Table 9.5-1

Sheet 1

ESTIMATED OFFGAS RELEASE RATES PER UNIT

Activation Gases Isotope	(µCi/sec) Half-Life	Evolution Rate	Stack Release
N-13	10 min	3.5 X 10^3	Negligible
N-16	7.4 sec	1.47 X 10^8	Negligible
0-19	19 sec	0.9 X 10^6	Negligible

Fission Product Gases

Release rates are given in µCi/sec, based on modified [(a)] gas mixture

Isotope	Half-Life	T = O	30-Min Holdup	Discharge From Charcoal Adsorbers
Kr-83m	1.86 hr	3.4×10^3	2.9×10^3	1.0×10^1
Kr-85m	4.4 hr	6.1×10^3	5.6×10^3	5.2×10^2
Kr-85(b)	10.74 yr	10-20	10-20	10-20
Kr-87	76 min	2.0×10^4	1.5×10^4	3.7×10^0
Kr-88	2.79 hr	2.0×10^4	1.8×10^4	4.1×10^2
Kr-89	3.18 min	1.3×10^5	1.8×10^2	
Kr-90	32.3 sec	2.8×10^5		
Kr-91	8.6 sec	3.3×10^5		
Mr-92	1.84 sec	3.3×10^5		
Kr-93	1.29 sec	9.9×10^4		
Kr-94	1.0 sec	2.3×10^4		
Kr-95	0.5 sec	2.1×10^3		
Kr-97	1 sec	1.4×10^1		
Xe-131m	11.96 day	1.5×10^1	1.5×10^1	9.8×10^0
Xe-133m	2.26 day	2.9×10^2	2.8×10^2	2.7×10^1
Xe-133	5.27 day	8.2×10^3	8.2×10^3	3.0×10^3
Xe-135m	15.7 min	2.6×10^4	6.9×10^3	
Xe-135	9.16 hr	2.2×10^4	2.2×10^4	
Xe-137	3.82 min	1.5×10^5	6.7×10^2	
Xe-138	14.2 min	8.9×10^4	2.1×10^4	
Xe-139	40 sec	2.8×10^5		
Xe-140	13.6 sec	3.0×10^5		
Xe-141	1.72 sec	2.4×10^5		
Xe-142	1.22 sec	7.3×10^4		
Xe-143	0.96 sec	1.2×10^4		
Xe-144	9 sec	5.6×10^2		
	Totals	$\approx2.5\times10^6$	$\approx1.0\times10^5$	4.0×10^3

(a) The release rate (R) of each noble gas can be expressed by the simplified form:

$$R_i = K_g y_i \lambda_i^{m} e^{-\lambda_i t}$$

Table 9.5-1 (cont'd)

ESTIMATED OFFGAS RELEASE RATES PER UNIT

Sheet 2

The observed experimental data from several operating BWRs including KRB and Dresden 2 have shown a variation in individual noble gas isotopes with respect to each other that can be expressed in terms of variation in m, the exponent of the decay constant term (λ). The average measured value of m was 0.4 with a standard deviation of $\pm$ 0.07. With the ΣR_i @ t=30 min set at 100,000 μCi/sec, the value of K_g is 2.6 X 10^7. Y_i is the fission yield for isotope i. Decay times (t) of 15.7 hrs and 181 hrs were used for Kr and Xe, respectively, in arriving at the values in the column headed "Discharge from Charcoal Adsorbers." These times include a 6 hr delay in the holdup pipe.

(b) Estimated from experimental observations.

