1 of 4

Hanford Site Radionuclide National Emission Standards for Hazardous Air Pollutants Registered Stack Source Assessment

Prepared for the U.S. Department of Energy
Office of Environmental Restoration and
Waste Management

Westinghouse
Hanford Company Richland, Washington

Hanford Operations and Engineering Contractor for the
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7. Abstract

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The assement of potential emissions for 84 reg istered stacks was performed. 15 stacks had potential emissions which produced an efective dose equivalent > 0.1 mrem/yr to a maximum exposed individual. These stacks require continous monitoring as specified in Code of Federal Regulations 40 Part 61 Subpart H.

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**HANFORD SITE RADIONUCLIDE NATIONAL EMISSION
STANDARDS FOR HAZARDOUS AIR POLLUTANTS
REGISTERED STACK SOURCE ASSESSMENT**

WHC-SD-EN-RPT-007, Rev. 0

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**HANFORD SITE RADIONUCLIDE NATIONAL EMISSION
STANDARDS FOR HAZARDOUS AIR POLLUTANTS
REGISTERED STACK SOURCE ASSESSMENT**

EXECUTIVE SUMMARY

On February 3, 1993, the U.S. Department of Energy, Richland Operations Office received a Compliance Order and Information Request from the Director of the Air and Toxics Division of the U.S. Environmental Protection Agency, Region 10. The Compliance Order requires the Richland Operations Office to evaluate all radionuclide emission points at the Hanford Site to determine which are subject to continuous emission measurement requirements in 40 Code of Federal Regulations (CFR) 61, Subpart H, and to continuously measure radionuclide emissions in accordance with 40 CFR 61.93. The Information Request required the Richland Operations Office to provide a written Compliance Plan to meet the requirements of the Compliance Order. A Compliance Plan was submitted to the U.S. Environmental Protection Agency, Region 10, on April 30, 1993.

The Compliance Plan set as one of the milestones: complete assessment of the Hanford Site registered stacks, i.e., registered with the Washington State Department of Health, by December 17, 1993. This evaluation provides an assessment of the 84 registered stacks, under Westinghouse Hanford Company's management, and their potential radionuclide emissions, i.e., emissions with no control devices in place. The evaluation also determined if the effective dose equivalent from any of these stack emissions exceeded 0.1 mrem/yr, which will require the stack to have continuous monitoring.

The result of this assessment identified a total of 16 stacks as having potential emissions that would cause an effective dose equivalent greater than 0.1 mrem/yr. These stacks, as noted by 40 CFR 61.93, would require continuous monitoring.

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1.0 INTRODUCTION

The U.S. Department of Energy (DOE), Richland Operations Office (RL), is a department, agency, or instrumentality of the executive branch of the Federal Government and must comply with the requirements of the *Clean Air Act* (CAA) and its implementing regulations. On December 15, 1989, the U.S. Environmental Protection Agency (EPA) promulgated in the *Code of Federal Regulations* (CFR) the "National Emission Standards for Emissions of Radionuclides Other Than Radon From Department of Energy Facilities" (40 CFR Part 61, Subpart H). Subpart H requires that the emissions of radionuclides from DOE facilities shall not exceed those amounts that would cause any member of the public to receive an effective dose equivalent (EDE) of 10 mrem in a year. In addition, potential emissions of radionuclides from a facility that exceed 0.1 mrem/yr require continuous monitoring.

To determine compliance, 40 CFR 61.93 provides requirements for monitoring of radionuclide emissions from point sources. These monitoring requirements became effective upon promulgation of the regulation on December 15, 1989. Also, RL, as defined in 40 CFR 61, is an "owner or operator" of a "facility," i.e., the Hanford Site. Some monitoring systems on the Hanford Site that meet the continuous monitoring requirement do not use EPA-approved methods as specified in the regulations. A preliminary assessment revealed that seven stacks would require continuous monitoring: 291-A-1, 291-B-1, 291-T-1, 291-Z-1, 296-A-22, 296-A-40, and 340-NT-EX. On May 7, 1991, RL requested approval of the existing measurement systems for these stacks. On June 3, 1991, the EPA denied approval of these systems.

On February 3, 1993, RL received a Compliance Order and Information Request from the Director of the Air and Toxics Division of the EPA, Region 10 (McCormick 1993). The Compliance Order requires RL to evaluate all radionuclide emission points at the Hanford Site to determine which are subject to continuous emission measurement requirements in 40 CFR 61, Subpart H, and to continuously measure radionuclide emissions in accordance with 40 CFR 61.93. The Information Request required RL to provide a written Compliance Plan to meet the requirements of the Compliance Order. A Compliance Plan was submitted to EPA, Region 10, on April 30, 1993. The Compliance Plan called for developing a Federal Facility Compliance Agreement (FFCA). An FFCA was negotiated between RL and EPA, Region 10, and was entered into on February 7, 1994.

The Compliance Plan set as one of the milestones: complete assessment of the 84 Hanford Site registered stacks under management by Westinghouse Hanford Company by December 17, 1993.

The purpose of this document is to present the assessment results for the registered stacks on the Hanford Site for potential emissions, i.e., emissions with no control devices in place. The document also will identify those stacks requiring continuous monitoring, i.e., the EDE from potential emissions >0.1 mrem/yr.

2.0 SCOPE

The stack assessment of potential emissions was performed on all registered stacks on the Hanford Site (Table A-1, Appendix A). These emission sources represent 84 individual point sources presently registered under *Washington Administrative Code* (WAC) 246-247 with the Washington State Department of Health. The methods used in assessing the potential emissions from the stacks are described. For those stacks assessed as requiring continuous monitoring, a description is provided of the stacks and their sampling/monitoring systems. Also provided in this document is a current listing of the unregistered stacks with powered ventilation systems (Appendix B).

3.0 METHODS FOR CALCULATING POTENTIAL STACK EMISSIONS

The calculation of potential emissions for the registered stacks were made using five methods:

1. Source term estimation based on Appendix D release factors
2. Back calculations based on a decontamination factor of $3,000^n$, where n equals the number of high-efficiency particulate air (HEPA) filter banks in series
3. Nondestructive assessment (NDA)
4. Upstream of HEPA filter air concentration measurements
5. Spill release fraction (296-A-5).

Calculations based on the first two methods are considered extremely conservative, while the calculations made using the last three methods should produce realistic estimates of emissions. The assessment of stack emissions based on release factors in Appendix D or from back calculations could indicate that the potential emissions would result in an EDE, exceeding 0.1 mrem/yr. Calculations using one of the latter methods would result in an EDE less than 0.1 mrem/yr. If this occurs, the latter methods' results would be accepted over the results from either of the first two methods.

3.1 APPENDIX D RELEASE FACTORS

The potential emissions for a system without control devices can be estimated based on release factors presented in 40 CFR 61, Appendix D: gases = 1, liquids or particulate solids = 1×10^{-3} , and solids = 1×10^{-6} . This method is extremely conservative, because accidents involving liquids and loose particulates have a release fraction orders of magnitude less than the 1×10^{-3} release fraction. In an accident condition for a spill of powder from a 1-m height, a 4×10^{-5} release fraction would be used. Likewise, a liquid spill from the same height would use a 1×10^{-6} release fraction. Both of these cases use a release fraction less than a 1×10^{-3} release fraction that is used for powders and liquids from Appendix D. In cases where the assessment was performed on waste tanks, if the inventory was covered by supernate the supernate was evaluated using the release factor for liquids, while the covered salt cake was estimated using a release factor for solids.

3.2 BACK CALCULATIONS BASED ON A DECONTAMINATION FACTOR OF $3,000^n$

This method for estimating potential emissions assumes the *Nuclear Air Cleaning Handbook* (Buchsted et al. 1976) decontamination factor (DF) of 3,000 ($DF = 1/[1.0 - 0.9997]$) for a HEPA filter. The method assumes that each bank in series acts independently of a preceding bank and will remove contamination with the same 3,000 decontamination factor. For a system with

n banks of HEPA filters in series, the decontamination factor is $3,000^n$. This method can be extremely conservative for a contaminated system. When processing no longer occurs, the resuspension of contamination downstream of the HEPA filters can dominate the airborne releases from a facility. Multiplying these releases by $3,000^n$ will overestimate the potential emissions by orders of magnitude.

3.3 NONDESTRUCTIVE ASSESSMENT

The NDA method provides a technical basis for measuring potential emissions. NDA measures gamma decay of the curie content of the HEPA filters and prefilters. By testing the NDA in the same geometry as the filters, the curie content on the filters can be calculated. It is assumed that the contents would be released to the atmosphere over the time the filters were in place. The drawback to this method is that alpha radiation is not measured by the microspec gamma spectrometer. Also, if the HEPA filters have not been changed out since processing occurred, the curie content of the HEPA filters may reflect essentially the potential release during processing.

3.4 UPSTREAM OF HEPA FILTER AIR CONCENTRATION MEASUREMENTS

The upstream air concentrations provide direct information on the potential emissions from a facility. This method can be applied by using continuous air monitoring (CAM) data, inserting an air sample probe for upstream measurements, or radiological analysis of removed HEPA filters. CAM data can be used if the data are taken from the process area, which contains the radionuclide inventory. Air measurements may also be collected in the ventilation system upstream of the HEPA filters. In this case, a sampling port is selected, a probe inserted, and air concentrations are measured. The final method is the sampling of the furthest upstream HEPA filters for the facility. In this case one or more HEPA filters are removed and the radiological content is analyzed either by destructive assay or by a gamma spectrometer. The airflow during the time the HEPA filter is online is used to determine the annual release rate. All of these methods are technically based in that the measurements represent the potential concentrations emitted from a facility without control devices.

3.5 SPILL RELEASE FRACTION (296-Z-5)

In the facility venting to the 296-Z-5 stack, the only potential emissions occur when a canister of PuO_2 powder is repackaged. No emissions are expected from contamination in the ventilation system for the facility because it is essentially uncontaminated. When a canister is to be repackaged, the double canisters containing 1,500 grams of PuO_2 are opened in a hood and the powder is poured into another canister. The canister is sealed, put into another canister, and sealed. The pouring could cause a PuO_2 release to the air. To estimate the potential maximum release, observed spill release fractions for depleted uranium oxide spills (Sutter et al. 1981) were used. A maximum release fraction value of 4.0×10^{-5} was used. This number is extremely conservative because it represents a release fraction for

a 1-m release height for the spill. The actual release height is a maximum of 0.15 m. The spill release fraction was only used for the 296-Z-5 stack.

4.0 CAP88 DOSE MODELING

One of the five methods were applied to the 84 registered stacks to produce a potential source term for each stack. (A complete listing of the radionuclides with curies emissions are provided on individual stack assessment worksheets in Appendix A.) Once the potential source terms were determined, the source term, location, and stack height were used in a computer model to predict dose for the maximum exposed individual. The dispersion modeling was performed using an EPA-approved computer model, CAP88, with Hanford Site meteorology (Beres 1990).

The CAP88 model is able to incorporate plume rise from the stack based on the flow rate and stack diameter. After leaving the stack, the plume is modeled to disperse based on meteorological conditions. Modeled concentrations are decreased based on dry deposition (dry deposition velocity = 1.8 cm/s). However, wet deposition is ignored because of the low incident of precipitation on the Hanford Site. The modeled concentrations are used to calculate an EDE for an offsite maximum exposed individual.

Normalized source terms were used in CAP88 for each of the major areas on site, i.e., 100, 200, 300, 400, and 600 Areas. Five-year averaged Hanford Site meteorological data (1983-1987) taken on the site were used to compute normalized air concentrations, i.e., X/Q , where X is the air concentration (Ci/m^3) normalized by the source term Q (Ci/s). Two stack release heights were used: 89 m (200-ft stack with a 100-ft plume rise) and 10 m (33 ft). To model an individual stack the following input was needed: the potential radiological source terms, the stack release height chosen, and the location of the stack in one of the major areas. Potential dose data were produced by the CAP88 model for each registered stack. When the data were analyzed, 15 stacks were identified as a potential emission that would cause an EDE greater than 0.1 mrem/yr.

5.0 RESULTS OF DOSE ASSESSMENT

Results of the dose assessment are provided in Appendix A (see Table A-1) for each of the registered stacks. The 15 stacks with potential emissions to cause an EDE >0.1 mrem/yr and require continuous monitoring are listed below in Table 1.

Table 1. Designated Stacks.^a

Stack number	Facility	Number of HEPA filters
291-A-1 ^b	PUREX	3
296-A-1	PUREX	3
291-B-1 ^b	B Plant	2
291-Z-1 ^b	PFP	1-3 ^c
296-Z-3	PFP	2
296-A-17	Tank Farms	2
296-A-27	Tank Farms	2
296-A-29	Tank Farms	2
296-A-40 ^b	Tank Farms	2
296-P-16	Tank Farms	2
296-A-22 ^b	Tank Farms	2
296-P-23	Tank Farms	2
296-S-7W	ERO ^d	2
296-S-15	Tank Farms	2
308-GL-EX ^b	308 Building	3
340-NT-EX	340 Building	2

^aStacks with the potential to exceed 0.1 mrem/yr.

^bOriginal seven designated stacks.

^cVentilation from different areas undergoes 1, 2, or 3 stages of HEPA filtration.

^dEnvironmental Restoration Organization.

6.0 REFERENCES

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APPENDIX A

REGISTERED STACK ASSESSMENTS

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REGISTERED STACK ASSESSMENTS

A summary table is provided to indicate the assessment method used for each stack and the result of the assessment (Table A-1). The worksheets and, in cases where the assessment required additional information, a description of the assessments have been included in this appendix. The headings on the worksheets indicate whether release factors from Appendix D (back calculations, nondestructive assessment, or upstream air samples) were used to perform the assessment. Note: the assessment of 296-Z-5 where a release fraction of 4×10^{-5} was used is included in Appendix D, release factor calculations. When worksheets using release factors from Appendix D are used, the inventory at risk is provided and a release fraction is applied to the inventory to provide an estimated emission. For back calculations, the 1992 annual air concentrations¹ are multiplied by a high-efficiency particulate air (HEPA) filter factor $3,000^n$, where n indicates the number of banks of HEPA filters in series and if a prefilter exists, by a prefilter factor (3 to 20). The resulting number is the estimate of potential emissions. The worksheet for nondestructive assessment provides the curie content collected on the HEPA filters and the potential annual emissions. Upstream air samples were considered to have been taken for 296-T-11 and 296-T-12 when sampling was performed on the HEPA filters to determine the curie content. From the curie content an annual emission was estimated. For all of the assessments, once the emissions were known, the CAP88 model was applied with an appropriate source release height and location. The CAP88 model then used Hanford Site meteorology for the transport and diffusion to produce an effective dose equivalent to the offsite maximum exposed individual.

Appendix A is divided into 14 sections:

- A1.0 PUREX STACKS
- A2.0 B PLANT
- A3.0 SOLID WASTE OPERATIONS
- A4.0 TANK FARMS (INCLUDING AR AND CR VENTS AND EVAPORATORS)
- A5.0 GROUT
- A6.0 222-S LABORATORY
- A7.0 T PLANT
- A8.0 UO₂ PLANT
- A9.0 PFP
- A10.0 LAUNDRY (SHUTDOWN)
- A11.0 S PLANT AND U PLANT
- A12.0 300 AREA
- A13.0 400 AREA
- A14.0 100 AREA

¹WHC, 1993, *Environmental Releases for Calendar Year 1992*, WHC-EP-0527-2, Westinghouse Hanford Company, Richland, Washington.

