2}$ µCi/cc	Co^{60}, Mixed Fission Products
Containment Area at Personnel Lock	VRS-1101, 2101	Air	$1x10^{-1}$ to $1x10^{4}$ mR/hr	
Upper Containment Area Monitor	VRS-1201, 2201	Air	$1x10^{-1}$ to $1x10^{4}$ mR/hr	
Steam Generator Power Operated Relief Valve Monitor	MRA-1600, 2600 1700, 2700	Vapor	$1x10^{-1}$ to $1x10^{+2}$ µCi/cc	Xe^{133}, Noble Gas
Sampling Room Iodine	ERA-7003	Air	$2x10^{-4}$ to 3 µCi	I^{131}, Radioiodine

Radiation Monitoring System Channel Sensitivities and Detecting Medium

Monitor Name	Channel Number	Medium	Typical Range	Detected Isotopes
Sampling Room Low Range Noble Gas	ERA-7005	Air	$1x10^{-7}$ to $1x10^{-1}$ μCi/cc	Xe^{133}, Noble Gas
Sampling Room Area	ERA-7006	Air	$1x10^{-2}$ to $1x10^{7}$ mR/hr	
Spent Fuel Area	12-RRC-330	Air	$1x10^{-2}$ to $1x10^{7}$ mR/hr	
In-Core Instrumentation Room Area	ERA-7402 (Unit 1)	Air	$1x10^{-4}$ to $1x10^{4}$ R/hr [1]	
	ERA-8402 (Unit 2)	Air	$1x10^{-4}$ to $1x10^{4}$ R/hr [1]	
Drumming Station Area	12-RRA-322 12-ERA-7505	Air	$1x10^{-2}$ to $1x10^{7}$ mR/hr	

[1] These monitors are calibrated to the appropriate range for the expected radiation levels in a particular area.

Radiation Monitoring System Channel Sensitivities and Detecting Medium

Monitor Name	Channel Number	Medium	Typical Range	Detected Isotopes
High Range Containment Area Monitor	VRA-1310, VRA-2310, VRA-1410, VRA-2410	Air	1 to $1x10^{7}$ R/HR	
Vestibule Elevation 591'	ERA-1306, -2306	Air	$1x10^{-3}$ to $1x10^{2}$ mR/hr	
Outside Containment Spray Pump Rooms Elevation 573'	ERA-1406, -2406	Air	$1x10^{-3}$ to $1x10^{2}$ mR/hr	
West of Equipment Hatch Elevation 650'	VRA-1506, -2506	Air	$1x10^{-3}$ to $1x10^{2}$ mR/hr	
Turbine Building, Elevation 609'	SRA-1906	Air	$1x10^{-3}$ to $1x10^{2}$ mR/hr	
Turbine Building, Elevation 591'	SRA-2906	Air	$1x10^{-3}$ to $1x10^{2}$ mR/hr	
North of Boric Acid Tanks Elevation 587'	RRA-1003	Air	$1x10^{-1}$ to $1x10^{4}$ mR/hr	
Unit 1 E CCP Room	ERA-7303	Air	$1x10^{-4}$ to $1x10^{4}$ R/hr [1]	

Radiation Monitoring System Channel Sensitivities and Detecting Medium

Monitor Name	Channel Number	Medium	Typical Range	Detected Isotopes
Unit 1 W CCP Room	ERA-7304	Air	$1x10^{-4}$ to $1x10^{4}$ R/hr [1]	
Unit 1 E RHR Pump Room	ERA-7305	Air	$1x10^{-4}$ to $1x10^{4}$ R/hr [1]	
Unit 1 W RHR Pump Room	ERA-7306	Air	$1x10^{-4}$ to $1x10^{4}$ R/hr [1]	
Unit 1 N SIS Pump Room	ERA-7307	Air	$1x10^{-4}$ to $1x10^{4}$ R/hr [1]	
Unit 1 S SIS Pump Room	ERA-7308	Air	$1x10^{-4}$ to $1x10^{4}$ R/hr [1]	
Unit 1 Reactor Coolant Filter Cubicle	ERA-7309	Air	$1x10^{-4}$ to $1x10^{4}$ R/hr [1]	
Unit 2 E CCP Room	ERA-8303	Air	$1x10^{-4}$ to $1x10^{4}$ R/hr [1]	
Unit 2 W CCP Room	ERA-8304	Air	$1x10^{-4}$ to $1x10^{4}$ R/hr [1]	
Unit 2 E RHR Pump Room	ERA-8305	Air	$1x10^{-4}$ to $1x10^{4}$ R/hr [1]	
Unit 2 W RHR Pump Room	ERA-8306	Air	$1x10^{-4}$ to $1x10^{4}$ R/hr [1]	