Table 9.5-2

PROCESS INSTRUMENT ALARMS

Functional Parameter	Main Control Room Indicated	Main Control Room Recorded
Preheater discharge temperature - low	X	
Recombiner catalyst temperature - high/low	X	X
Offgas condenser drain well (dual) level - high/low	X	
Offgas condenser gas discharge temperature - high	X	
H_2 analyzer (condenser discharged) (dual) - high	X	X
Gas flow (offgas condenser discharge) - high/low	X	X
Cooler - condenser discharge temperature - high/low	X	X
Glycol solution temperature - high/low	X	X
Gas reheater discharge humidity high	X*	X
Prefilter ΔP - high	X	
Carbon bed temperature - high	X	X
Carbon vault temperature - high/low	X	X
Post filter ΔP - high	X	

Instrumentation elements:

- Temperature - thermocouple
- Level - differential pressure diaphram
- Hydrogen - thermal conductivity
- Gas flow - flow orifice and thermal dispersion
- Differential pressure - differential pressure diaphragm

*Disconnected for Unit 2.

TABLE 9.5-3

OFFGAS SYSTEM MAJOR EQUIPMENT ITEMS

Sheet 1

Offgas Preheaters

Two Required.

Duty: ≈5.8 X 10^5 Btu/hr each

Construction: Stainless steel tubes and carbon steel shell. 300 ft^2 (minimum). 350 psig shell design pressure, 1,000 psig tube design pressure. 400°F shell design temperature, 575°F tube design temperature.

Catalytic Recombiners

Two Required.

Duty: ≈2.2 X 10^6 Btu/hr each

Construction: Stainless steel cartridge, low alloy steel shell. Catalyst cartridge containing a precious metal catalyst on nichrome strips. Catalyst cartridge to be replaceable without removing vessel. 350 psig design pressure. 900°F design temperature.

Offgas Condenser

One Required.

Duty: 1.25 X 10^7 Btu/hr

Construction: Low alloy steel shell. Stainless steel tubes. 600 ft^2 (minimum) surface area. 350 psig shell design pressure. 250 psig tube design pressure. 900°F shell design temperature. 150°F tube design temperature.

Water Separator

One Required.

Construction: Carbon steel shell, stainless steel wire mesh. 350 psig design pressure. 250°F design temperature.

Cooler Condenser

Duty: ≈1.1 X 10^5 Btu/hr

Construction: Stainless steel shell. Stainless steel tubes. 100 ft^2 (minimum) surface area. 100 psig tube design pressure. 350 psig shell design pressure. 150°F tube design temperature. 150°F shell design temperature.

Moisture Separators (Downstream of Cooler-Condenser)

Two Required.

Construction: Carbon steel shell, stainless steel wire mesh. 350 psig design pressure. 150°F design temperature.

Gas Reheater

One Required.

Duty: 2.8 kW (minimum)

Construction: Carbon steel shell. 14 ft^2 surface area. 350 psig process pipe design pressure. 150°F design temperature.

TABLE 9.5-3 (Cont'd)

OFFGAS SYSTEM MAJOR EQUIPMENT ITEMS

Sheet 2

Glycol Storage Tank

One Required. 7.5 feet inside diameter, 9.5 feet high.

Construction: Carbon steel. 3,000 gal. Water-filled hydrostatic design pressure. 0°F design temperature. Code, API 650.

Glycol Solution Refrigerators and Motor Drives

Two Required.

Duty: $\approx 9x10^4$ Btu/hr each, single stage vapor compressor, 20 hp.

Construction: Conventional refrigerator units w/chilling self-contained and pump exchangers, glycol exit solution temperature 35°F.

Glycol Pumps and Motor Drives

Two Required.

Duty: 65 gal./min. 5 hp

Construction: Cast iron, 3-in. connections, 85 ft TDH, 0°F design temperature.

Glycol Tank Agitator and Motor Drive

One Required

Duty: 2 hp

Eliminate thermal gradients in tank.

Prefilters and After Filters

Two Required of each type.

Duty: 160 cfm rating at 1 in. H_20P (clean)

Construction: Carbon steel shell. High efficiency moisture resistant filter element. Flanged shell. 350 psig design pressure. 150°F design temperature.