Table A-1. Hanford Site Registered Stacks. (4 sheets)

Stack	HEPA Stages	NESHAP Assessment method				Status of stack
		Appendix D release factors	NDA	Upstream	Back calculations	
PUREX Plant						
291-A-1*	3				Designated	Designated
296-A-1	3	Designated				Designated
296-A-2	1				Minor	Minor
296-A-3	1				Minor	Minor
296-A-5A	1-2	Minor				Minor
296-A-5B	1-2	Minor				Minor
296-A-6	1				Minor	Minor
296-A-7	1				Minor	Minor
296-A-8	1				Minor	Minor
296-A-10	1				Minor	Minor
296-A-14	1				Minor	Minor
296-A-24	0				Minor	Minor
B Plant						
291-B-1*	2				Designated	Designated
296-B-5	1				Minor	Minor
296-B-10	2	Minor				Minor
296-B-13	2		Minor			Minor
Solid Waste Operations						
296-T-11*	2			Minor		Minor
296-T-12*	2			Minor		Minor
296-W-3	2		Minor			Minor
AR and CR Vents (Tank Farms)						
296-A-12	2	Minor				Minor
296-A-13	2	Minor				Minor
296-C-5	2	Minor				Minor

Table A-1. Hanford Site Registered Stacks. (4 sheets)

Stack	HEPA Stages	NESHAP Assessment method				Status of stack
		Appendix D release factors	NOA	Upstream	Back calculations	
200 East Area Tank Farm						
296-A-17	2	Designated				Designated
296-A-18	2	Minor				Minor
296-A-19	2	Minor				Minor
296-A-20	2	Minor				Minor
296-A-25	2	Minor				Minor
296-A-26	2	Minor				Minor
296-A-27	2	Designated				Designated
296-A-28	2	Minor				Minor
296-A-29	2	Designated				Designated
296-A-30	2	Minor				Minor
296-A-40*	2	Designated				Designated
296-A-41	2	Minor				Minor
296-B-28	2	Minor				Minor
296-P-16	2	Designated				Designated
296-P-17	2	Minor				Minor
296-P-31	2	Minor				Minor
200 East Area Evaporator (Tank Farms)						
296-A-21	2	Minor				Minor
296-A-22*	2	Designated				Designated
200 West Area Tank Farms						
296-P-22	2	Minor				Minor
296-P-23	2	Designated				Designated
296-T-18	2	Minor				Minor
296-S-15	2	Designated				Designated
296-S-22	2	Minor				Minor
200 West Area Evaporator (Tank Farms)						
296-S-18	2	Minor				Minor
296-T-17	2	Minor				Minor

Table A-1. Hanford Site Registered Stacks. (4 sheets)

Stack	HEPA Stages	NESHAP Assessment method				Status of stack
		Appendix D release factors	NDA	Upstream	Back calculations	
Grout						
296-G-1	2		Minor			Minor
222-S Laboratory						
296-S-16	1		Minor			Minor
296-S-21	2-4	Minor				Minor
T Plant						
291-T-1*	2		Minor			Minor
296-T-13	2		Minor			Minor
UO ₂ Plant						
296-U-2	1				Minor	Minor
296-U-4	0				Minor	Minor
296-U-13	1				Minor	Minor
Plutonium Finishing Plant						
291-Z-1*	1-3				Designated	Designated
296-Z-3	2	Designated				Designated
296-Z-5*	2-3	Minor				Minor
296-Z-6	2	Minor				Minor
296-Z-14	5		Minor			Minor
200 West Area Laundry						
296-W-1	0				Minor	Shutdown
S Plant and U Plant						
291-S-1	1S				Minor	Minor
296-S-2	2		Minor			Minor
296-S-4	1				Minor	Minor
296-S-6	0				Minor	Minor
296-S-7W	2-3	Designated				Minor
291-U-1	1S				Minor	Minor

Table A-1. Hanford Site Registered Stacks. (4 sheets)

Stack	HEPA Stages	NESHAP Assessment method				Status of stack
		Appendix D release factors	NDA	Upstream	Back calculations	
300 Area						
304-E-ULAB	1				Minor	Minor
308-GL-EX ^d	3	Designated				Designated
308-ET-EX ^d	2	Minor				Minor
308-TRIGA	2	Minor				Minor
340-HT-EX ^d	2				Designated	Designated
377-GEL	3	Minor				Minor
400 Area						
FFTF-CB-EX	0				Minor	Minor
FFTF-RE-SB	0				Minor	Minor
FFTF-HT-TR	0				Minor	Minor
437-MN&ST	2		Minor			Minor
100 Areas						
116-N	0-1				Minor	Minor
109-N-Z-1	0				Minor	Minor
109-N-C-6	0				Minor	Minor
105-KE	0				Minor	Minor
105-KW	0				Minor	Minor
1706-KER	1				Minor	Minor
1706-KEL	1-2		Minor			Minor

CY = calendar year.

HEPA = high-efficiency particulate air.

NDA = nondestructive assessment.

NESHAP = National Emission Standards for Hazardous Air Pollutants.

PUREX = Plutonium-Uranium Extraction.

^dOriginal designated stack.^b296-T-11 and 296-T-12 used samples taken from the HEPA filters to determine the upstream air concentrations.^c296-Z-5 used 4×10^{-3} release fraction for a PuO₃ spill.^aTo be shut down in early 1994.

A1.0 PUREX STACKS

The Plutonium-Uranium Extraction Plant (PUREX) has 12 registered stacks: 291-A-1, 296-A-1, 296-A-2, 296-A-3, 296-A-5A, 296-A-5B, 296-A-6, 296-A-7, 296-A-8, 296-A-10, 296-A-14, and 296-A-24. Two of the stacks are designated stacks: 291-A-1 and 296-A-1. Supporting documentation (released earlier as WHC-SD-CP-TI-188) is provided for 296-A-1 to indicate why this stack is a newly designated stack.

**STACK ASSESSMENT FOR
40 CFR 61, SUBPART H**

BACK CALCULATION (3000ⁿ) SOURCE ASSESSMENT

FACILITY PUREX DISCHARGE POINT Stack 291-A-1
 NUMBER OF HEPA FILTER BANKS (n) 3 BACK CALCULATION FACTOR (3000)³
 Annual Air Emissions Report (year) 1992

Radionuclide	Quantity Released (Curies)	Back Calculation Factor	Potential Quantity Released (curies)	Projected Dose (mrem/yr)
1. ⁹⁰ Sr	<u>3.3 E-04</u>	<u>(3000)³</u>	<u>8.9 E+06</u>	<u>1.1 E+05</u>
2. ¹²⁹ I	<u>2.7 E-02</u>	<u>(3000)⁰</u>	<u>2.7 E-02</u>	<u>5.0 E-03</u>
3. ¹³⁷ Cs	<u>1.6 E-03</u>	<u>(3000)³</u>	<u>4.3 E+07</u>	<u>2.8 E+05</u>
4. ¹⁴⁷ Pm	<u>1.7 E-04</u>	<u>(3000)³</u>	<u>4.6 E+06</u>	<u>1.4 E+03</u>
5. ²¹² Pb	<u>2.7 E-03</u>	<u>(3000)³</u>	<u>7.3 E+07</u>	<u>6.9 E+04</u>
6. ²²⁰ Rn	<u>3.4 E+01</u>	<u>-----</u>	<u>-----</u>	<u>-----</u>
7. ²³⁸ Pu	<u>1.3 E-05</u>	<u>(3000)³</u>	<u>3.5 E+05</u>	<u>7.7 E+05</u>
8. ^{239,240} Pu	<u>2.2 E-05</u>	<u>(3000)³</u>	<u>5.9 E+05</u>	<u>1.4 E+06</u>
9. ²⁴¹ Pu	<u>4.7 E-04</u>	<u>(3000)³</u>	<u>1.3 E+07</u>	<u>4.8 E+05</u>
10. ²⁴¹ Am	<u>1.3 E-04</u>	<u>(3000)³</u>	<u>3.5 E+06</u>	<u>1.3 E+07</u>
Total Dose				<u>1.6 E+07</u>

Method Used to Project Dose (CAP88) WHC-EP-0498, 200 East Area 89-m Stack

COMMENTS

Releases of ²²⁰Rn were modeled (CAP88) by assuming that this short-lived gas had decayed to the next long-lived member of its decay chain, ²¹²Pb, before transport offsite.

¹²⁹I, Iodine (gaseous) is not filterable.

EVALUATOR

MANAGER, ENVIRONMENTAL

FACILITY MANAGER

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DISCUSSION

The potential unmitigated dose was calculated in two ways. The first method uses existing releases and assumes a decontamination factor for the HEPA filters system. The second method uses the NESHAPs release rate for powdered sources and a duct loss (particulate dropout) equation from the Appendix to estimate the potential dose at the Hanford Site boundary.

Method 1

The disadvantage of the first method is that the decontamination factor of the existing complex HEPA filters system cannot be accurately calculated and therefore must be assumed. The advantage of this method is that actual release rates and therefore actual particle suspension, drop out and resuspension rates are used.

The annual potential dose at the Hanford Site boundary was obtained by multiplying the present release quantity in curies (Ci) for plutonium by the corresponding unit dose conversion factor from CAP-88 computer code. In addition, a treatment factor was applied for the series of HEPA filters to adjust for unmitigated releases. The dose calculation is determined by the following relationship.

$$Dose = (AR) (HF) (DF)$$

Where

- AR = Annual release of $^{239,240}\text{Pu}$, 1.0 E-06 curies (Reference 2)
- HF = Assumed HEPA decontamination factor (3000)²
- DF = Dose factor from CAP-88 Computer Code 8.67 millirem/curies (Reference 5)

With the above information, the result from the above equation is tabulated in Table 1 below.

Method 2

The advantage of the second method is that it uses the measured source term for plutonium and does not rely on an assumed efficiency for the HEPA filters. The disadvantage of this method is that an assumed suspension rate and theoretical particle dropout rate must be used.

The annual dose to the maximally exposed individual at the Hanford Site boundary was determined from the concentration of airborne radionuclides in the N-Cell gloveboxes based on the known mass of source-term, and from the CAP-88 computer code dose conversion factor using a duct loss (particulate dropout) Equation (11), as derived in the Appendix for calculating an unmitigated dose.

$$Dose = (DF) (A) \left[\frac{C_1 Q_1}{Q_3} \exp - \left(\frac{U_{t1} L}{U_b H} \right) \right]$$

Where

- Q₁ = 970 ft³/min, bulk flow rate of air at the N-Cell gloveboxes
- Q₃ = 5,425 ft³/min, bulk flow rate of air at the stack exit
- U_{t1} = 1.48 ft/min, terminal settling velocity in the duct
- L/U_bH = 0.1 min/ft, depletion coefficient for flow in duct
- A = 2.0 x 10⁰⁸ Ci-ft³/g-year, conversion factor to Ci/year
- DF = 8.67 mrem/Ci, CAP-88 dose conversion factor

C₁, the concentration of airborne radionuclides in the N-Cell gloveboxes was calculated by multiplying the known mass of source-term (14,000 grams) in the gloveboxes with the NESHAP release rate of 10⁻³ per year for powder sources and converted to g/ft³.

The results for both methods are tabulated in Table 1. Note: The NESHAP criteria is 0.1 mrem per year for an unmitigated offsite dose. A similar study (Reference 1) confirmed these calculations. This study showed that with no engineering controls in the stack system, the 296-A-1 stack would exceed the NESHAP criteria of 0.1 millirem per year at the Hanford Site boundary if all 14,000 grams of source-term was released to the environment over a 100 year period.

Table 1. $^{239,240}\text{Pu}$ Doses to the Maximally Exposed Individual from an Unmitigated Release.

Method	Off-Site Dose (mrem/yr)
1	78
2	7.5

Source-term

PUREX Plant personnel are presently preparing the plant for long-term shutdown. This includes reducing or isolating radioactive contamination within the plant. The following section determines how much the exiting source term must be reduced.

Present mitigated releases and the known source were used to calculate the source which would equal the NESHAP criteria of 0.1 millirem. This was calculated as follows by using equation 14 from the Appendix, and the known ratios of airborne plutonium concentrations at the stack for two cases, the present mitigated release (case 1) and unmitigated release EDE of 0.1 millirem per year at the Hanford Site boundary (case 2).

$$SOURCE_{case2} = SOURCE_{case1} \left(\frac{C_3 case2}{(HF) C_3 case1} \right)$$

Where

$C_3 case 1$ = the concentration of airborne $^{239,240}\text{Pu}$ from 296-A-1 stack during 1992

$C_3 case 2$ = the concentration of airborne $^{239,240}\text{Pu}$ from 296-A-1 stack when the stack has potential for an unmitigated EDE of 0.1 millirem per year to a maximally exposed individual at the Site boundary.

HF = assumed HEPA decontamination factor $(3000)^2$

The quantity of source-term (case 2) was calculated to be 18 grams with the information of Table 3 in the Appendix. It should also be noted (for comparison) based on the NESHAP release rate of 10^{-3} , the quantity of source would be 162 grams.

RESULTS AND RECOMMENDATIONS

Results indicate that because the unmitigated dose calculated by methods 1 and 2 calculation would be 78 and 7.5 millirem per year respectively, the 296-A-1 stack exceeds the NESHAP criteria of 0.1 millirem per year at the Hanford Site boundary. In order for the stack to comply with the NESHAP criteria, the required quantity of plutonium oxide contamination (source-term) was calculated to be between 18 and 162 grams. This is well below the existing source (14,000 grams) and below expected decontamination levels. Thus, it is recommended that the 296-A-1 stack should be declared a significant stack. Over the short term, point-by-point comparison of the sampling and monitoring equipment should be conducted with the NESHAP requirements.

For long term, it is recommended that in order for the 296-A-1 stack to comply with NESHAP regulations during PUREX Plant shutdown and decontamination and decommissioning, either the plutonium oxide contamination in gloveboxes and the ventilation system should be reduced to between 18 and 162 grams or the stack shut down and blanked.

It is further recommended that if/when the gloveboxes and ventilation system are cleaned out, that a new NDA be performed. Hopefully, the uncertainty of the existing NDA (1,000 to 14,000) would be reduced.

REFERENCES

1. Internal Letter 17530-93-085, D. L. Wiegand to Memo to File, "Product Removal Stack (296-A-1) Off-Site Dose Calculation," Westinghouse Hanford Company, Richland, Washington, dated August 27, 1993.
2. WHC-EP-0527-2, Revision 0, "Environmental Releases for Calendar Year 1992," L. P. Diediker, Westinghouse Hanford Company, Richland, Washington, dated July 1993.
3. Internal Memo 15660-92-110, Waste Packaging and Analysis Unit to L. L. Buckley, "NDA PUREX N-Cell," Westinghouse Hanford Company, Richland, Washington, dated August 12, 1992.
4. U.S. Environmental Protection Agency, National Emission Standards for Hazardous Air Pollutants Requirements, Title 40, Code of Federal Regulations, Part 61, U.S. Environmental Protection Agency, Washington, D.C., dated July 1992.
5. WHC-EP-0498, Revision 0, "Unit Dose Calculation Methods and Summary of Facility Effluent Monitoring Plan Determinations," J. M. Nickels, Westinghouse Hanford Company, Richland, Washington, dated November 1991.

6. RHO-CD-1113, Revision 0, "Prediction of Releases of Airborne Particulates from PUREX Gloveboxes, Process Cells, and Canyon," M. D. Anderson, Rockwell Hanford Operations, Richland, Washington, dated December 1981.
7. Book, H. E. Hasketh, "Fine Particles in Gaseous Media," Ann Arbor Science, dated 1977.

APPENDIX A-1

DERIVATION OF DOSE AND SOURCE-TERM EQUATIONS

This section describes the method used to develop equations for calculating an unmitigated dose to the maximally exposed individual at the Hanford Site boundary and the quantity of source-term in the N-Cell gloveboxes.