Radiation Monitoring System Channel Sensitivities and Detecting Medium

Monitor Name	Channel Number	Medium	Typical Range	Detected Isotopes
Unit 2 N SIS Pump Room	ERA-8307	Air	$1x10^{-4}$ to $1x10^{4}$ R/hr [1]	
Unit 2 S SIS Pump Room	ERA-8308	Air	$1x10^{-4}$ to $1x10^{4}$ R/hr [1]	
Unit 2 Reactor Coolant Filter Cubicle	ERA-8309	Air	$1x10^{-2}$ to $1x10^{4}$ R/hr [1]	
Unit 1 Control Room	ERS-7401	Air	$1x10^{-1}$ to $1x10^{4}$ mR/hr	
Access Control Facility	ERA-7403	Air	$1x10^{-1}$ to $1x10^{4}$ mR/hr	
Radio Chemistry Lab	ERA-7404	Air	$1x10^{-1}$ to $1x10^{4}$ mR/hr	
Unit 1 N Seal Water Injection Filter Cubicle	ERA-7407	Air	$1x10^{-4}$ to $1x10^{4}$ R/hr [1]	
Unit 1 S Seal Water Injection Filter Cubicle	ERA-7408	Air	$1x10^{-4}$ to $1x10^{4}$ R/hr [1]	
Unit 1 Seal Water Filter Cubicle	ERA-7409	Air	$1x10^{-4}$ to $1x10^{4}$ R/hr [1]	
Unit 2 Control Room	ERS-8401	Air	$1x10^{-1}$ to $1x10^{4}$ mR/hr	

Radiation Monitoring System Channel Sensitivities and Detecting Medium

Monitor Name	Channel Number	Medium	Typical Range	Detected Isotopes
609' Elevation Passageway	ERA-8403	Air	$1x10^{-4}$ to $1x10^{4}$ R/hr [1]	
Unit 2 N Seal Water Injection Filter Cubicle	ERA-8407	Air	$1x10^{-4}$ to $1x10^{4}$ R/hr [1]	
Unit 2 S Seal Water Injection Filter Cubicle	ERA-8408	Air	$1x10^{-4}$ to $1x10^{4}$ R/hr [1]	
Unit 2 Seal Water Injection Filter, Filter Cubicle	ERA-8409	Air	$1x10^{-4}$ to $1x10^{4}$ R/hr [1]	
587' Elevation Passageway	ERA-7504	Air	$1x10^{-4}$ to $1x10^{4}$ R/hr [1]	
Emergency Sampling Location	ERA-7507	Air	$1x10^{-1}$ to $1x10^{4}$ mR/hr	
573' Elevation Passageway	ERA-7508	Air	$1x10^{-4}$ to $1x10^{4}$ R/hr [1]	
Refueling Water Purification Filter Cubicle	ERA-7509	Air	$1x10^{-4}$ to $1x10^{4}$ R/hr [1]	
Unit 1 Vent Sampling Area	ERA-7601	Air	$1x10^{-1}$ to $1x10^{4}$ mR/hr	