Carbon Bed Adsorbers

Quantity: 6 Beds

Construction: Carbon steel, 4 ft o.d. (5/8 inch wall) x 21 ft 6-1/8 inch length vessels each with a 16-ft packed section containing $\approx$3 tons of 8-16 mesh carbon (~200 ft^3 of activated carbon) Columbia G or equivalent. Design pressure 350 psig. Design temperature 150°F.

A flow distributor will be placed in the inlet of each column. Channeling is precluded by use of a vertical bed and a large bed to particle diameter ratio (~500). Underhill[1] has stated that channeling or wall effects may reduce efficiency of the holdup bed if this ratio is not greater than 12.

Table 9.5-4

EQUIPMENT MALFUNCTION ANALYSIS

Sheet 1

Equipment Item	Malfunction	Consequences	Design Precautions
Preheaters	Steam leak	Would further dilute process offgas Steam consumption would increase.	Spare preheater.
	Low pressure steam supply	Recombiner performance would fall off at low power level, and hydrogen content of recombiner gas discharge would increase, eventually to a combustible mixture.	Low temperature alarms on preheater exist and recombiner inlet. Recombiner H_2 analyzer.
Recombiners	Catalyst gradually deactivates	Temperature profile changes through catalyst. Eventually excess H_2 would be detected by H_2 analyzer or by gas flowmeter. Eventually the gas could become combustible.	Temperature probes in recombiner and H_2 analyzer provided. Spare recombiner.
	Catalyst gets wet at start	H_2 conversion falls off and H_2 is detected by downstream analyzers. Eventually the gas could become combustible.	Condensate drains, temperature probes in recombiner. Air bleed system at startup. Recombiner thermal blanket, spare recombiner and heater. (For Units 2 & 3, low condenser vacuum scram has been removed.) Hydrogen analyzer.
Recombiner Condenser	Cooling water leak	The coolant (reactor condensate) would leak to the process gas (shell) side. This would be detected if drain-well liquid level increases. Moderate leakage would be of no concern from a process standpoint. (The process condensate drains to the hotwell.)	None.
Drain well	Liquid level instruments fail	If both drain valves fail to open, water will build up in the condenser and pressure drop will increase. The high ΔP, if not detected by instrumentation, could cause pressure buildup in the main condenser and eventually initiate a reactor scram. If a drain valve fails to close, gas will recycle to the main condenser, increase the load on the SJAE, and cause back pressure on the main condenser, eventually causing a reactor scram.	Two separate drain systems are provided each with high and low level alarms.

Table 9.5-4 (Continued)

EQUIPMENT MALFUNCTION ANALYSIS

Sheet 2

Equipment Item	Malfunction	Consequences	Design Precautions
Water separator	Corrosion of wire mesh element	Higher quantity of water collected in holdup line and routed to radwaste.	Stainless steel mesh specified.
Six-hour holdup line	Corrosion of line	Leakage to soil of gaseous and liquid fission products provided.	Outside of pipe dipped and wrapped. Dehumidification coil
Cooler-condensers	Corrosion of finned tube	Glycol-water solution would leak into process (shell) side and be discharged to clean radwaste. If not detected at radwaste, the glycol solution would discharge to the reactor condensate system.	Stainless-steel-finned tubes specified. The inventory of glycol-water can be observed in tank.
	Icing up of finned tube	Shell side of cooler could plug up with ice, gradually building up pressure drop. If this happens, the spare unit could be activated. Complete blockage of both units would increase ΔP and lead to a reactor scram.	Design glycol-H_2O solution temperature of 33 to 50°F. Redundant temperature indication and alarm systems.
Moisture separators	Corrosion of wire mesh element	Increased moisture would be retained in process gas routed to charcoal[1] adsorbers. Over a long period, the charcoal[1] performance would deteriorate as a result of moisture pickup.	Stainless steel mesh specified. Relative humidity instrumentation provided.
Gas reheater	Heater element failure	Cool gas, saturated with water vapor would enter the charcoal adsorbers. Eventually, charcoal[1] performance will deteriorate as charcoal[1] moisture content increases, and plant emissions will increase.	Dual heating circuits provided. Moisture recorder and high moisture alarm. (Alarm for Unit 2 is disconnected.)
Prefilters	Hole in filter media	More radioactivity would deposit on the charcoal[1] in the first adsorber vessel of the train. This would increase the radiation level in the charcoal[1] vault and make maintenance more difficult.	ΔP instrumentation provided. Spare unit provided.
[1]Charcoal adsorbers	[1]Charcoal gets wet	[1]Charcoal performance will deteriorate gradually as charcoal gets wet. Holdup times for krypton and xenon will decrease, and plant emissions will increase.	Highly instrumented, mechanically simple gas dehumidification system with redundant equipment.