Figure 1 represents the path of the airborne radionuclides from the N-Cell gloveboxes to the PR stack. As shown in this figure, the airborne radionuclides enter an exhaust plenum where they are combined with other air streams before entering the stack. Therefore, the steady state mass balance for a particle with diameter i flowing through a long, horizontal duct is

$$C_2 Q_1 = C_1 Q_1 (1 - \epsilon_i) \quad (1)$$

Where

C_1, C_2 = concentration of airborne particles with diameter i , g/ft³
 Q_1 = bulk flow rate of air, ft³/min
 ϵ_i = fractional deposition efficiency in a horizontal rectangular duct

The ϵ_i for particles in turbulent flow in a horizontal rectangular duct is defined in (Reference 7) and is given below.

$$\epsilon_i = 1 - \exp\left(-\frac{U_{ti} L}{U_b H}\right) \quad (2)$$

Where

L and H represent the length and height of the duct and U_b is the bulk flow rate through the duct. U_{ti} can be calculated for a given particle with diameter D_p in the range $0.1 \mu\text{m} < D_p < 10 \mu\text{m}$ and specific gravity (SpG; assume 5) at 70°F as follows (Reference 6):

$$U_{ti} = (5.84 \times 10^{-3}) \left(1 + \frac{0.143}{D_p}\right) (D_p)^2 (\text{SpG}) \quad (3)$$

Where

D_p = particle diameter, μm
 SpG = specific gravity of particle
 U_{ti} = terminal settling velocity in the duct, ft/min

By substituting equation (2) into equation (1), equation (1) can be rewritten as follows:

$$C_2 = C_1 \exp\left(-\frac{U_{ci}L}{U_bH}\right) \quad (4)$$

As shown in Figure 1, air from the N-Cell gloveboxes flows through parallel HEPA filters via the ventilation system into an exhaust plenum, where it is diluted with other gas streams from Q-Cell and the PR room (Q_d). The combined stream then flows through a HEPA, followed by a prefilter/HEPA combination. Filter efficiencies of 99.95% for individual HEPA filters are given in Reference 5. A combination of parallel and series HEPA filters would be expected to exceed 99.95% efficiency, in this study a factor of $(3000)^2$ was used for all the filters involved in this system. The mass balance equation for the filters can be written as:

$$C_3Q_3 = (1-\eta)(C_dQ_d + C_2Q_1) \quad (5)$$

Assuming the quantities of radionuclides entering the plenum from Q-Cell and the PR room are insignificant ($C_d=0$), equation (5) can be rewritten as:

$$C_3Q_3 = (1-\eta)C_2Q_1 \quad (6)$$

and Equation (4) can be substituted into Equation (6) to calculate C_3 and C_1 , the concentration of airborne radionuclides at the stack exit and in the N-Cell gloveboxes respectively as follows:

$$C_3 = \frac{(1-\eta)C_1Q_1}{Q_3} \exp\left(-\frac{U_{ci}L}{U_bH}\right) \quad (7)$$

$$C_1 = \frac{C_3Q_3}{Q_1(1-\eta)} \exp\left(\frac{U_{ci}L}{U_bH}\right) \quad (8)$$

DOSE CALCULATION

The application of the above mathematical models are used to calculate an unmitigated dose to the maximally exposed individual at the Hanford Site boundary.

The annual dose (mrem/year) to the maximally exposed individual at the Hanford Site boundary was determined from the concentration of airborne radionuclides at the stack exit C_3 , and by the CAP-88 computer code dose conversion factor (Reference 5) as follows:

$$Dose = (DF) (A) (C_3) \quad (9)$$

Where

• $A = (2.0 \text{ E}+08 \text{ Ci-ft}^3/\text{g-year})$, conversion factor from concentration C_3 in g/ft^3 to curies per year and is presented in Table 2, Column 3
 • $DF = (8.67 \text{ mrem/Ci})$, CAP-88 dose conversion factor from curies per year to millirem per year. C_3 is calculated from equation (7) for unmitigated release (assumes no prefilter/HEPA filters exist in the system, $\eta = 0$) as follows:

$$C_3 = \frac{C_1 Q_1}{Q_3} \exp\left(-\frac{U_{t1} L}{U_b H}\right) \quad (10)$$

Therefore, by substituting equation (10) into equation (9) the annual dose can be determined from the following relationship.

$$Dose = (DF) (A) \left[\frac{C_1 Q_1}{Q_3} \exp\left(-\frac{U_{t1} L}{U_b H}\right) \right] \quad (11)$$

Where

- Q_1 = 970 ft^3/min , bulk flow rate of air at the N-Cell gloveboxes (as per design flows on drawing H-2-91961)
- Q_3 = 5,425 ft^3/min , bulk flow rate of air at the stack exit (as per design flows on drawing H-2-91961)
- U_{t1} = 1.48 ft/min , terminal settling velocity in the duct

$L/U_b H$ = 0.1 min/ft , depletion coefficient for flow in duct
 (calculated from drawing H-2-52306) and

C_1 , the concentration of airborne radionuclides in the N-Cell gloveboxes was calculated from multiplying the known mass of source-term (14,000 grams) in the gloveboxes by the NESHAPs release factor of 10^{-3} per year for liquids and particulate solids (see Reference 4) and converted to g/ft^3 . The result is given in Table 2 below.

The annual dose to the maximally exposed individual at the Hanford Site boundary was calculated by substituting the above information into Equation (11). The results are given in Table 2, Column 4.

Table 2. $^{239,240}\text{Pu}$ Airborne Discharge and Dose to the Maximally Exposed Individual From An Unmitigated Release

Gloveboxes	Stack		Off-Site Dose
C_1 , g/ft ³	C_3 , g/ft ³	C_1 /year	mrem/year
2.8 E-08	4.3 E-09	8.6 E-01	7.5

SOURCE-TERM CALCULATION

The quantity of source-term is determined from the ratio of airborne $^{239,240}\text{Pu}$ concentrations in the N-Cell gloveboxes (C_1 case 2/ C_1 case 1) for two cases. Case 1 is based on the present airborne mitigated release from the 296-A-1 stack system, and case 2 is based on the NESHAP criteria of 0.1 millirem per year unmitigated release.

Therefore, the source-term in the gloveboxes for case 2 can be determined from the known ratios as follows.

$$\text{source}_{\text{case2}} = \text{source}_{\text{case1}} \left(\frac{C_1 \text{ case2}}{C_1 \text{ case1}} \right) \quad (12)$$

Where the $\text{source}_{\text{case1}}$ is the existing plutonium oxide which was determined to be 14,000 grams from non-destructive Assay (NDA) of the gloveboxes (see Reference 3). The C_1 , airborne concentration of $^{239,240}\text{Pu}$ in the N-Cell gloveboxes for each cases can be determine as follows:

Case 1 (mitigated release): the concentration of airborne radionuclides in the N-Cell gloveboxes can be determined from equation (8) and is as follows:

$$C_1 = \frac{C_3 Q_3}{Q_1 (1 - \eta)} \exp \left(\frac{U_{ci} L}{U_b H} \right) \quad (13)$$

Case 2 (unmitigated release), by substituting $\eta=0$ in equation (13) (assumes no prefilter/HEPA filters in the system) the concentration of airborne radionuclides in the N-Cell gloveboxes can be written as:

$$C_1 = \frac{C_3 Q_3}{Q_1} \exp\left(\frac{U_{c1} L}{U_H H}\right) \quad (14)$$

The ratio of plutonium concentrations in the N-Cell gloveboxes (C_1 case 2 to C_1 case 1) for the above two cases were determined from the ratio of equations (14) and (13) as follows.

$$\frac{C_1 \text{ case 2}}{C_1 \text{ case 1}} = \frac{(1-\eta) C_3 \text{ case 2}}{C_3 \text{ case 1}} \quad (15)$$

By substituting equation (15) into equation (12), the source-term in the gloveboxes can be determine from following equation where $HF = 1/1 - \eta$, is the HEPA decontamination factor.

$$\text{source}_{\text{case 2}} = \text{source}_{\text{case 1}} \left(\frac{C_3 \text{ case 2}}{(HF) C_3 \text{ case 1}} \right) \quad (16)$$

Where the airborne concentration of $^{239,240}\text{Pu}$, C_3 at the stack exit for the above two cases can be determine as follows and the results are tabulated in Table 3:

Case 1: Present airborne release (mitigated) the concentration in g/ft^3 is derived by the annual release of plutonium (1.0 E-06 Ci) from 296-A-1 stack using 1992 data (see Reference 2).

Case 2: NESHAPs criteria of 0.1 millirem per year (unmitigated). The annual release of plutonium in curies from 296-A-1 stack is obtained by dividing the 0.1 millirem per year into the dose factor (8.67 mrem/Ci). The factor was determined by CAP-88 computer code (see Reference 5). Curies is then converted to g/ft^3 .

Table 3. $^{239,240}\text{Pu}$ Airborne Discharges

Case	Stack	
	Ct/year	C_s , g/ft ³
1	1.0 E-06	5.0 E-15
2	1.15 E-02	5.77 E-11

With the above information, equations (16) can be used to calculate the source-term in the N-Cell gloveboxes (source case 2).

Figure 1: N Cell Gloveboxes Ventilation System: Simplified Flowsheet

HEPA Filter
Pre - filter

Note Several Gloveboxes in N Cell

**STACK ASSESSMENT FOR
40 CFR 61, SUBPART H**

BACK CALCULATION (3000ⁿ) SOURCE ASSESSMENT

FACILITY PUREX DISCHARGE POINT Stack 296-A-1
 NUMBER OF HEPA FILTER BANKS (n) 3 BACK CALCULATION FACTOR (3000)³
 Annual Air Emissions Report (year) 1992 (3000ⁿ)

Radionuclide	Quantity Released (Curies)	Back Calculation Factor	Potential Quantity Released (curies)	Projected Dose (mrem/yr)
1. <u>^{239,240}Pu</u>	<u>1.0 E-06</u>	<u>(3000)³</u>	<u>2.7 E+04</u>	<u>6.4 E+04</u>
2. <u>²⁴¹Pu</u>	<u>7.1 E-06</u>	<u>(3000)³</u>	<u>1.9 E+05</u>	<u>7.1 E+03</u>
3. <u>²⁴¹Am</u>	<u>3.5 E-07</u>	<u>(3000)³</u>	<u>9.5 E+03</u>	<u>3.4 E+04</u>
4. <u>Total Beta</u>	<u><2.4 E-06</u>	<u>(3000)³</u>	<u><6.5 E+04</u>	<u><7.8 E+02</u>
Total Dose				<u>1.1 E+05</u>

Method Used to Project Dose (CAP88) WHC-EP-0498, 200 East Area 89-m Stack

COMMENTS

Three (HEPA) filters with including one (HEPA) filter in gloveboxes.

Using the Minimum Detection Limit (MDL) for Total Beta and assuming

Total Beta = ⁹⁰Sr.

EVALUATOR

MANAGER, ENVIRONMENTAL

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**STACK ASSESSMENT FOR
40 CFR 61, SUBPART H**

BACK CALCULATION (3000ⁿ) SOURCE ASSESSMENT

FACILITY PUREX DISCHARGE POINT Stack 296-A-2
 NUMBER OF HEPA FILTER BANKS (n) 1 BACK CALCULATION FACTOR (3000)
 Annual Air Emissions Report (year) 1992
 (3000ⁿ)

Radionuclide	Quantity Released (Curies)	Back Calculation Factor	Potential Quantity Released (curies)	Projected Dose (mrem/yr)
1. <u>Total Alpha</u>	<u><3.1 E-07</u>	<u>(3000)</u>	<u><9.3 E-04</u>	<u><2.2 E-03</u>
2. <u>Total Beta</u>	<u><2.4 E-06</u>	<u>(3000)</u>	<u><7.2 E-03</u>	<u><8.6 E-05</u>
			Total Dose	<u><2.3 E-03</u>

Method Used to Project Dose (CAP88) WHC-EP-0498, 200 East Area 89-m Stack

COMMENTS

Using the Minimum Detection Limit (MDL) for Total Alpha and Total Beta.

Assuming ²³⁹Pu and ⁹⁰Sr for Total Alpha and Total Beta respectively.

EVALUATOR
 MANAGER, ENVIRONMENTAL
 FACILITY MANAGER

John Thrali
[Signature]
[Signature]

DATE 11-17-93
 DATE 11-17-93
 DATE 11/17/93

STACK ASSESSMENT FOR
40 CFR 61, SUBPART H

BACK CALCULATION (3000ⁿ) SOURCE ASSESSMENT

FACILITY PUREX DISCHARGE POINT Stack 296-A-3
 NUMBER OF HEPA FILTER BANKS (n) 1 BACK CALCULATION FACTOR (3000)
 Annual Air Emissions Report (year) 1992 (3000ⁿ)

Radionuclide	Quantity Released (Curies)	Back Calculation Factor	Potential Quantity Released (curies)	Projected Dose (mrem/yr)
1. <u>Total Alpha</u>	<u><1.8 E-07</u>	<u>(3000)</u>	<u><5.4 E-04</u>	<u><1.3 E-03</u>
2. <u>Total Beta</u>	<u><1.4 E-06</u>	<u>(3000)</u>	<u><4.2 E-03</u>	<u><5.0 E-05</u>
Total Dose				<u><1.4 E-03</u>

Method Used to Project Dose (CAP88) WHC-EP-0498, 200 East Area 89-m Stack

COMMENTS

Using the Minimum Detection Limit (MDL) for Total Alpha and Total Beta.

Assuming ²³⁹Pu and ⁹⁰Sr for Total Alpha and Total Beta respectively.

EVALUATOR
 MANAGER, ENVIRONMENTAL
 FACILITY MANAGER

John Thaler
S. J. [Signature]
C.D. Wollam

DATE 11-17-93
 DATE 11-17-93
 DATE 11/17/93

WHC-SD-EN-RPT-007

**STACK ASSESSMENT FOR
40 CFR 61, SUBPART H**

BACK CALCULATION (3000ⁿ) SOURCE ASSESSMENT

FACILITY PUREX DISCHARGE POINT Stack 296-A-5A
 NUMBER OF HEPA FILTER BANKS (n) 1 BACK CALCULATION FACTOR (3000)
 (3000ⁿ)
 Annual Air Emissions Report (year) 1992

Radionuclide	Quantity Released (Curies)	Back Calculation Factor	Potential Quantity Released (curies)	Projected Dose (mrem/yr)
1. <u>^{239,240}Pu</u>	<u>6.4 E-07</u>	<u>(3000)</u>	<u>1.9 E-03</u>	<u>1.7 E-02</u>
2. <u>²⁴¹Am</u>	<u>ND</u>	<u>(3000)</u>	<u>0.0 E+00</u>	<u>0.0 E+00</u>
3. <u>Total Beta</u>	<u><1.4 E-05</u>	<u>(3000)</u>	<u><4.2 E-02</u>	<u><1.8 E-03</u>
			Total Dose	<u>1.9 E-02</u>

Method Used to Project Dose (CAP88) WHC-EP-0498, 200 East Area 10-m Stack

COMMENTS

ND = none detected

The Inductive Coupled Plasma (ICP) hood has two (HEPA) filter banks on the exhaust. The Appendix D Source Assessment is attached and the dose is eight orders of magnitude (100,000,000x) lower than the criteria of 0.1 mrem/yr.

Using the Minimum Detection Limit (MDL) for Total Beta and assuming Total Beta = ⁹⁰Sr.