Radiation Monitoring System Channel Sensitivities and Detecting Medium

Monitor Name	Channel Number	Medium	Typical Range	Detected Isotopes
Unit 1 Vent Sampling Flow Adjacent Area	ERA-7602	Air	$1x10^{-4}$ to $1x10^{4}$ R/hr [1]	
Unit 2 Vent Sampling Area	ERA-7603	Air	$1x10^{-1}$ to $1x10^{4}$ mR/hr	
Unit 2 Vent Sampling Flow Adjacent Area	ERA-7604	Air	$1x10^{-4}$ to $1x10^{4}$ R/hr [1]	
633' Elevation Passageway	ERA-7605	Air	$1x10^{-1}$ to $1x10^{4}$ mR/hr	

REACTOR COOLANT FISSION AND CORROSION PRODUCT ACTIVITIES DURING STEADY STATE OPERATION AND PLANT SHUTDOWN OPERATION

	OPERATING PWR PLANT		DONALD C. COOK PLANT - 1% FUEL DEFECTS	
ISOTOPE	**MEASURED ACTIVITY BEFORE SHUTDOWN µCi/gm**	**MEASURED PEAK SHUTDOWN ACTIVITY µCi/gp**	**CALCULATED ACTIVITY BEFORE SHUTDOWN µCi/gm**	**EXPECTED PEAK SHUTDOWN ACTIVITY µCi/gm**
I-131	0.83	14.9	2.4	43.0
Xe-133	127.0	65.0 [1]	254.0	130.0 (1)
Cs-134	1.29	1.7	0.19	0.25
Cs-137	1.67	2.14	1.1	1.4
Cs-144	0.00068	0.0058	0.00051	0.0044
Sr-89	0.0033	0.40	0.0042	0.51
Sr-90	0.00057	0.013	0.0001	0.0023
Co-58	---	0.95	0.025	1.0

[1] Activity reduced from steady state level by approximately one day of system degassification prior to plant shutdown.

RADIATION MONITORING SYSTEM CHANNELS		
CHANNEL	**PURPOSE**	**ASSOCIATED TRIP FUNCTION OVERVIEW**
ERS-1301, 1401, 2301, 2401	Containment Airborne Particulates - Detection	Containment ventilation isolation, prevent further release
ERS-1303, 1403, 2303, 2403	Containment Radioiodine - Detection	Containment ventilation isolation, prevent further release
ERS-1305, 1405, 2305, 2405	Containment Normal Range Noble Gas - Detection	Containment ventilation isolation, prevent further release
ERS-7401, 8401	Control Room Area Monitor	Isolate Control Room Ventilation
CRA-415, CRA-425	Component Cooling Water Loop Liquid Monitor - Detect leaks from RCS or RHR into the CCW system	Isolate CCW surge tank vent
DRA-300	Steam Generator Blowdown Liquid Monitor - detect primary to secondary leakage via common blowdown header	Isolate steam generator blowdown system.
WRA-713, WRA-714, WRA-717, WRA-718	Essential Service Water Liquid Monitor – Detect leakage in the containment spray heat exchangers, (post LOCA)	None
DRA-353	Steam Generator Blowdown Treatment System Liquid Monitor - measure activity in the blowdown liquid after it passes the treatment demineralizer	Isolate steam generator blowdown system
12-RRC-330	SFP Area Monitor	Place SFP ventilation into service
RRS-1001-A, RRS-1001-B	Waste Disposal System Liquid Effluent Monitor	Automatic valve closure to prevent further release
SRA-1805	Gland Seal Condenser Exhaust – Normal Range Detection	None
SRA-1809	Gland Seal Condenser Exhaust – Accident Range Detection	None
SRA-1905-A, 1905-B	Steam Jet Air Ejector Normal Range Noble Gas - Detect primary and secondary leakage	None
SRA-1909	Steam Jet Air Ejector Accident Range Noble Gas - Detect primary and secondary leakage	None
SRA-2805	Gland Seal Condenser Exhaust – Normal Range Detection	None