Table 9.5-4 (Continued)

EQUIPMENT MALFUNCTION ANALYSIS

Sheet 3

Equipment Item	Malfunction	Consequences	Design Precautions
Vault air conditioning units	Mechanical failure	If ambient temperature exceeds approximately 80°F, increased emission could occur.	Spare refrigerator unit provided.
		If ambient temperature is below approximately 60°F, charcoal[1] could pick up additional moisture.	Vault temperature alarms provided.
After filters	Hole in filter media	Probably of no real consequence. The charcoal[1] media itself should be a good filter at the low air velocity.	ΔP instrumentation provided. Spare unit provided.
Glycol refrigera-machines	Mechanical failure	If spare unit fails to operate, the glycol solution temperature will rise and the dehumidification system performance will deteriorate. This will cause gradual buildup of moisture on the charcoal,[1] with increased plant emissions.	Spare refrigerator Glycol solution temperature alarms provided.
Steam jet ejectors	Low flow of motive high pressure steam	When the hydrogen and oxygen concentrations exceed 4 and 5 vol %, respectively, the process gas becomes combustible.	The normal steam pressure to the air ejectors is 200 psig. If the steam supply pressure to the operating air ejector drops to 170 psig, the steam supply to the SJAE is shut off. If the steam supply pressure for the standby unit is also less than 170 psig, the steam supply to the standby SJAE is shut off. If neither SJAE is in operation, condenser back pressure will continue to increase. By ensuring adequate steam supply to the SJAEs, the 0_2 concentration cannot get as high as 5 percent.
		Inadequate steam flow will cause overheating and deterioration the catalyst.	Steam flow to be held at constant maximum flow regardless of plant power level.
	Wear of steam supply nozzle of ejector	Increased steam flow to recombiner. This could reduce degree of recombination at low power levels.	

[1]The term "activated carbon" would be more appropriate than the term "charcoal."

TABLE 9.5-5

ISOTOPIC INVENTORY-CHARCOAL OFFGAS SYSTEM
(μc)