EVALUATOR
 MANAGER, ENVIRONMENTAL
 FACILITY MANAGER

[Signature]
[Signature]
 C.D. Wilson

DATE 11-17-93
 DATE 11-17-93
 DATE 11/17/93

STACK ASSESSMENT FOR
40 CFR 61, SUBPART H

BACK CALCULATION (3000ⁿ) SOURCE ASSESSMENT

FACILITY PUREX DISCHARGE POINT Stack 296-A-5B
 NUMBER OF HEPA FILTER BANKS (n) 1 BACK CALCULATION FACTOR (3000)
 (3000ⁿ)
 Annual Air Emissions Report (year) 1992

Radionuclide	Quantity Released (Curies)	Back Calculation Factor	Potential Quantity Released (curies)	Projected Dose (mrem/yr)
1. <u>^{239,240}Pu</u>	<u>6.4 E-07</u>	<u>(3000)</u>	<u>1.9 E-03</u>	<u>1.7 E-02</u>
2. <u>²⁴¹Am</u>	<u>ND</u>	<u>(3000)</u>	<u>0.0 E+00</u>	<u>0.0 E+00</u>
3. <u>Total Beta</u>	<u><1.4 E-05</u>	<u>(3000)</u>	<u><4.2 E-02</u>	<u><1.8 E-03</u>
			Total Dose	<u>1.9 E-02</u>

Method Used to Project Dose (CAP88) WHC-EP-0498, 200 East Area 10-m Stack

COMMENTS

ND = none detected

The Inductive Coupled Plasma (ICP) hood has two (HEPA) filter banks on the exhaust. The Appendix D Source Assessment is attached and the dose is eight orders of magnitude (100,000,000x) lower than the criteria of 0.1 mrem/yr.

Using the Minimum Detection Limit (MDL) for Total Beta and assuming Total Beta = ⁹⁰Sr.

EVALUATOR
 MANAGER, ENVIRONMENTAL
 FACILITY MANAGER

[Signature]
[Signature]
[Signature]

DATE 11-17-93
 DATE 11-17-93
 DATE 11/17/93

STACK ASSESSMENT FOR
40 CFR 61, SUBPART H

APPENDIX D
SOURCE ASSESSMENT

FACILITY PUREX DISCHARGE POINT 296-A-5A and 296-A-5B from (ICP) hood

FACILITY RADIOLOGICAL INVENTORY AT RISK

Radionuclide	Physical/ Chemical Form	Quantity (curies)	Release Factor	Potential Quantity Released (curies)	Projected Dose (mrem/yr)
1. <u>Total Alpha</u>	<u>gas</u>	<u>8.58 E-11</u>	<u>1.0</u>	<u>8.58 E-11</u>	<u>7.4 E-10</u>
2. <u>Total Beta</u>	<u>gas</u>	<u>1.14 E-10</u>	<u>1.0</u>	<u>1.14 E-10</u>	<u>5.0 E-12</u>
Total Dose					<u>7.0 E-10</u>

Method Used to Project Dose (CAP88) WHC-EP-0498, 200 East Area 10-m Stack

COMMENTS

The source-term is calculated from the concentration of samples in the Inductive Coupled Plasma (ICP) hood.

Total Alpha emissions are ^{239}Pu and Total Beta emissions are ^{90}Sr .

EVALUATOR
MANAGER, ENVIRONMENTAL
FACILITY MANAGER

John J. H. [Signature]
[Signature]
C. [Signature]

DATE 11-17-93
DATE 11-17-93
DATE 11/17/93

STACK ASSESSMENT FOR
40 CFR 61, SUBPART H

BACK CALCULATION (3000ⁿ) SOURCE ASSESSMENT

FACILITY PUREX DISCHARGE POINT Stack 296-A-6
 NUMBER OF HEPA FILTER BANKS (n) 1 BACK CALCULATION FACTOR (3000)
 (3000ⁿ)
 Annual Air Emissions Report (year) 1992

Radionuclide	Quantity Released (Curies)	Back Calculation Factor	Potential Quantity Released (curies)	Projected Dose (mrem/yr)
1. <u>Total Alpha</u>	<u><1.0 E-06</u>	<u>(3000)</u>	<u><3.0 E-03</u>	<u><7.1 E-03</u>
2. <u>Total Beta</u>	<u><8.0 E-06</u>	<u>(3000)</u>	<u><2.4 E-02</u>	<u><2.9 E-04</u>
Total Dose				<u><7.4 E-03</u>

Method Used to Project Dose (CAP88) WHC-EP-0498, 200 East Area 89-m Stack

COMMENTS

Using the Minimum Detection Limit (MDL) for Total Alpha and Total Beta.

Assuming ²³⁹Pu and ⁹⁰Sr for Total Alpha and Total Beta respectively.

EVALUATOR
 MANAGER, ENVIRONMENTAL
 FACILITY MANAGER

John Shauli
C.D. Wollan

DATE 11-17-93
 DATE 11-17-93
 DATE 11/17/93

**STACK ASSESSMENT FOR
40 CFR 61, SUBPART H**

BACK CALCULATION (3000ⁿ) SOURCE ASSESSMENT

FACILITY PUREX DISCHARGE POINT Stack 296-A-7
 NUMBER OF HEPA FILTER BANKS (n) 1 BACK CALCULATION FACTOR (3000)
 (3000ⁿ)
 Annual Air Emissions Report (year) 1992

Radionuclide	Quantity Released (Curies)	Back Calculation Factor	Potential Quantity Released (curies)	Projected Dose (mrem/yr)
1. <u>Total Alpha</u>	<u><1.4 E-06</u>	<u>(3000)</u>	<u><4.2 E-03</u>	<u><1.0 E-02</u>
2. <u>Total Beta</u>	<u><1.1 E-05</u>	<u>(3000)</u>	<u><3.3 E-02</u>	<u><4.0 E-04</u>
			Total Dose	<u><1.0 E-02</u>

Method Used to Project Dose (CAP88) WHC-EP-0498, 200 East Area 89-m Stack

COMMENTS

Using the Minimum Detection Limit (MDL) for Total Alpha and Total Beta.

Assuming ²³⁹Pu and ⁹⁰Sr for Total Alpha and Total Beta respectively.

EVALUATOR
 MANAGER, ENVIRONMENTAL
 FACILITY MANAGER

John Threlk
R. J. Smith
C.D. Wallan

DATE 11-17-93
 DATE 11-17-93
 DATE 11/17/93

WHC-SD-EN-RPT-007

STACK ASSESSMENT FOR
40 CFR 61, SUBPART H

BACK CALCULATION (3000ⁿ) SOURCE ASSESSMENT

FACILITY PUREX DISCHARGE POINT Stack 296-A-8
 NUMBER OF HEPA FILTER BANKS (n) 1 BACK CALCULATION FACTOR (3000)
 Annual Air Emissions Report (year) 1992
 (3000ⁿ)

Radionuclide	Quantity Released (Curies)	Back Calculation Factor	Potential Quantity Released (curies)	Projected Dose (mrem/yr)
1. <u>Total Alpha</u>	<u><7.0 E-07</u>	<u>(3000)</u>	<u><2.1 E-03</u>	<u><5.0 E-03</u>
2. <u>Total Beta</u>	<u><5.6 E-06</u>	<u>(3000)</u>	<u><1.7 E-02</u>	<u><2.0 E-04</u>
			Total Dose	<u><5.2 E-03</u>

Method Used to Project Dose (CAP88) WHC-EP-0498, 200 East Area 89-m Stack

COMMENTS

Using the Minimum Detection Limit (MDL) for Total Alpha and Total Beta.

Assuming ²³⁹Pu and ⁹⁰Sr for Total Alpha and Total Beta respectively.

EVALUATOR
 MANAGER, ENVIRONMENTAL
 FACILITY MANAGER

[Signature]
[Signature]
 C.D. Wallan

DATE 11-17-93
 DATE 11-17-93
 DATE 11/17/93

**STACK ASSESSMENT FOR
40 CFR 61, SUBPART H**

BACK CALCULATION (3000ⁿ) SOURCE ASSESSMENT

FACILITY PUREX DISCHARGE POINT Stack 296-A-10
 NUMBER OF HEPA FILTER BANKS (n) 1 BACK CALCULATION FACTOR (3000)
 Annual Air Emissions Report (year) 1992 (3000ⁿ)

Radionuclide	Quantity Released (Curies)	Back Calculation Factor	Potential Quantity Released (curies)	Projected Dose (mrem/yr)
1. <u>Total Alpha</u>	<u><4.3 E-07</u>	<u>(3000)</u>	<u><9.3 E-03</u>	<u><1.1 E-02</u>
2. <u>Total Beta</u>	<u><3.3 E-06</u>	<u>(3000)</u>	<u><1.0 E-02</u>	<u><4.4 E-04</u>
Total Dose				<u><1.1 E-02</u>

Method Used to Project Dose (CAP88) WHC-EP-0498, 200 East Area 10-m Stack

COMMENTS

Using the Minimum Detection Limit (MDL) for Total Alpha and Total Beta.

Assuming ²³⁹Pu and ⁹⁰Sr for Total Alpha and Total Beta respectively.

EVALUATOR

MANAGER, ENVIRONMENTAL

FACILITY MANAGER

DATE

DATE

DATE

11-17-93

11-17-93

11/17/93

**STACK ASSESSMENT FOR
40 CFR 61, SUBPART H**

BACK CALCULATION (3000ⁿ) SOURCE ASSESSMENT

FACILITY PUREX DISCHARGE POINT Stack 296-A-14
 NUMBER OF HEPA FILTER BANKS (n) 1 BACK CALCULATION FACTOR (3000)
 Annual Air Emissions Report (year) 1992
 (3000ⁿ)

Radionuclide	Quantity Released (Curies)	Back Calculation Factor	Potential Quantity Released (curies)	Projected Dose (mrem/yr)
1. <u>Total Alpha</u>	<u><3.6 E-07</u>	<u>(3000)</u>	<u><1.1 E-03</u>	<u><9.5 E-03</u>
2. <u>Total Beta</u>	<u><2.8 E-06</u>	<u>(3000)</u>	<u><8.4 E-03</u>	<u><3.7 E-04</u>
			Total Dose	<u><9.9 E-03</u>

Method Used to Project Dose (CAP88) WHC-EP-0498, 200 East Area 10-m Stack

COMMENTS

Using the Minimum Detection Limit (MDL) for Total Alpha and Total Beta.

Assuming ²³⁹Pu and ⁹⁰Sr for Total Alpha and Total Beta respectively.

EVALUATOR
 MANAGER, ENVIRONMENTAL
 FACILITY MANAGER

John J. Li
C.D. Weller

DATE 11-17-93
 DATE 11-17-93
 DATE 11/17/93

STACK ASSESSMENT FOR
40 CFR 61, SUBPART H

BACK CALCULATION (3000ⁿ) SOURCE ASSESSMENT

FACILITY PUREX DISCHARGE POINT 296-A-24
NUMBER OF HEPA FILTER BANKS (n) 2 BACK CALCULATION FACTOR (3000)²
Annual Air Emissions Report (year) 1992
(3000ⁿ)

Radionuclide	Quantity Released (Curies)	Back Calculation Factor	Potential Quantity Released (curies)	Projected Dose (mrem/yr)
1. _____	_____	_____	_____	_____
Total Dose				_____

Method Used to Project Dose (CAP88) _____
COMMENTS

This stack is no longer in operation (fan is off)

EVALUATOR *John J. Li*
MANAGER, ENVIRONMENTAL *C. D. Williams*
FACILITY MANAGER

DATE 11-17-93
DATE 11-17-93
DATE 11/17/93

A2.0 B PLANT

B Plant has four registered stacks: 291-B-1, 296-B-5, 296-B-10, and 296-B-13. Only the 291-B-1 stack is a designated stack.

**STACK ASSESSMENT FOR
40 CFR 61, SUBPART H**

BACK CALCULATION (3000") SOURCE ASSESSMENT

FACILITY B Plant DISCHARGE POINT 291-B-1
 NUMBER OF HEPA FILTER BANKS (n) 2 BACK CALCULATION FACTOR 9.0×10^6
 (3000")
 Annual Air Emissions Report (year) 1992

Radionuclide	Quantity Released (Curies)	Back Calculation Factor	Potential Quantity Released (curies)	Projected Dose (mrem/yr)	CAP-88 unit dose factors
1. <u>Sr-90</u>	<u>2.2×10^{-5}</u>	<u>9.0×10^6</u>	<u>1.98×10^2</u>	<u>2.38</u>	<u>1.2×10^{-2}</u>
2. <u>Cs-137</u>	<u>5.3×10^{-4}</u>	<u>9.0×10^6</u>	<u>4.77×10^3</u>	<u>31.2</u>	<u>6.54×10^{-3}</u>
3. <u>Pu-239, 240</u>	<u>3.1×10^{-6}</u>	<u>9.0×10^6</u>	<u>27.9</u>	<u>66.1</u>	<u>2.37</u>
4. _____	_____	_____	_____	_____	_____
5. _____	_____	_____	_____	_____	_____
6. _____	_____	_____	_____	_____	_____
7. _____	_____	_____	_____	_____	_____
8. _____	_____	_____	_____	_____	_____
9. _____	_____	_____	_____	_____	_____
10. _____	_____	_____	_____	_____	_____
11. _____	_____	_____	_____	_____	_____
12. _____	_____	_____	_____	_____	_____
13. _____	_____	_____	_____	_____	_____
14. _____	_____	_____	_____	_____	_____
15. _____	_____	_____	_____	_____	_____
16. _____	_____	_____	_____	_____	_____
Total Dose				<u>99.7 mrem/yr</u>	

Method Used to Project Dose (CAP88) CAP-88

COMMENTS

Released quantities taken from 1992 Air Emissions Report (DOE/RL-93-36).
CAP-88 unit dose factors taken from WHC-EP-0498 (p. A3-12).
Since 291-B-1 is 6m high, 89m dose factors are used instead of 10m values
Filtration system in use actually contains 3 stages of HEPA filters, but air flow has
been re-routed to bypass the first stage for several years.

EVALUATOR Thomas J. Beem
 MANAGER, ENVIRONMENTAL _____
 FACILITY MANAGER _____

DATE 11/29/93
 DATE 11/29/93
 DATE 11-30-93

STACK ASSESSMENT FOR
40 CFR 61, SUBPART H

BACK CALCULATION (3000ⁿ) SOURCE ASSESSMENT

FACILITY B Plant DISCHARGE POINT 296-B-5
 NUMBER OF HEPA FILTER BANKS (n) 1 BACK CALCULATION FACTOR 3000
 (3000ⁿ)
 Annual Air Emissions Report (year) 1992

Radionuclide	Quantity Released (Curies)	Back Calculation Factor	Potential Quantity Released (curies)	Projected Dose (mrem/yr)	CAP-88 unit dose factors (mrem/yr-Ci)
1. <u>total alpha</u>	<u>3.6×10^{-8} *</u>	<u>3000</u>	<u>1.08×10^{-4}</u>	<u>9.36×10^{-4}</u>	<u>8.67×10^0</u>
2. <u>total beta</u>	<u>3.42×10^{-7} *</u>	<u>3000</u>	<u>1.03×10^{-3}</u>	<u>4.49×10^{-5}</u>	<u>4.38×10^{-2}</u>
3. _____	_____	_____	_____	_____	_____
4. _____	_____	_____	_____	_____	_____
5. _____	_____	_____	_____	_____	_____
6. _____	_____	_____	_____	_____	_____
7. _____	_____	_____	_____	_____	_____
8. _____	_____	_____	_____	_____	_____
9. _____	_____	_____	_____	_____	_____
10. _____	_____	_____	_____	_____	_____
11. _____	_____	_____	_____	_____	_____
12. _____	_____	_____	_____	_____	_____
13. _____	_____	_____	_____	_____	_____
14. _____	_____	_____	_____	_____	_____
15. _____	_____	_____	_____	_____	_____
16. _____	_____	_____	_____	_____	_____
Total Dose				<u>9.81×10^{-4} mrem/yr</u>	

Method Used to Project Dose (CAP88) CAP-88

* see comments

COMMENTS

Reported emissions for 296-B-5 (DOE/RL-93-36) were non-detectable. For this assessment, the quantity released was calculated by multiplying the total annual flow through 296-B-5 of $1.8 \times 10^3 \text{ m}^3$ (DOE/RL-93-36) by the minimum detectable concentrations (MDC) from lab analysis for total beta & total alpha. These values were $2.0 \times 10^{-10} \text{ Ci/mL}$ for alpha & $1.9 \times 10^{-14} \text{ Ci/mL}$ for beta (WHC-EP-06898, p.7). Unit dose factors (WHC-EP-0498, p. A3-12) were used for the 10m height. 296-B-5 is 3.7m high.