RADIATION MONITORING SYSTEM CHANNELS		
CHANNEL	**PURPOSE**	**ASSOCIATED TRIP FUNCTION OVERVIEW**
SRA-2809	Gland Seal Condenser Exhaust –Accident Range Detection	None
SRA-2905-A, 2905-B	Steam Jet Air Ejector Normal Range Noble Gas – Detect primary and secondary leakage	None
SRA-2909	Steam Jet Air Ejector Accident Range Noble Gas – Detect primary and secondary leakage	None
Unit Vent Continuous air flow sampler	Tritium sampling	None
VRA-1501, 2501	Unit Vent Airborne Particulates - Detection	None
VRA-1503, 2503	Unit Vent Radioiodines - Detection	None
VRS-1505-A, 1505-B	Unit Vent Normal Range Noble Gas - Detection	Gas decay tank isolation valves [1]
VRS-1509	Unit Vent Accident Range Noble Gas - Detection	Sample pathway bypass of channels 1, 3, 5 to sample panel
VRS-2505-A, 2505-B	Unit Vent Normal Range Noble Gas – Detection	Gas Decay Tank isolation valves [1]
VRS-2509	Unit Vent Accident Range Noble Gas – Detection	Sample pathway bypass of channels 1, 3, 5 to sample pallet

[1] Available setpoint is used to accommodate: 1) normal operation, and 2) gas decay tank release.

DESIGN AND MEASURED EQUILIBRIUM REACTOR COOLANT FISSION PRODUCT

ACTIVITIES FOR OPERATING PWR'S AND CALCULATED VALUES FOR THE D. C. COOK STATIONS

		GINNA STATION [1]			BEZNAU STATION (1)		COOK STATION
	DESIGN VALUE [2] µc/cc	MEASURED VALUE µc/cc	RATIO MEASURED (Design)	DESIGN VALUE (2) µc/cc	MEASURED VALUE µc/cc	RATIO MEASURED (DESIGN)	DESIGN VALUE (2) µc/cc
Total Activity	216	71	0.33	299	168	0.73	207
Isotopic Activity (Key Isotopes)							
I-131	1.53	0.56	0.37	0.96	0.75	0.78	1.7
I-133	2.55	1.7	0.67	1.74	2.0	1.16	2.6
Xe-133	184	45	0.24	200	119	0.60	178
Cs-134	0.19	0.06	0.32	0.22	0.075	0.35	0.13
Cs-137	0.94	0.37	0.40	1.53	0.22	0.15	0.8

[1] Based on an assumed 1% defect level.
[2] Amendment 20 to original FSAR (Mar, 1972).

Blowdown Treatment System Components

Pump	
Number	1 per unit
Fluid	Steam generator blowdown
Pressure, Suction	Atmospheric
Temperature	200°F
Head	125 ft.
Flow	60 gpm
Type	Horizontal centrifugal
Material, Casing	Stainless Steel
Impeller	Stainless Steel
NPSH, minimum Ft. H_2O	2.5
Heat Exchanger[1]	
Number	1 per unit
Shell Side (blowdown liquid)	
Inlet Temperature	200°F
Outlet Temperature	120°F
Max. pressure	70 psi
Operating pressure	50 psi
Flow	60 gpm
Material	304 Stainless Steel
Pressure drop, normal	4 psi
maximum allowable	15 psi
Tube Side (non-essential service water)	
Inlet Temperature	76°F

[1] The system has been evaluated for a NESW pump discharge temperature of 88.9°F.

Blowdown Treatment System Components

Outlet Temperature	106°F
Max. pressure	150 psig
Operating pressure	75 psig
Flow	160 gpm
Material 304 Stainless Steel	
Pressure drop, normal	5 psi
maximum allowable	9 psi
Mixed Bed Demineralizers	
Number	3 per unit
Type	Flushable
Vessel, design pressure, psig	200
Operating pressure, psig	50
Vessel, design temperature, °F	250
Operating temperature, °F	120
Resin volume, ft^3	56 (Nos. 1 & 2) 20 (No. 3)
Design flow rate, gpm	50
Resin type	Cation and anion
Material of construction	Austenitic stainless steel