Sheet 1

Component	Preheater	Recom-biner	Offgas Con-denser	Water Separator	Holdup Pipe	Cooler Con-denser	Moisture Separator	Reheater	Prefilter	Charcoal Vessel Train	First Charcoal Vessel	Afterfilter
Residence Time	0.8 Sec	0.94 Sec	50 Sec	5.1 Sec	6 Hr	178 Sec	6.5 Sec	14.5 Sec	43.5 Sec	Kr-9.7 Hr Xe-7.3 Day	Kr-1.6 Hrs. Xe-1.2 Day	43.5 Sec
Operating Time	0	0	0	0	0	0	0	0	1 Yr	10 Yr	10 Yr	1 Yr
Solid Daughter Capture	0	0	100%	100%	60%	0	0	0	100%	100%	100%	100%
Solid Daughter Washout	-	-	100%	100%	100%	-	-	-	0	0	0	0
Isotope												
Kr-83M	2.77+3	3.26+3	1.73+5	1.76+4	2.98+7	6.57+4	2.38+3	5.30+3	1.58+4	3.43+6	1.59+6	4.33+2
Kr-85M	4.92+3	5.78+3	3.07+5	3.13+4	8.57+7	4.22+5	154+4	3.42+4	1.03+5	4.21+7	1.21+7	2.22+4
Ke-85	1.90+1	2.24+1	1.19+3	1.21+2	5.14+5	4.26+3	1.56+2	3.48+2	1.03+3	8.38+5	1.39+5	1.03+3
Kr-87	1.57+4	1.85+4	9.79+5	9.95+4	1.23+8	1.28+5	4.62+3	1.03+4	3.07+4	4.61+6	2.72+6	1.52+2
Rb-87	0	0	0	0	0	0	0	0	0	6.38-4	3.76-4	0
Kr-88	1.61+4	1.90+4	1.01+6	1.02+5	2.26+8	8.01+5	2.90+4	6.48+4	1.94+5	5.87+7	2.13+7	1.74+4
Rb-88	4.21+0	1.57+1	1.74+4	1.70+2	1.31+8	3.85+5	1.49+4	3.36+4	3.75+6	5.87+7	2.13+7	1.74+4
Kr-89	9.67+4	1.13+5	5.50+6	5.07+5	2.71+7	0	0	0	0	0	0	0
Rb-89	2.94+1	1.09+2	1.14+5	9.84+2	1.63+7	1.29-1	4.38-3	9.70-3	8.76-1	0	0	0
Sr-89	1.27-6	1.15-5	3.17-1	2.65-4	5.14+4	3.04+2	1.11+1	2.48+1	1.07+7	0	0	0
Y-89M	0	0	1.23-1	1.44-5	5.13+4	3.04+2	1.11+1	2.48+1	1.07+7	0	0	0
Kr-90	1.67+5	1.93+5	6.23+6	3.35+5	2.89+6	0	0	0	0	0	0	0
Rb-90	2.87+2	1.06+3	7.95+5	3.70+3	1.73+6	0	0	0	0	0	0	0
Sr-90	0	0	1.15-2	4.83-6	2.81+1	1.56-1	5.71-3	1.27-2	2.74+4	0	0	0
Y-90	0	0	0	0	8.83-1	9.77-3	3.58-4	7.99-4	2.71+4	0	0	0
Kr-91	8.62+4	9.44+4	1.18+6	7.19+3	1.41+4	0	0	0	0	0	0	0
Rb-91	4.17+2	1.50+3	5.10+5	2.30+2	8.49+3	0	0	0	0	0	0	0
Sr-91	2.23-3	2.02-2	2.36+2	8.09-3	2.95+3	1.30+1	4.75-1	1.06+0	3.67+3	0	0	0
Y-91M	0	1.29-6	8.30-1	2.39-6	2.43+3	1.41+1	5.15-1	1.15+0	4.02+3	0	0	0
Y-91	0	0	1.32-6	0	3.18+0	3.94-2	1.44-3	3.23-3	5.58+3	0	0	0
Kr-92	1.41+3	1.20+3	2.81+3	1.58+1	2.70+0	0	0	0	0	0	0	0
Rb-92	8.82+1	2.67+2	5.06+3	2.11+6	1.62+0	0	0	0	0	0	0	0
Sr-92	1.74-3	1.42-2	1.65+1	4.36+2	1.28+0	2.92-3	1.06-4	2.36-4	2.27-1	0	0	0
Y-92	0	0	1.97-2	4.29-2	6.30-1	4.17-3	1.52-4	3.39-4	6.56-1	0	0	0
Kr-93	4.53+1	3.35+1	5.10+1	0	0	0	0	0	0	0	0	0

TABLE 9.5-5 (Cont'd)

ISOTOPIC INVENTORY-CHARCOAL OFFGAS SYSTEM
(μc)