EVALUATOR Thomas Y. Beam
 MANAGER, ENVIRONMENTAL 1/19/93
 FACILITY MANAGER 1/19/93

DATE 1/19/93
 DATE 1/19/93
 DATE 1/19/93

WHC-SD-EN-RPT-007

STACK ASSESSMENT FOR
40 CFR 61, SUBPART HAPPENDIX D
SOURCE ASSESSMENTFACILITY B Plant/WESF DISCHARGE POINT 296-B-10

FACILITY RADIOLOGICAL INVENTORY AT RISK

Radionuclide	Physical/ Chemical Form	Quantity (curies)	Release Factor	Potential Quantity Released (curies)	Projected Dose (mrem/yr)	CAP-88 unit dose - (mrem/yr)
1. ⁹⁰ Sr	Solid	8625-30000	10 ⁻⁶	.009-.03	.0004-.0013	4.38x1
2. ¹³⁷ Cs	Solid	1275-4335	10 ⁻⁶	.0013-.0043	.00003-.0001	2.39x1
3. _____	_____	_____	_____	_____	_____	_____
4. _____	_____	_____	_____	_____	_____	_____
5. _____	_____	_____	_____	_____	_____	_____
6. _____	_____	_____	_____	_____	_____	_____
7. _____	_____	_____	_____	_____	_____	_____
8. _____	_____	_____	_____	_____	_____	_____
9. _____	_____	_____	_____	_____	_____	_____
10. _____	_____	_____	_____	_____	_____	_____
11. _____	_____	_____	_____	_____	_____	_____
12. _____	_____	_____	_____	_____	_____	_____
13. _____	_____	_____	_____	_____	_____	_____
14. _____	_____	_____	_____	_____	_____	_____
15. _____	_____	_____	_____	_____	_____	_____
16. _____	_____	_____	_____	_____	_____	_____
Total Dose					.00043-.0014 mrem/yr	

Method Used to Project Dose (CAP88) CAP-88

COMMENTS

Quantities taken from 85% ¹³⁷Cs & 15% ⁹⁰Sr inventory estimate found in PNL-3397 "An Estimate of the Radioisotope Inventory Inside the K-3 Ventilation Duct, WESF" (Soldat & Brackenbush 1990). CAP-88 unit dose factors taken from WHC-EP-0498 (O.A3-12). Since 296-B-10 is 22.9m high, 10m dose factors were used instead of 89m values.

EVALUATOR Thomas J. Beam
 MANAGER, ENVIRONMENTAL John L. Smith
 FACILITY MANAGER [Signature]

DATE 11/19/93
 DATE 11/17/93
 DATE 11-30-93

STACK ASSESSMENT FOR
40 CFR 61, SUBPART H

NONDESTRUCTIVE ASSESSMENT [NDA]
(In Situ Gamma Spectroscopy)

FACILITY B Plant DISCHARGE POINT 296-B-13
NUMBER OF HEPA FILTER BANKS (n) 2

Emission and Effective Dose Equivalent (CAP88) values reported in the
Radionuclide Air Emissions Report for the Hanford Site, CY 1992.

Radionuclide	Unabated Potential (Curies)	EDE (mrem Ci ⁻¹ y ⁻¹)	Projected Dose (mrem y ⁻¹)
1. <u>Cs-137</u>	<u>2.03 · 10⁻⁶</u>	<u>2.39 · 10⁻²</u>	<u>4.85 · 10⁻⁸</u>
2. _____	_____	_____	_____
3. _____	_____	_____	_____
4. _____	_____	_____	_____
5. _____	_____	_____	_____
6. _____	_____	_____	_____

Total Dose 4.85 · 10⁻⁸

COMMENTS

No alpha or beta detectable/reported.

EVALUATOR [Signature]

DATE 29 Nov. 1993

MANAGER, ENVIRONMENTAL [Signature]

DATE 11-29-93

FACILITY MANAGER [Signature]

DATE 11/30/93

A3.0 SOLID WASTE OPERATIONS

Solid Waste Operations has three registered stacks: 296-T-11, 296-T-12, and 296-W-3. A description of the sampling of the high-efficiency particulate air filters for 296-T-11 and 296-T-12 is included. None of these stacks are designated stacks.

NESHAP ASSESSMENT FOR 296-T-11 AND -12 STACKS

A radiological evaluation was performed on source-term air upstream of any filtration devices within the exhaust system of the 296-T-11 and -12 stacks. The information gathered from the evaluation was then assessed against the NESHAP Subpart H dose limit of 0.1 mrem effective dose equivalent for specific continuous monitoring requirements. The calculated doses for both stacks, 296-T-11 and -12, are below the limit, being $1.8 \text{ E}-3$ and $3.7 \text{ E}-4$ mrem/yr, respectively. Accordingly, neither the 296-T-11 stack nor the 296-T-12 stack is subject to the stringent continuous monitoring requirements specified in Subpart H.

For NESHAP Subpart compliance, the assessment method and information included these elements, also summarized in Tables 1 and 2:

- Continuous air monitor (CAM) data for calendar-year 1992 were used. These data represent radioactive air concentrations inside the 224-T building. This air is exhausted by both the 296-T-11 and -12 stacks, operating at different periods throughout the year. To make the assessment conservative, the largest annual average concentrations were selected from among the alpha and beta activities collected by the eight CAMs in the building and then analyzed. For total alpha, that concentration is $6.4 \text{ E}-14 \text{ } \mu\text{Ci/mL}$ and for total beta it is coincidentally $6.4 \text{ E}-14 \text{ } \mu\text{Ci/mL}$, too.
- The concentrations for total alpha and total beta are multiplied by the annual flow through each stack to derive the radioactive releases, in Ci, for the whole year. In 1992, the 296-T-11 stack emitted $2.4 \text{ E}+11 \text{ L}$ of air and the 296-T-12 stack, $5.1 \text{ E}+10 \text{ L}$.
- One of two steps in determining the dose to the offsite nearest resident is to multiply CAP-88 unit dose factors by the hypothetical annual unabated Ci releases from the 224-T building, emitted through its two stacks. In this case, it was appropriate, based on process knowledge, to use the dose factor for ^{241}Am with the total alpha release and the dose factor for ^{90}Sr with the total beta release.
- The second step, unique for this assessment, is to add the estimated Ci inventory in a filter box (TRUSAF Filter Box 5) to the total release that is based on CAM data. The filter box is part of the ventilation system for some sealed-off process areas of the 224-T building that still exhaust through the two stacks but for which CAM data are unavailable. Factoring in this inventory conservatively compensates for the lack of air concentration data. The estimated filter inventory is $2.6 \text{ E}-4 \text{ Ci}$, for which the unit dose factor for ^{241}Am is applied. The resultant dose to the nearest offsite resident from this activity is $2.0 \text{ E}-3$ mrem EDE. Of this total, $1.7 \text{ E}-3$ mrem EDE is considered released from the 296-T-11 stack and $3.4 \text{ E}-4$ mrem EDE from the 296-T-12 stack. This distribution is based on the total flow of the two stacks being apportioned as: 83% for 296-T-11 and 17% for 296-T-12.

Table 1

Dose to Nearest Offsite Resident Resulting from Hypothetical Unabated Release through 296-T-11 Stack Using 1992 Upstream and Filter Box Inventory Data

Radioactivity	Annual average concentration, $\mu\text{Ci/mL}$	Emission Volume, m^3	Release, Ci	CAP-88 Unit Dose Factor, mrem/Ci	Dose to Nearest Offsite Resident, mrem
Total α	6.4 E-14	2.4 E+8	1.5 E-5	7.79 E+0	1.2 E-4
Total β	6.4 E-14	2.4 E+8	1.5 E-5	2.60 E-2	3.9 E-7
Offsite dose from filter box*:					1.7 E-3
NESHAP designation threshold of 0.1 mrem EDE > Total:					1.8 E-3

Table 2

Dose to Nearest Offsite Resident Resulting from Hypothetical Unabated Release through 296-T-12 Stack Using 1992 Upstream and Filter Box Inventory Data

Radioactivity	Annual average concentration, $\mu\text{Ci/mL}$	Emission Volume, m^3	Release, Ci	CAP-88 Unit Dose Factor, mrem/Ci	Dose to Nearest Offsite Resident, mrem
Total α	6.4 E-14	5.1 E+7	3.3 E-6	7.79 E+0	2.6 E-5
Total β	6.4 E-14	5.1 E+7	3.3 E-6	2.60 E-2	8.6 E-8
Offsite dose from filter box*:					3.4 E-4
NESHAP designation threshold of 0.1 mrem EDE > Total:					3.7 E-4

* See Table 3

Table 3

Summary of Filter Analyses of TRUSAF Filter Box 5

by John Glissmeyer, PNL
November 23, 1993

Filter	Radionuclide or Activity Type, μCi				
	^{60}Co	^{137}Cs	^{154}Eu	^{241}Am	TRU
Pre-1	1.43 E-2	8.99 E-1		2.50 E+1	1.14 E+2
Pre-2	ND	2.93 E-1		7.50 E-1	3.39 E+0
Pre-3	1.15 E-2	2.27 E-1		1.50 E-1	7.02 E-1
Pre-4	8.07 E-4	1.87 E-1		3.90 E-1	1.78 E+0
Pre-5	1.86 E-3	2.29 E-1		1.20 E-1	5.59 E-1
Pre-6	ND	4.09 E-2		ND	ND
Pre-7	1.50 E-2	2.14 E-1		1.40 E-1	6.25 E-1
Pre-8	3.95 E-3	1.47 E-1		1.10 E-1	4.93 E-1
Pre-total	4.74 E-2	2.24 E+0		2.67 E+1	1.22 E+2
HEPA 197187	3.44 E-2	6.67 E+0	5.76 E-2	6.40 E+0	2.93 E+1
HEPA 197157	2.61 E-2	6.33 E+0	7.70 E-2	5.30 E+0	2.42 E+1
HEPA 197182	2.46 E-2	6.55 E+0	5.82 E-2	6.20 E+0	2.79 E+1
HEPA 197185	3.28 E-2	6.00 E+0	6.63 E-2	6.00 E+0	2.72 E+1
HEPA-total	1.18 E-1	2.56 E+1	2.59 E-1	2.39 E+1	1.09 E+2
Total	1.65 E-1	2.78 E+1	2.59 E-1	5.06 E+1	2.30 E+2
Grand total of all activity: 2.58 E+2					
Pre %	29%	8%	0%	53%	53%
HEPA %	71%	92%	100%	47%	47%
Total % by filter type: Pre, 48%; HEPA, 52%					
Radionuclide %	0.06%	10.76%	0.10%		89.08%
Dose to nearest offsite resident attributable to 2.58 E+2 μCi = 2.01 E-3 mrem EDE ^a					

Pre = pre-filter

HEPA = high-efficiency particulate air (filter)

EDE = effective dose equivalent

^a Derives from: (2.58 E+2 μCi)(7.79 mrem/Ci [^{241}Am unit dose factor])(E-6 Ci/ μCi)

STACK ASSESSMENT FOR
40 CFR 61, SUBPART H

UPSTREAM ASSESSMENT

FACILITY: 224-T Building

DISCHARGE POINT: 296-T-11

FACILITY RADIOLOGICAL INVENTORY AT RISK

Radionuclide	Physical/ Chemical Form	Potential Quantity Released (curies)	Projected Dose (mrem/yr)
1. Total α	particle	2.3 E-4	1.8 E-3
2. Total β	particle	1.5 E-5	3.9 E-7
3. _____	_____	_____	_____
4. _____	_____	_____	_____
5. _____	_____	_____	_____
6. _____	_____	_____	_____
7. _____	_____	_____	_____
8. _____	_____	_____	_____
9. _____	_____	_____	_____
10. _____	_____	_____	_____
11. _____	_____	_____	_____
12. _____	_____	_____	_____
13. _____	_____	_____	_____
14. _____	_____	_____	_____
15. _____	_____	_____	_____
16. _____	_____	_____	_____
Total Dose: 1.8 E-3			

Method Used to Project Dose (CAP-88): CAP-88

COMMENTS: Total alpha modeled as ^{241}Am and total beta as ^{90}Sr for dose calculations. Total alpha release comprises two source values: 1.5 E-5 Ci from CAM data, which is classified under the upstream method, and 2.6 E-4 Ci from the filter box analysis, which is classified under the source-term method.

Evaluator K. M. McDonaldDate 12/13/93RJB Manager, EEM* [Signature]Date 12-13-93Facility Manager [Signature]Date 12/13/93

* EEM = Effluent and Emission Monitoring

STACK ASSESSMENT FOR
40 CFR 61, SUBPART H

UPSTREAM ASSESSMENT

FACILITY: 224-T Building

DISCHARGE POINT: 296-T-12

FACILITY RADIOLOGICAL INVENTORY AT RISK

Radionuclide	Physical/ Chemical Form	Potential Quantity Released (curies)	Projected Dose (mrem/yr)
1. Total α	particle	4.7 E-5	3.7 E-4
2. Total β	particle	3.3 E-6	8.6 E-8
3. _____	_____	_____	_____
4. _____	_____	_____	_____
5. _____	_____	_____	_____
6. _____	_____	_____	_____
7. _____	_____	_____	_____
8. _____	_____	_____	_____
9. _____	_____	_____	_____
10. _____	_____	_____	_____
11. _____	_____	_____	_____
12. _____	_____	_____	_____
13. _____	_____	_____	_____
14. _____	_____	_____	_____
15. _____	_____	_____	_____
16. _____	_____	_____	_____

Total Dose: 3.7 E-4

Method Used to Project Dose (CAP-88): CAP-88

COMMENTS: Total alpha modeled as ^{241}Am and total beta as ^{90}Sr for dose calculations. Total alpha release comprises two source values: 1.5 E-5 Ci from CAM data, which is classified under the upstream method, and 2.6 E-4 Ci from the filter box analysis, which is classified under the source-term method.

Evaluator *K. M. McDonald*Date 12/13/93Manager, EEM* *[Signature]*Date 12-13-93Facility Manager *[Signature]*Date 12-13-93

* EEM = Effluent and Emission Monitoring

STACK ASSESSMENT FOR
40 CFR 61, SUBPART H

NONDESTRUCTIVE ASSESSMENT [NDA]
(In Situ Gamma Spectroscopy)

FACILITY Waste Compactor (540) DISCHARGE POINT 296-W-3
NUMBER OF HEPA FILTER BANKS (n) 2

Emission and Effective Dose Equivalent (CAP88) values reported in the Radionuclide Air Emissions Report for the Hanford Site, CY 1992.

Radionuclide	Unabated Potential (Curies)	EDE (mrem Ci ⁻¹ y ⁻¹)	Projected Dose (mrem y ⁻¹)
1. <u>Cs-137</u>	<u>1.1 · 10⁻²</u>	<u>0.0142</u>	<u>1.56 · 10⁻⁹</u>
2. _____	_____	_____	_____
3. _____	_____	_____	_____
4. _____	_____	_____	_____
5. _____	_____	_____	_____
6. _____	_____	_____	_____

Total Dose 1.56 · 10⁻⁹

COMMENTS

No alpha or beta reported/detected.

EVALUATOR J. R. Smith

DATE 29 Nov. 93

MANAGER, ENVIRONMENTAL A. Smith

DATE 11-29-93

FACILITY MANAGER C. J. H. H. H.

DATE 12-8-93

12/8/93

A4.0 TANK FARMS (INCLUDING AR AND CR VENTS AND EVAPORATORS)

Tank Farms has 28 (the largest number) registered stacks. The assessment sheets are provided in the following pages (formerly released as WHC-SD-WM-EMP-031, Rev. 0). Eight of the registered stacks are designated stacks: 296-A-17, 296-A-22, 296-A-27, 296-A-29, 296-A-40, 296-P-16, 296-P-23, and 296-S-15. As noted in the following pages, an additional six registered stacks are anticipated to become designated in the future: 296-A-25, 296-B-28, 296-C-05, 296-S-22, 296-T-18, and 296-U-11. Two unregistered stack assessments are also included: 296-P-28 and 296-U-11. 296-P-28 is a designated stack and 296-U-11 is anticipated to become a registered stack in the future.

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EXECUTIVE SUMMARY

The National Emission Standards for Hazardous Air Pollutants (NESHAP), specified in 40 CFR Part 61, Subpart H, require that radionuclide emissions from each stack on the Hanford Site be evaluated to determine compliance with the standard. If an emission point could potentially cause a member of the public to be exposed to greater than 0.1 mrem per year, then that emission point would be considered to be "designated" and must be monitored continuously as specified in the standard.

This document provides calculations of the potential offsite doses due to the source inventories and operation of 31 Tank Farm stacks. Twenty-eight of these stacks are currently registered with the State of Washington. These calculations were performed using release factors in 40 CFR 61, Appendix D and waste tank radionuclide inventories identified in two Westinghouse Hanford Company (WHC) documents.

A summary of the results is found in Table 3.1 of this document. Results of the calculations show that 8 of the 28 registered stacks would currently be identified as "designated." Six other stacks associated with specific Double Contained Receiver Tanks (DCRTs) will be identified as "designated" when scheduled waste transfers pass through those facilities. Dates on which those stacks would become designated (i.e., the scheduled date that the waste transfer is to be initiated) are included in the text. One non-registered stack is identified as designated. The rest of the stacks are considered to be non-designated at this time.

1.0 INTRODUCTION

This document provides an applicability determination of Tank Farm Exhausters to the standards of the "National Emission Standards for Hazardous Air Pollutants" (NESHAP) specified in the 40 Series Code of Federal Regulations (CFRs), Part 61, Subpart H, "National Emission Standards for Emissions of Radionuclides Other Than Radon From Department of Energy Facilities." The determination was made per an Environmental Protection Agency (EPA) approved method contained in 40 CFR 61, Appendix D.

The NESHAP regulation sets the radionuclide emission limit for the entire Hanford Site to 10 mrem offsite to any member of the public. NESHAP requires that if any one emission point could potentially cause any member of the public to be exposed to greater than or equal to 0.1 mrem per year, then that emission point must measure the emissions continuously per those methods and standards specified in the regulations. EPA approval or equivalency can be obtained for measurements by other means if it is shown that the emissions are not significantly underestimated by those other means. If the emission point is shown to result in potentially less than or equal to 0.1 mrem per year, then only periodic confirmatory measurements are required.

The completion of this determination is scheduled for submittal to EPA on December 17, 1993 per the compliance plan referenced as follows:

Letter, J. D. Bauer, RL, to Jerry Leitch, EPA, "Compliance Plan Prepared in Response to Compliance Order and Information Request EPA Docket Number: 1092-01-23-113/114," 93-RPS-177, dated April 30, 1993.

Appendix D to Part 61 of 40 CFR provides methods for estimating radionuclide emissions. These methods can be used for dose calculations instead of measuring the actual emissions. Two parameters for each radionuclide must be known: the activity level and the physical state. The activity level is determined from the inventory of radionuclides in each tank. Appendix D provides release factors that depend on the physical state of the radionuclide. These factors are "1" for gases, "1E-3" for liquids or particulates, and "1E-6" for solids. The activity level is multiplied by the release factor to calculate the amount of activity for each radionuclide that would be available for emission to the atmosphere if no controls (e.g., HEPA filtration) were available. The releasable amount is multiplied by a dose conversion factor (i.e., the CAP-88 factor) for that radioisotope to estimate the potential offsite dose due to that specific radioisotope. The potential doses for all of the radioisotopes are added to calculate the total potential offsite dose due to entire source inventory in a tank or Tank Farm.

2.0 METHODS AND ASSUMPTIONS USED FOR THE APPENDIX D CALCULATIONS

The methods used and the assumptions made for the calculations of potential offsite doses using 40 CFR, Part 61, Appendix D factors are discussed in this section. The stack systems are divided into five different types: tank primary exhausters, double-shell tank annuli exhausters, back-up systems, double contained receiver tanks (DCRTs), and containment facilities. The methods used for the calculations for each of these types of stack systems are described separately below.

The design and configuration of each stack system were reviewed to determine which tanks are ventilated through each exhauster. Radionuclide data for the waste in each tank is available from published WHC documents. Where available and applicable, the radiological source terms for each stack system were evaluated in terms of their constituents (e.g., supernatant versus slurry/sludge, pumpable liquid versus total waste). For the DCRTs, different scenarios have been proposed based on scheduled waste transfers. Only the volume of the waste that is "pumpable" (i.e., drainable liquid minus the solid heel) through the transfer system is used in the DCRT calculations. For each stack system, the source term for each radionuclide is multiplied by the appropriate CAP-88 dose conversion factor obtained from WHC-EP-0498, Unit Dose Calculation Methods and Summary of FEMP Determinations. This converts the activity (in Curies) to a potential offsite dose (in mrem). The sum of the contributions from the radionuclides in the specific waste tanks is calculated to determine the potential offsite dose for a specific stack system.

The activities for the source terms for the primary exhausters and the DCRTs were taken from two Westinghouse Hanford Company (WHC) documents:

- Van Vleet, R. J., August 10, 1993, Radionuclide and Chemical Inventories for the Single Shell Tanks, WHC-SD-WM-TI-565, Rev. 1, Westinghouse Hanford Company, Richland, WA.
- Van Vleet, R. J., August 10, 1993, Radionuclide and Chemical Inventories for the Double Shell Tanks, WHC-SD-WM-TI-543, Rev. 1, Westinghouse Hanford Company, Richland, WA.

The radionuclide activities listed in these documents were obtained from several different sources and summarized by tank for each Tank Farm. In some cases, the activities were listed for supernatant and for slurry/sludge. For others, only the total radionuclide activity level was available. When separate data for each are available, supernatant source terms are considered to be liquid and slurry/sludge are considered to be solids. For the sake of conservatism, when only the total activity in waste is available and the separate forms are not distinguished from each other, the physical form of the waste is considered to be liquid. Radioactivity levels used were based on sample analyses results or WHC Track Radioactive Components (TRAC) computer records. Descriptions of the activities based on sample analyses included the dates of the samples; the TRAC computer record activities were all dated January 1990. Decay corrections were made on all data and the activities were decay-corrected to September 1993. The raw data and the decay-corrected data for all of the radionuclide activities are included in Appendix A.

The specific volumes of the wastes in each tank were obtained from the following reference:

- Hanlon, B. M., October 1993, Tank Farm Surveillance and Waste Status Summary Report for June 1993, WHC-EP-0182-63, Westinghouse Hanford Company, Richland, WA.

Ratios of pumpable liquid volume to total volume were required for the calculations for the DCRTs; the specific data for each tank are included in the appropriate subsection of Section 3.0 for each stack system.

Table 2.1 lists the Tank Farm stacks for which calculations have been made. Listed are the stack identification number and a brief description of the stack system.

No HEPA filter factor as designated in Appendix D (i.e., 0.01) was used in the calculations. For the NESHAP calculations, it is assumed that there is no filtration in place as specified in 40 CFR 61.93(b)(4)(ii) concerning engineered emission controls.

2.1 PRIMARY EXHAUSTERS

Nine stack systems are classified as primary exhausters for different Tank Farm facilities. Listed below are the systems and their identification numbers.

- 241-AY/AZ Tank Farm Primary Ventilation (296-A-17)
- 242-A Evaporator Vessel Ventilation (296-A-22)
- AW Tank Farm Primary Ventilation (296-A-27)
- AN Tank Farm Primary Ventilation (296-A-29)
- AP Tank Farm Primary Ventilation (296-A-40)
- 241-C-104/105/106 Portable Exhauster (296-P-16)
- 241-A-104/105/106 Ventilation (296-P-17)
- 241-SY Tank Farm Primary Ventilation (296-P-23)
- 241-SX Tank Farm (296-S-15)

For the calculations of 8 of the 9 primary systems, the source term data were obtained from the two references by Van Vleet; the 242-A Evaporator Vessel Ventilation (296-A-22) was the exception. Radionuclide levels were decay-corrected to September 1993 for all source terms. If data were available for the radioactivity fraction in the supernatant, that level was used in the calculations and is noted in the applicable subsection of Section 3.0 in this report. The source term for the 242-A Evaporator Vessel ventilation was obtained from the Facility Effluent Monitoring Plan for that facility. It was

based on sample radioactivity concentration data and was assumed for the maximum volume of the vessel.

Release factors for the different forms of waste were obtained from Appendix D of CFR 40, Part 61. Factors of 1 were used for gaseous emissions (i.e., I-129), $1\text{E-}03$ for liquids and particulates, and $1\text{E-}06$ for solids. A factor of $1\text{E+}00$ was used for the complex form of Ru/Rh which is considered to be conservative; it can be a combination of gaseous and particulate in differing fractions.

Table 2.1. Tank Farm Stacks

Stack	Description
296-A-12	244-AR Vault Ventilation
296-A-13	244-AR Vault Canyon and Cell Exhauster
296-A-17	241-AY/AZ Tank Farm Primary Ventilation
296-A-18	241-AY-101 Tank Annulus Ventilation Exhauster
296-A-19	241-AY-102 Tank Annulus Ventilation Exhauster
296-A-20	241-AZ Tank Farm Annulus Ventilation Exhauster
296-A-21	242-A Evaporator Building Ventilation Exhauster
296-A-22	242-A Evaporator Vessel Ventilation Exhauster
296-A-25	244-A Double Contained Receiver Tank & Annulus
296-A-26	204-AR Unloading Facility
296-A-27	AW Tank Farm Primary Ventilation
296-A-28	AW Tank Farm Annulus Ventilation
296-A-29	AN Tank Farm Primary Ventilation
296-A-30	AN Tank Farm Annulus Ventilation
296-A-40	AP Tank Farm Primary Ventilation
296-A-41	AP Tank Farm Annulus Ventilation
296-B-28	244-BX Double Contained Receiver Tank & Annulus
296-C-05	244-CR Vault Ventilation
296-P-16	241-C-104/105/106 Portable Exhauster
296-P-17	241-A-104/105/106 Ventilation
296-P-22	241-SY Tank Farm Annulus Ventilation
296-P-23	241-SY Tank Farm Primary Ventilation
296-P-26	241-AY/AZ Tank Farm Primary Backup Exhauster
296-P-28	241-SY Tank Farm Primary Backup Ventilation
296-P-31	209-E Building Critical Mass Laboratory
296-S-15	241-SX Tank Farm Ventilation Exhauster
296-S-18	242-S Evaporator Building Ventilation
296-S-22	244-S Double Contained Receiver Tank & Annulus
296-T-17	242-T Evaporator Facility
296-T-18	244-TX Double Contained Receiver Tank & Annulus
296-U-11	244-U Double Contained Receiver Tank & Annulus

2.2 DOUBLE-SHELL TANK ANNULI EXHAUSTERS

Seven stack systems are classified as annuli exhausters for different Tank Farm facilities. Listed below are the systems and their identification numbers.

- 241-AY-101 Tank Annulus Ventilation (296-A-18)
- 241-AY-102 Tank Annulus Ventilation (296-A-19)
- 241-AZ Tank Farm Annulus Ventilation (296-A-20)
- AW Tank Farm Annulus Ventilation (296-A-28)
- AN Tank Farm Annulus Ventilation (296-A-30)
- AP Tank Farm Annulus Ventilation (296-A-41)
- 241-SY Tank Farm Annulus Ventilation (296-P-22)

For the calculation of the potential annual offsite dose for each of these facilities, it is not expected that any of the primary containment vessels in any of the Double-Shell tanks will leak. The design life of each vessel is a minimum of 50 years and the tanks have undergone integrity assessments. If a leak is found, the affected annulus source term would be re-evaluated at that time. Therefore, there is no radionuclide source term associated with this stack system. Also, no HEPA factors are included in the calculations.

2.3 BACK-UP EXHAUSTERS

Two stack systems are classified as back-up exhausters for different Tank Farm facilities. Listed below are brief descriptions of the systems and the identification numbers.

- 241-AY/AZ Tank Farm Primary Backup Exhauster (296-P-26)
- 241-SY Tank Farm Primary Backup Ventilation (296-P-28)

These back-up systems are not routinely operated. Preventative maintenance procedures require that the systems be operated periodically and only for a short period of time. The backup exhauster for the 241-AY/AZ Tank Farm has been in operation for a number of months during 1993 because of repairs required on the primary equipment.

The minimum operation time required for each system to be placed into a designated mode is calculated by using 0.1 mrem as the dose limit, dividing by the potential offsite dose of the effluent for the specific source, and converting the units to a useful time units. These minimum operation times are listed in Sections 3.23.4 and 3.24.4 for Stacks 296-P-26 and 296-P-28, respectively.

2.4 DOUBLE CONTAINED RECEIVER TANKS (DCRTS)

Seven stack systems are classified as exhausters for DCRTs for different Tank Farm facilities. Listed below are the systems and their identification numbers.

- 244-AR Vault Ventilation (296-A-12)
- 244-A DCRT & Annulus (296-A-25)
- 244-BX DCRT & Annulus (296-B-28)
- 244-CR Vault Ventilation (296-C-05)
- 244-S DCRT & Annulus (296-S-22)
- 244-TX DCRT & Annulus (296-T-18)
- 244-U DCRT & Annulus (296-U-11)

For the calculations of the potential offsite doses for these facilities, the radiological source term data were obtained from the Van Vleet references. These data were decay-corrected to September 1993.

The 244-AR Vault ventilation system has not been used to transfer waste for a number of years and is currently not scheduled to be put back into operation. Currently, the vault tanks contain some waste. Specific assumptions used for the source term for this facility are discussed in Section 3.1 of this report.

The calculations for the other 6 DCRTs were performed using the following method. The schedule for Tank Farm waste transfers for the next several years was obtained from the WHC Single-Shell Tank Stabilization Program. The DCRTs through which these transfers will be made is known. The fraction of the total activity to be transferred was calculated by dividing the pumpable liquid volume by the total volume of the waste for each tank involved in the transfer. This volume data was obtained by the June 1993 report on the Tank Farm Surveillance and Waste Status Summary (i.e., WHC-EP-0182-63) and the data for the specific tanks involved for a DCRT are listed in the report. The fraction for each radionuclide in each of the transfer tanks was calculated and the total "transfer" contributions were summed.

The amount of waste that is able to be in a DCRT at any time is limited to the maximum allowable volume of the DCRT itself; this is limited by physical and administrative limits. The administrative limit is normally 95% of the physical volume and is established to prevent overflow of the system. The administrative limit is the volume used in the calculations. The volumes for the specific DCRTs are used in the calculations. The fraction of the "total" Effective Dose Equivalent (EDE) is calculated based on the ratio of the volume of the DCRT to the total pumpable liquid volume of the waste from the tanks. The pumpable liquid volume is the drainable liquid volume remaining in a tank minus the volume of the undrainable heel.

Static and dynamic situations are evaluated for each scenario.

A static situation exists when a specific volume of waste is "stored" in the DCRT and no more waste is being transferred.

A dynamic situation exists when the waste is being transferred from one waste system to another and the waste is going through the DCRT.

With regard to the static situation, there is currently no restriction on the length of time that the waste can be stored in a DCRT. In this case, the calculated potential dose is based on the "administrative" volume of the DCRT, the average radioactivity concentration of the waste, and the length of time that the waste is stored.