Sheet 2

Component	Preheater	Recombiner	Offgas Condenser	Water Separator	Holdup Pipe	Cooler Condenser	Moisture Separator	Reheater	Prefilter	Charcoal Vessel Train	First Charcoal Vessel	Afterfilter
Rb-93	2.22+0	6.47+0	1.21+2	0	0	0	0	0	0	0	0	0
Sr-93	9.51-4	7.53-3	8.01+0	0	0	0	0	0	0	0	0	0
Y-93	0	0	3.30-3	0	0	0	0	0	0	0	0	0
Zr-93	0	0	0	0	0	0	0	0	0	0	0	0
Nb-93M	0	0	0	0	0	0	0	0	0	0	0	0
Kr-94	1.20+0	7.77-1	8.46-1	0	0	0	0	0	0	0	0	0
Rb-94	1.27-1	3.30-1	2.37+0	0	0	0	0	0	0	0	0	0
Sr-92	3.22-4	2.37-3	9.57-1	0	0	0	0	0	0	0	0	0
Y-94	0	0	1.35-2	0	0	0	0	0	0	0	0	0
Kr-95	7.16-6	2.56-6	0	0	0	0	0	0	0	0	0	0
Rb-95	3.99-6	4.24-6	2.44-6	0	0	0	0	0	0	0	0	0
Sr-95	0	0	1.78-6	0	0	0	0	0	0	0	0	0
Y-95	0	0	0	0	0	0	0	0	0	0	0	0
Zr-95	0	0	0	0	0	0	0	0	0	0	0	0
Nb-95M	0	0	0	0	0	0	0	0	0	0	0	0
Kr-97	7.22-4	4.66-4	5.08-4	0	0	0	0	0	0	0	0	0
Rb-97	5.68-4	5.37-4	5.90-4	0	0	0	0	0	0	0	0	0
Sr-97	2.40-4	5.57-4	8.99-4	0	0	0	0	0	0	0	0	0
Y-97	3.44-5	2.29-4	1.43-3	0	0	0	0	0	0	0	0	0
Zr-97	0	0	0	0	0	0	0	0	0	0	0	0
Nb-97	0	0	0	0	0	0	0	0	0	0	0	0
Xe-131M	1.21+1	1.42+1	7.56+2	7.72+1	3.24+5	2.65+3	9.69+1	2.16+2	6.49+2	7.66+6	1.51+6	4.25+2
Xe-133M	2.22+2	2.61+2	1.39+4	1.41+3	5.76+6	4.57+4	1.67+3	3.72+3	1.11+4	6.45+7	2.25+7	1.19+3
Xe-133	6.60+3	7.76+3	4.13+5	4.21+4	1.75+8	1.42+6	5.19+4	1.16+5	3.47+5	3.26+9	7.78+8	1.36+5
Xe-135M	2.09+4	2.45+4	1.28+6	1.28+5	3.40+7	5.20-1	1.77-2	3.93-2	1.15-1	3.54+0	3.54+0	0
Xe-135	1.78+4	2.09+4	1.11+6	1.13+5	3.97+8	2.58+6	9.43+4	2.22+5	6.45+5	7.06+8	6.28+8	1.16+0
Cs-135	0	0	0	0	2.63-2	2.64-4	9.73-6	2.17-5	4.74+1	2.13+3	1.89+3	0
Xe-137	1.18+5	1.39+5	6.84+6	6.42+5	4.14+7	0	0	0	0	0	0	0
Cs-137	3.45-5	1.29-4	1.37-1	1.19-3	3.84+2	2.14+0	7.83-2	1.75-1	3.75+5	0	0	0
Ba-137M	0	0	1.02-2	9.15-6	3.80+2	2.14+0	7.83-2	1.75-1	3.75+5	0	0	0

TABLE 9.5-5 (Cont'd)

ISOTOPIC INVENTORY-CHARCOAL OFFGAS SYSTEM
(μc)