For the dynamic situation, the operating range of the transfer system in terms of transfer velocity is 0.5 to 3 gal/min. This has been established to protect the system (e.g., screens, valves, etc.) from damage during the transfer. In the calculations, a transfer velocity of 0.5 gal/min is used as a conservative value. The limiting factors for the dynamic situation are the volume of the DCRT, the volume of waste being transferred, and the transfer velocity of the waste. If the volume of the waste to be transferred is greater than the volume that can be transferred in one year, then it will take more than one year to make the transfer, and the static calculation is the annual potential dose. If the volume of the waste is less than the volume that can be transferred in one year, then the dose will be less than the static level calculated - if the waste is indeed transferred in less than a year.

Examples:

- 1) Transfer of waste from tanks BY-102 and 109 through the 244-BX DCRT (Stack 296-B-28)

- BY-102: 22 Kgal pumpable liquid
- BY-109: 57 Kgal pumpable liquid
- Volume of 244-BX DCRT: 26.0 Kgal
- Total dose for the 79 Kgal: 4.89E-1 mrem/yr

Static and dynamic situations:

$$\text{Static: } [(4.89\text{E-}01 \text{ mrem/yr})(26.0 \text{ Kgal}/79 \text{ Kgal})] \\ = 0.16 \text{ mrem/yr}$$

$$\text{Dynamic: } [(4.89\text{E-}01 \text{ mrem/yr})(26.0 \text{ Kgal}/79 \text{ Kgal})] \\ \times (79 \text{ Kgal}) / [(0.5\text{E-}03 \text{ Kgal/min})(60 \text{ min/hr}) \\ \times (24 \text{ min/d})(365 \text{ d/yr})] \\ = 4.8\text{E-}02 \text{ mrem over 108 days}$$

- 2) Transfer of waste from tanks U-102 and 110 through the 244-U DCRT (Stack 296-U-11)

- U-102: 122 Kgal pumpable liquid
- U-110: 9 Kgal pumpable liquid
- Volume of 244-U DCRT: 13.03 Kgal
- Total dose for the 131 Kgal: 1.371 mrem/yr

Static and dynamic situations:

Static: $[(1.871)(26 \text{ Kgal}/131 \text{ Kgal})] = 0.371 \text{ mrem/yr}$

Dynamic: $[(1.871)(26 \text{ Kgal}/131 \text{ Kgal})]$
 $\times (131 \text{ Kgal})/[(0.5\text{E}-3 \text{ Kgal}/\text{min})(60 \text{ min}/\text{hr})]$
 $\times (24 \text{ hrs}/\text{d})(365 \text{ d}/\text{yr})$
 $= 0.185 \text{ mrem over 182 days}$

Example 1 is a situation where if the static situation exists; that is, the waste resides in the DCRT over a full year, then the stack would be need to be identified as designated. If the dynamic situation exists where the waste is transferred through the system at an average rate of not less than 0.5 gal/min, then the stack would be classified as non-designated.

Example 2 shows that the DCRT could be classified as designated for either the static or dynamic situation if this specific waste is transferred or stored in this DCRT.

2.5 CONTAINMENT FACILITIES

Five stack systems are classified as exhausters for different Tank Farm containment facilities. Listed below are brief descriptions of the systems and the identification numbers.

- 244-AR Vault Canyon and Cell Exhauster (296-A-13)
- 242-A Evaporator Building Ventilation (296-A-21)
- 204-AR Unloading Facility (296-A-26)
- 242-S Evaporator Building Ventilation (296-S-18)
- 242-T Evaporator Facility (296-T-17)
- 209-E Bldg. Critical Mass Laboratory (296-P-31)

These six stack systems ventilate buildings or specific rooms within buildings which control small (i.e., μCi to mCi levels) inventories of radionuclides from associated vessels or operations within these areas. The 244-AR Vault canyon and cells, the 204-AR Unloading Facility, and containment buildings for Evaporators 242-S, 242-A, and 242-T are designated as surface contamination areas per WHC Controlled Manual (CM) 1-6, Radiological Control Manual. Stack systems which ventilate these areas normally exhaust through HEPA filtration systems to prevent potential release of surface contamination made airborne during normal facility operations.

Inventories of surface contamination in five of the six buildings are not routinely maintained (209-E is the exception), so calculation of radionuclide source terms is based on expected contamination levels which would allow entry and work in the areas. Contamination levels and decontamination activities in

the areas are controlled by facility operating procedures which conform with WHC-CM-1-6.

For the sake of conservatism, inventories calculated in this section assume uniform contamination over 100 percent of ventilated surface areas (floors, ceilings, walls, and large vessels) in the buildings. The inventory is, therefore, proportional to the surface area. Contamination levels are based on WHC-CM-1-6 threshold levels for "very-high contamination area". The calculations assume removable contamination levels of 2000 disintegrations per minute (dpm) per 100 cm² of Am-241 (alpha emitter) plus 100,000 dpm per 100 cm² of Sr-90 in equilibrium with daughter Y-90 (beta emitters). These radionuclides are both routinely available in Tank Farm operations and are the worst-case (most conservative) nuclides for potential offsite dose through airborne release.

Review of 1993 surface contamination surveys for the 242-A and 242-S evaporator buildings shows contamination levels approximating this model: gross alpha contamination below detection limit in all readings, gross beta contamination averaging 62,000 dpm per 100 cm² (range: below detection limit - 250,000 dpm per 100 cm²) in 37 survey points. Surveys of Evaporator 242-T and 244-AR Vault canyons, and the 204-AR Facility were not available.

Results of Appendix D calculations based on the contamination-based inventory shows offsite doses as high as 2.8×10^{-6} mrem/yr for the 244-AR Vault. This annual dose is more than two orders of magnitude below the NESHAP stack regulation limit of 0.1 mrem/yr.

For the 209-E Building Critical Mass Laboratory, a building nuclear materials inventory and the contents of a worst-case radioactive solid waste package (CR Vault HEPA filter package assay and sample counting report) were used to determine the maximum inventory. Plans are established to use the critical assembly room and the mix room to assay, sample, and repackage low-level radioactive solid waste containers.

3.0 CALCULATIONS OF POTENTIAL OFFSITE DOSES BASED ON APPENDIX D FACTORS

Calculations of potential offsite doses based on source term information and 40 CFR, Part 61, Appendix D factors are performed in the following subsections. Table 3.1 lists the 31 stacks systems for which calculations have been made and the associated sub-sections in this report for each stack.

Each subsection includes a brief description of the stack system, a discussion on the tank waste volumes (i.e., total, pumpable) if applicable, a discussion on the calculation of the source term if applicable, the calculation of the potential offsite doses for different scenarios, and identification of each tank system as "Designated" or "Non-designated." A stack system is considered to be designated if the calculation of the Effective Dose equivalent (EDE) is greater than 0.1 mrem.

Data sheets are included for each scenario for each stack system. These sheets show the activity for each radionuclide, the CAP-88 factors used, the Appendix D factors, the calculated EDE for each radionuclide, and the percent of the total EDE for each radionuclide. Appendix B includes NESHAP forms for the Appendix D calculations and include WHC Quality Assurance (QA), Facility, and Environmental signature approval.

3.1 STACK 296-A-12

3.1.1 SYSTEM DESCRIPTION / CONFIGURATION

The 296-A-12 stack system ventilates the 244-AR Vault vessels, providing negative pressure and removal of moisture from the vessels' offgas. The 244-AR Vault is located near the 241-A Tank Farm in the 200 East area.

The 244-AR Vault is considered to be a double-contained receiver tank (DCRT) in the Hanford Site Tank Farm Facilities Interim Safety Basis (WHC-SD-WM-ISB-001) based on its functional characteristics, although it is not listed as one of the five designated DCRTs in the 200 Area tank system. The 244-AR Vault was first used to transfer waste in 1966. Waste which was received from PUREX and B-Plant waste streams was held for transfer to the AY and AZ (Aging Waste) Tank Farms. This facility is currently not in operation. Future uses of the Vault may include additional waste transfers from PUREX.

Table 3.1. Tank Farm Stacks, Section Number, Description, and Status

STACK	SECTION	DESCRIPTION	STATUS
296-A-12	3.1	244-AR Vault	NON-DESIGNATED
296-A-13	3.2	244-AR Vault Canyon and Cell	NON-DESIGNATED
296-A-17	3.3	241-AY/AZ Tank Farm Primary	DESIGNATED
296-A-18	3.4	241-AY-101 Tank Annulus	NON-DESIGNATED
296-A-19	3.5	241-AY-102 Tank Annulus	NON-DESIGNATED
296-A-20	3.6	241-AZ Tank Farm Annulus	NON-DESIGNATED
296-A-21	3.7	242-A Evaporator Building	NON-DESIGNATED
296-A-22	3.8	242-A Evaporator Vessel	DESIGNATED
296-A-25	3.9	244-A DCRT & Annulus	NON-DESIGNATED ⁽¹⁾
296-A-26	3.10	204-AR Unloading Facility	NON-DESIGNATED
296-A-27	3.11	AM Tank Farm Primary	DESIGNATED
296-A-28	3.12	AM Tank Farm Annulus	NON-DESIGNATED
296-A-29	3.13	AN Tank Farm Primary	DESIGNATED
296-A-30	3.14	AN Tank Farm Annulus	NON-DESIGNATED
296-A-40	3.15	AP Tank Farm Primary	DESIGNATED
296-A-41	3.16	AP Tank Farm Annulus	NON-DESIGNATED
296-B-28	3.17	244-BX DCRT & Annulus	NON-DESIGNATED ⁽¹⁾
296-C-05	3.18	244-CR Vault	NON-DESIGNATED ⁽¹⁾
296-P-16	3.19	241-C-104/105/106 Portable	DESIGNATED
296-P-17	3.20	241-A-104/105/106	NON-DESIGNATED ⁽²⁾
296-P-22	3.21	241-SY Tank Farm Annulus	NON-DESIGNATED
296-P-23	3.22	241-SY Tank Farm Primary	DESIGNATED
296-P-26	3.23	241-AY/AZ Tank Farm Primary Backup	DESIGNATED ⁽⁴⁾
296-P-28	3.24	241-SY Tank Farm Primary Backup	NON-DESIGNATED ^(2,4)
296-P-31	3.25	209-E Critical Mass Laboratory	NON-DESIGNATED
296-S-15	3.26	241-SX Tank Farm	DESIGNATED
296-S-18	3.27	242-S Evaporator Building	NON-DESIGNATED
296-S-22	3.28	244-S DCRT & Annulus	NON-DESIGNATED ⁽¹⁾
296-T-17	3.29	242-T Evaporator Facility	NON-DESIGNATED
296-T-18	3.30	244-TX DCRT & Annulus	NON-DESIGNATED ⁽¹⁾
296-U-11	3.31	244-U DCRT & Annulus	NON-DESIGNATED ^(1,4)

⁽¹⁾ This transfer unit ventilation stack may be determined to be designated in the future depending on the waste that is sent through the transfer unit. The first scheduled transfer dates that would put the stacks into designated modes are discussed in the text.

⁽²⁾ This system is not currently in operation. If the exhausters would be operated again, the system would become designated.

⁽³⁾ This stack could become designated if required to operate for a specific length of time; refer to subsection that describes this stack.

⁽⁴⁾ This stack is not currently registered.

There are a total of four vessels in the 244-AR Vault which are ventilated by the 296-A-12 stack. Vessels 1 and 2 have a nominal volume of 50,000 gallons (limited respectively to 40,990 and 41,226 gallons by WHC operating specifications). Vessels 3 and 4 have a nominal volume of 5,000 gallons (limited respectively to 4,553 and 4,427 gallons by WHC operating specifications). Vessels 1, 2 and 4 are not in service. Vessel 3 currently holds stormwater runoff pumped from the 244-AR canyon and residual contamination from previous transfers. Each of the vessels is held in its own cell and isolated from the 244-AR Vault canyon via a cell cover. Each of the vessels is ventilated via a common pipe which passes through ports in the cell walls, then through a heater followed by parallel pre-filters/HEPA filters, and a single blower system before venting in the 296-A-12 stack.

3.1.2 CALCULATION OF SOURCE TERM

The source term used in the calculation is 1×10^{-4} of the radionuclide inventory of the 241-AY-101, 241-AY-102, 241-AZ-101, 241-AZ-102 total inventory. A 1×10^{-4} fraction corresponds to the ratio of potential residual heel volumes (assumed to be six inches) in the 244-AR Vault vessels to the four 1 million gallon tanks in the AY/AZ Farms. The 296-A-12 stack system is used very infrequently due to the lack of a current mission for the facility. A maintenance running period of 10 days per year is assumed.

3.1.3 CALCULATION OF POTENTIAL OFFSITE DOSE

- 3.1.3.1 Scenario: 1×10^{-4} of the total AY/AZ Tank farm inventory (i.e., supernatant plus slurry/sludge) is estimated to be in the 244-AR Vault Vessel and is used in the calculation. Stack running time 10 days per year. No HEPA filter factors are included in the calculations.

Potential offsite dose = 2.6×10^{-3} mrem/yr

3.1.4 TANK STATUS: NON-DESIGNATED

Stack 296-A-12

244-AR VAULT VESSEL VENTILATION SOURCE TERM EMISSIONS

R-nuclide	Sum of Ci*	CAP-88 c-factor	APP D factor	EDE (mrem/yr)	% of Total EDE	
14-C	.5570E-03	.2620E-02	1.E-03	1.459E-09	1.504E-06	1
60-Co	.3150E+00	.2900E-01	1.E-03	9.135E-06	9.416E-03	2
79-Se	.0000E+00	.4380E-01	1.E-03	0.000E+00	0.000E+00	3
89/90-Sr	.1160E+04	.4380E-01	1.E-03	5.081E-02	5.237E+01	4
90-Y	.1160E+04	.3770E-03	1.E-03	4.373E-04	4.508E-01	5
99-Tc	.1290E+02	.1090E-02	1.E-03	1.406E-05	1.449E-02	6
106-Ru/Rh	.0000E+00	.2090E-01	1.E+00	0.000E+00	0.000E+00	7
125-Sb	.0000E+00	.4150E-02	1.E-03	0.000E+00	0.000E+00	8
129-I	.2790E-03	.2910E+00	1.E+00	8.119E-05	8.369E-02	9
134-Cs	.3020E+01	.3130E-01	1.E-03	9.453E-05	9.743E-02	10
137-Cs	.9540E+03	.2390E-01	1.E-03	2.280E-02	2.350E+01	11
143-Ce	.0000E+00	.1370E-01	1.E-03	0.000E+00	0.000E+00	12
147-Pm	.0000E+00	.1140E-02	1.E-03	0.000E+00	0.000E+00	13
154-Eu	.3810E+01	.4380E-01	1.E-03	1.669E-04	1.720E-01	14
Nat-U	.3680E-03	.2840E+01	1.E-03	1.045E-06	1.077E-03	15
237-Np	.4590E-03	.1190E+02	1.E-03	5.462E-06	5.630E-03	16
238-Pu	.3120E-01	.8020E+01	1.E-03	2.502E-04	2.579E-01	17
239/240-Pu	.1430E+00	.8670E+01	1.E-03	1.240E-03	1.278E+00	18
241-Pu	.5550E+00	.1380E+00	1.E-03	7.659E-05	7.894E-02	19
241-Am	.1600E+01	.1310E+02	1.E-03	2.096E-02	2.160E+01	20
242/244-Cm	.1040E-01	.6940E+01	1.E-03	7.218E-05	7.440E-02	21
TOTAL				9.702E-02	1.000E+02	

* - Decay-corrected to 9/93

$$[(9.702E-02 \text{ mrem/yr})(10 \text{ da/yr})/(365 \text{ da/yr})] = 2.6E-03 \text{ mrem/yr}$$

3.2 STACK 296-A-13

3.2.1 SYSTEM DESCRIPTION / CONFIGURATION

The 296-A-13 stack system ventilates the 244-AR Vault canyon and containment cells associated with the four 244-AR vessels. The 244-AR Vault is located near the 241-A Tank Farm in the 200 East area.