Sheet 3

Component	Preheater	Recom-biner	Offgas Con-denser	Water Separator	Holdup Pipe	Cooler Con-denser	Moisture Separator	Reheater	Prefilter	Charcoal Vessel Train	First Charcoal Vessel	Afterfilter
Xe-138	7.11+4	8.34+4	4.35+6	4.34+5	1.04+8	3.32-1	1.12-2	2.49-2	7.29-2	2.03+0	2.03+0	0
Cs-138	1.02+1	3.81+1	4.18+4	3.97+2	6.26+7	1.98+3	7.01+1	1.56+2	2.98+4	2.03+0	2.03+0	0
Xe-139	1.76+5	2.03+5	7.18+6	4.41+5	4.78+6	0	0	0	0	0	0	0
Cs-139	8.73+1	3.23+2	2.72+5	1.41+3	2.87+6	0	0	0	0	0	0	0
Ba-139	3.20-3	2.99-2	7.01+2	3.36-1	2.71+6	2.64+3	9.50+1	2.12+2	1.05+5	0	0	0
Xe-140	1.21+5	1.36+5	2.63+6	5.50+4	1.94+5	0	0	0	0	0	0	0
Cs-140	5.28+2	1.92+3	9.11+5	1.56+3	1.16+5	0	0	0	0	0	0	0
Ba-140	8.87-5	8.11-4	1.23+1	1.71-3	1.56+3	8.53+0	3.11-1	6.95-1	7.64+4	0	0	0
La-140	0	0	8.69-4	0	7.76+1	8.43-1	3.09-2	6.90-2	7.74+4	0	0	0
Xe-141	7.19+2	5.96+2	1.29+3	0	0	0	0	0	0	0	0	0
Cs-141	8.45+0	2.68+1	1.92+3	0	0	0	0	0	0	0	0	0
Ba-141	1.46-3	1.22-2	3.68+1	0	0	0	0	0	0	0	0	0
La-141	0	0	3.33-2	0	0	0	0	0	0	0	0	0
Ce-141	0	0	0	0	0	0	0	0	0	0	0	0
Xe-142	2.20+1	1.58+1	2.24+1	0	0	0	0	0	0	0	0	0
Cs-142	3.46+0	8.81+0	4.79+1	0	0	0	0	0	0	0	0	0
Ba-142	1.06-3	7.76-3	3.01+0	0	0	0	0	0	0	0	0	0
La-142	0	0	9.02-3	0	0	0	0	0	0	0	0	0
Xe-143	4.17-1	2.63-1	2.71-1	0	0	0	0	0	0	0	0	0
Cs-143	6.68-2	1.61-1	7.23-1	0	0	0	0	0	0	0	0	0
Ba-143	1.09-3	7.60-3	8.85-1	0	0	0	0	0	0	0	0	0
La-143	0	2.40-6	2.45-2	0	0	0	0	0	0	0	0	0
Ce-143	0	0	2.73-6	0	0	0	0	0	0	0	0	0
Pr-143	0	0	0	0	0	0	0	0	0	0	0	0
Xe-144	1.55+2	1.70+2	2.22+3	1.57+1	3.26+1	0	0	0	0	0	0	0
Cs-144	3.35+1	9.64+1	2.41+3	1.14+1	1.95+1	0	0	0	0	0	0	0
Ba-144	5.38-1	4.15+0	2.18+3	1.31+0	1.95+1	0	0	0	0	0	0	0
La-144	1.87-3	3.46-2	7.74+2	3.24-2	1.95+1	0	0	0	0	0	0	0
Ce-144	0	0	3.86-4	0	1.18-2	0	0	0	0	0	0	0
Pr-144	0	0	3.20-6	0	1.10-2	0	0	0	0	0	0	0

TABLE 9.5-5 (Cont'd)

ISOTOPIC INVENTORY-CHARCOAL OFFGAS SYSTEM
(μc)

Sheet 4

Component	Preheater	Recom-bier	Offgas Con-denser	Water Separator	Holdup Pipe	Cooler Con-denser	Moisture Separator	Reheater	Prefilter	Charcoal Vessel Train	First Charcoal Vessel	Afterfilter
N-13	6.73-3	7.90+3	4.08+5	4.03+4	6.86+6	2.07-5	0	1.50-6	4.34-6	8.39-5	0	0
N-16	4.72-7	5.09-7	5.30+8	1.62+6	2.52+6	0	0	0	0	0	0	0
N-17	4.43+3	4.50+3	2.66+4	3.57+0	2.66	0	0	0	0	0	0	0
O-19	7.12+5	8.18+5	2.41+7	1.13+6	8.01+6	0	0	0	0	0	0	0
Iodine	-	-	-	-	-	-	-	-	8.70+4	8.70+4	8.70+4	0
TOTAL	4.88+7	5.28+7	5.96+8	7.87+6	1.49+9	5.87+6	2.15+5	4.91+5	2.77+7	4.21+9	1.48+9	1.96+5

TABLE 9.5-5 (Cont.)

ISOTOPIC INVENTORY-CHARCOAL OFFGAS SYSTEM
(μc)

Sheet 5

Component	Gas Kr + Xe	Solid Daughters	Gas Kr	Gas Xe
Preheater	9.24 + 5	1.4 + 3	3.91 + 5	5.33 + 5
Recombiner	1.06 + 6	1. + 4	4.48 + 5	6.1 + 5
Offgas Condenser	3.92 + 7	2.69 + 6	1.54 + 7	2.38 + 7
Water Separator	2.96 + 6	2.12 + 6	1.10 + 6	1.86 + 6
Holdup Pipe	1.25 + 9	2.4 + 8	4.95 + 8	7.6 + 8
Cooler Codenser	5.40 + 6	4.7 + 5	1.42 + 6	3.98 + 6
Moisture Separator	1.97 + 5	1.8 + 4	5.16 + 4	1.45 + 5
Gas Reheater	4.39 + 5	5.2 + 4	1.15 + 5	3.24 + 5
Prefilter	1.31 + 6	6.4 + 6	3.44 + 5	9.7 + 5
Carbon Bed Train	4.15 + 9	5.87 + 7	1.10 + 8	4.04 + 9
First Carbon Bed	1.46 + 9	2.13 + 7	3.78 + 7	1.42 + 9
Afterfilter	1.78 + 5	1.74 + 4	4.11 + 4	1.37 + 5

TABLE 9.5-6

RADIOLOGICAL EXPOSURES - MODIFIED OFFGAS SYSTEM

COMPONENT FAILURE

Component Failed	Pri. Act. Released	% Released	Resultant Exposure at 1400M
1st C. Bed	Iodine	1%	5.6 mr
6 C. Beds	Noble Gas	10%	0.6 mr
Prefilter	Particulate	1%	2.6 mr
Hold-up Pipe	Particulate	20%	10.2 mr
Total System	All	See above	20.2 mr*

*There is a 1.2 mr contribution from failure of all other components listed in Table 9.5-5.

Table 9.5-7

EFFLUENT - GLAND SEAL OFFGAS SUBSYSTEM*

Isotope	Release Rate to Environment μc/sec
Kr-83m	3.4×10^{0}
Kr-85m	5.7×10^{0}
Kr-85	8.3×10^{-3}
Kr-87	2.0×10^{1}
Kr-88	1.9×10^{1}
Kr-89	1.3×10^{2}
Kr-90	5.4×10^{1}
Kr-91	4.3×10^{-1}
Xe-131m	1.3×10^{-2}
Xe-133m	2.1×10^{-2}
Xe-133	5.4×10^{0}
Xe-135m	2.9×10^{1}
Xe-135	1.9×10^{1}
Xe-137	1.6×10^{2}
Xe-138	1.0×10^{2}
Xe-139	8.0×10^{1}
Xe-140	2.8×10^{0}

*Table taken from response to AEC Question 9.4, dated March 25, 1971.