The 244-AR Vault is considered to be a double-contained receiver tank (DCRT) in the Hanford Site Tank Farm Facilities Interim Safety Basis (WHC-SD-WM-ISB-001) based on its functional characteristics, although it is not listed as one of the five DESIGNATED DCRTs in the 200 Area tank system. The 244-AR Vault was first used to transfer waste in 1966. Waste which was received from PUREX and B-Plant waste streams was held for transfer to the AY and AZ (Aging Waste) Tank Farms. Future uses of the Vault may include additional transuranic and non-transuranic waste from PUREX.

Contained spaces which are ventilated by the 296-A-13 consist of the 244-AR canyon with dimensions of 94 feet x 18 feet x 36 feet high, two cells with dimensions of 21 feet x 21 feet x 32.8 feet deep each containing one of the two large process tanks, and a cell with dimensions of 32 feet x 12 feet x 21 feet deep containing tanks 3 and 4.

Air is drawn in from the non-radiologically controlled 244-AR ventilation system and passes through a heater, pre-filter, and water scrubber system before entering the 244-AR canyon. The air then passes through the three containment cells and then through two HEPA filter banks before being exhausted at the 296-A-13 stack.

3.2.2 CALCULATION OF SOURCE TERM

Radionuclide inventory is based on levels for "very high removable contamination" per WHC-CM-1-6 assuming worst case alpha (Am-241) and beta (Sr-90/Y-90) as representative nuclides. This level of contamination is assumed to be uniformly distributed over all ventilated surface areas.

NUCLIDE	TOTAL AREA (cm ²)	POSTULATED UNIT ACTIVITY (dpm /100 cm ²)	TOTAL ACTIVITY (Ci)
Am-241	2.3 x 10 ⁴	2,000	2.1 x 10 ⁻⁴
Sr-90	2.3 x 10 ⁴	100,000	1.05 x 10 ⁻²
Y-90	2.3 x 10 ⁴	100,000	1.05 x 10 ⁻²

3.2.3 CALCULATION OF POTENTIAL OFFSITE DOSE

- 3.2.3.1 Scenario #1:** Postulated Am-241, Sr-90/Y-90 inventories are included in the calculation. No HEPA filter factors are included in the calculation.

Potential offsite dose = 2.8×10^{-4} mrem/yr

- 3.2.4 TANK STATUS: NON-DESIGNATED**

Stack 296-A-13

244-AR CANYON AND VAULT SOURCE TERM EMISSIONS

R-nuclide	Sum of Ci	CAP-88 c-factor	APP D factor	EDE (mrem/yr)	% of Total EDE	
14-C	.0000E+00	.2620E-02	1.E-03	0.000E+00	0.000E+00	1
60-Co	.0000E+00	.2900E-01	1.E-03	0.000E+00	0.000E+00	2
79-Se	.0000E+00	.4380E-01	1.E-03	0.000E+00	0.000E+00	3
89/90-Sr	.1050E-01	.4380E-01	1.E-03	4.599E-07	1.669E-01	4
90-Y	.1050E-01	.3770E-03	1.E-03	3.959E-09	1.437E-03	5
99-Tc	.0000E+00	.1090E-02	1.E-03	0.000E+00	0.000E+00	6
106-Ru/Rh	.0000E+00	.2090E-01	1.E+00	0.000E+00	0.000E+00	7
125-Sb	.0000E+00	.4150E-02	1.E-03	0.000E+00	0.000E+00	8
129-I	.0000E+00	.2910E+00	1.E+00	0.000E+00	0.000E+00	9
134-Cs	.0000E+00	.3130E-01	1.E-03	0.000E+00	0.000E+00	10
137-Cs	.0000E+00	.2390E-01	1.E-03	0.000E+00	0.000E+00	11
143-Ce	.0000E+00	.1370E-01	1.E-03	0.000E+00	0.000E+00	12
147-Pm	.0000E+00	.1140E-02	1.E-03	0.000E+00	0.000E+00	13
154-Eu	.0000E+00	.4380E-01	1.E-03	0.000E+00	0.000E+00	14
Nat-U	.0000E+00	.2840E+01	1.E-03	0.000E+00	0.000E+00	15
237-Np	.0000E+00	.1190E+02	1.E-03	0.000E+00	0.000E+00	16
238-Pu	.0000E+00	.8020E+01	1.E-03	0.000E+00	0.000E+00	17
239/240-Pu	.0000E+00	.8670E+01	1.E-03	0.000E+00	0.000E+00	18
241-Pu	.0000E+00	.1380E+00	1.E-03	0.000E+00	0.000E+00	19
241-Am	.2100E-01	.1310E+02	1.E-03	2.751E-04	9.983E+01	20
242/244-Cm	.0000E+00	.6940E+01	1.E-03	0.000E+00	0.000E+00	21
TOTAL				2.756E-04	1.000E+02	

Inventory based on "High Contamination Area" definition in WHC-CM-1-6

3.3 STACK 296-A-17

3.3.1 SYSTEM DESCRIPTION / CONFIGURATION

The 296-A-17 stack serves the 241-A-702 primary ventilation system for tanks in the 241-AY and 241-AZ Tank Farms and several diverter stations and catch tanks associated with these facilities. The 241-A-702 system provides

negative pressure, removal of decay heat from radionuclides and removal of water vapor evaporating from the liquid waste. The 241-AY and 241 AZ Tank Farms are located in the 200 East area, northeast of the PUREX facility.

The 241-AY and 241-AZ Tank Farms contain double-shell tanks. The 241-AY Tank Farm received waste from 1968 to 1970 and the 241-AZ Tank received waste from 1971 to 1977. There are a total of four 1 M gallon tanks in the 241-AY/AZ Tank Farm.

The 241-A-702 system serves as primary ventilation for these tanks. The 241-AX-152 diverter station, the 241-AZ-151 catch tank and the 241-AZ-154 catch tank are also ventilated via this system. Additionally, the six tanks in the single-shell 241-A Tank Farm could be vented via this system upon opening of an isolation valve. Ducts from each of the tanks and ancillary stations are joined through isolation valves. Even though it is possible, there are no current plans to ventilate these tanks through the isolation valve. The ventilation system includes three condensers operating in parallel, two deentrainers, a steam air heater, six parallel trains of HEPA filter assemblies (each with two sets in series), and two exhaust fans feeding the 296-A-17 stack.

3.3.2 TANKS AND WASTE VOLUME

TANK	WASTE VOLUME (KGAL)	
	TANK TOTAL	PUMPABLE
241-AY-101	910	827
241-AY-102	835	803
241-AZ-101	972	937
241-AZ-102	962	871
TOTAL	3,679	3,438

3.3.3 CALCULATION OF POTENTIAL OFFSITE DOSE

3.3.3.1 Scenario: The radioactivity in the supernatant of the waste and in the slurry/sludge in AY and AZ Tank Farms is included in the calculation. No HEPA filter factors are included in the calculation.

3.3.4 Potential offsite dose = 226 mrem/yr
TANK STATUS: DESIGNATED

Stack 296-A-17

241-AZ/AZ TANK FARM SOURCE TERM EMISSIONS

R-nuclide	Sum of Ci*	CAP-88 c-factor	APP D factor	EDE (mrem/yr)	% of Total EDE	
14-C	.4970E+01	.2620E-02	1.E-03	1.302E-05	5.755E-06	1
60-Co	.1740E+04	.2900E-01	1.E-03	5.046E-02	2.230E-02	2
79-Se	.0000E+00	.4380E-01	1.E-03	0.000E+00	0.000E+00	3
89/90-Sr	.3950E+05	.4380E-01	1.E-03	1.730E+00	7.646E-01	4
90-Y	.3950E+05	.3770E-03	1.E-03	1.489E-02	6.581E-03	5
99-Tc	.1290E+06	.1090E-02	1.E-03	1.406E-01	6.214E-02	6
106-Ru/Rh	.0000E+00	.2090E-01	1.E+00	0.000E+00	0.000E+00	7
125-Sb	.0000E+00	.4150E-02	1.E-03	0.000E+00	0.000E+00	8
129-I	.2480E+01	.2910E+00	1.E+00	7.217E-01	3.190E-01	9
134-Cs	.2890E+01	.3130E-01	1.E-03	9.046E-05	3.998E-05	10
137-Cs	.9240E+07	.2390E-01	1.E-03	2.208E+02	9.760E+01	11
144-Ce	.0000E+00	.1370E-01	1.E-03	0.000E+00	0.000E+00	12
147-Pm	.0000E+00	.1140E-02	1.E-03	0.000E+00	0.000E+00	13
154-Eu	.1880E+05	.4380E-01	1.E-03	8.234E-01	3.639E-01	14
Nat-U	.1880E+01	.2840E+01	1.E-03	5.339E-03	2.360E-03	15
237-Np	.2440E+00	.1190E+02	1.E-03	2.904E-03	1.283E-03	16
238-Pu	.2630E+00	.8020E+01	1.E-03	2.109E-03	9.322E-04	17
239/240-Pu	.2500E+01	.8670E+01	1.E-03	2.168E-02	9.580E-03	18
241-Pu	.1180E+02	.1380E+00	1.E-03	1.628E-03	7.197E-04	19
241-Am	.1460E+03	.1310E+02	1.E-03	1.913E+00	8.453E-01	20
242/244-Cm	.0000E+00	.6940E+01	1.E-03	0.000E+00	0.000E+00	21
TOTAL				2.263E+02	1.000E+02	

* - Decay-corrected to 9/93

3.4 STACK 296-A-18

3.4.1 SYSTEM DESCRIPTION / CONFIGURATION

The 296-A-18 stack serves the annulus exhaust system for tank 241-AY-101 in the 241-AY Tank Farm. The 241-AY-101 annulus exhaust provides for air flow in the annulus to minimize corrosion of the outer surface of the primary tank, remove heat conducted through the tank wall, and provide emergency ventilation for the tank in the event of failure of primary and backup tank ventilation. The 241-AY Tank Farm is located in the 200 East area, northeast of the PUREX facility.

The 241-AY Tank Farm contains double-shell tanks. The 241-AY Tank Farm received waste from 1968 to 1970. There are a total of two 1 M gallon tanks in the 241-AY Tank Farm.

Makeup air is drawn in from the outside, heated and filtered through two HEPA filter banks and then sent through distribution ducts to the top and bottom surfaces of the primary tank. Air slots on the bottom of each tank uniformly distribute the circulating air. Air is removed from the annulus space through a 16-inch diameter duct and through two series HEPA filter trains each containing four filters (2 x 4), a single blower system and is vented through the 296-A-18 stack.

3.4.2 CALCULATION OF SOURCE TERM

It is not expected that the primary containment vessel in the 241-A-101 Tank will leak. The design life of this vessel is a minimum of 50 years and the tank has undergone an integrity assessment. If a leak is found, the annulus source term would be re-evaluated at that time. Therefore, there is no radionuclide source term associated with this stack system.

3.4.3 CALCULATION OF POTENTIAL OFFSITE DOSE

- 3.4.3.1 Scenario: No loss of primary containment of the tank is expected.
No HEPA filter factors are included in the calculations.

Potential offsite dose = 0 mrem/yr

3.4.4 TANK STATUS: NON-DESIGNATED

Stack 296-A-18

241-AY-101 TANK ANNULUS SOURCE TERM EMISSIONS

R-nuclide	Sum of Ci	CAP-88 c-factor	APP D factor	EDE (mrem/yr)	% of Total EDE	
14-C	.0000E+00	.2620E-02	1.E-03	0.000E+00	0.000E+00	1
60-Co	.0000E+00	.2900E-01	1.E-03	0.000E+00	0.000E+00	2
79-Se	.0000E+00	.4380E-01	1.E-03	0.000E+00	0.000E+00	3
89/90-Sr	.0000E+00	.4380E-01	1.E-03	0.000E+00	0.000E+00	4
90-Y	.0000E+00	.3770E-03	1.E-03	0.000E+00	0.000E+00	5
99-Tc	.0000E+00	.1090E-02	1.E-03	0.000E+00	0.000E+00	6
106-Ru/Rh	.0000E+00	.2090E-01	1.E+00	0.000E+00	0.000E+00	7
125-Sb	.0000E+00	.4150E-02	1.E-03	0.000E+00	0.000E+00	8
129-I	.0000E+00	.2910E+00	1.E+00	0.000E+00	0.000E+00	9
134-Cs	.0000E+00	.3130E-01	1.E-03	0.000E+00	0.000E+00	10
137-Cs	.0000E+00	.2390E-01	1.E-03	0.000E+00	0.000E+00	11
144-Ce	.0000E+00	.1370E-01	1.E-03	0.000E+00	0.000E+00	12
147-Pm	.0000E+00	.1140E-02	1.E-03	0.000E+00	0.000E+00	13
154-Eu	.0000E+00	.4380E-01	1.E-03	0.000E+00	0.000E+00	14
Nat-U	.0000E+00	.2840E+01	1.E-03	0.000E+00	0.000E+00	15
237-Np	.0000E+00	.1190E+02	1.E-03	0.000E+00	0.000E+00	16
238-Pu	.0000E+00	.8020E+01	1.E-03	0.000E+00	0.000E+00	17
239/240-Pu	.0000E+00	.8670E+01	1.E-03	0.000E+00	0.000E+00	18
241-Pu	.0000E+00	.1380E+00	1.E-03	0.000E+00	0.000E+00	19
241-Am	.0000E+00	.1310E+02	1.E-03	0.000E+00	0.000E+00	20
242/244-Cm	.0000E+00	.6940E+01	1.E-03	0.000E+00	0.000E+00	21
TOTAL				0.000E+00	1.000E+02	

3.5 STACK 296-A-19

3.5.1 SYSTEM DESCRIPTION / CONFIGURATION

The 296-A-19 stack serves the annulus exhaust system for tank 241-AY-102 in the 241-AY Tank Farm. The 241-AY-102 annulus exhaust provides for air flow in the annulus to minimize corrosion of the outer surface of the primary tank, to remove heat conducted through the tank wall, to provide for ventilation of the leak detection pits, and to provide emergency ventilation for the tank in the event of failure of primary and backup tank ventilation. The 241-AY Tank Farm is located in the 200 East area, northeast of the PUREX facility.

The 241-AY Tank Farm contains double-shell tanks. The 241-AY Tank Farm received waste from 1968 to 1970. There are a total of two 1 M gallon tanks in the 241-AY Tank Farm.

Makeup air is drawn in from the outside, heated and filtered through a pre-filter and a HEPA filter and then sent through distribution ducts to the top and bottom surfaces of the primary tank. Air slots on the bottom of each tank uniformly distribute the circulating air. Air is removed from the annulus space through a 16-inch diameter duct and through two series HEPA filter trains each containing four filters (2 x 4), a single blower system and is vented through the 296-A-19 stack.

3.5.2 CALCULATION OF SOURCE TERM

It is not expected that the primary containment vessel in the 241-A-102 Tank will leak. The design life of this vessel is a minimum of 50 years and the tank has undergone an integrity assessment. If a leak is found, the annulus source term would be re-evaluated at that time. Therefore, there is no radionuclide source term associated with this stack system.

3.5.3 CALCULATION OF POTENTIAL OFFSITE DOSE

3.5.3.1 Scenario: No loss of primary containment of the tank is expected. No HEPA filter factors are included in the calculations.

Potential offsite dose = 0 mrem/yr
3.5.4 TANK STATUS: NON-DESIGNATED

Stack. 296-A-19

241-AY-102 TANK ANNULUS SOURCE TERM EMISSIONS

R-nuclide	Sum of Ci	CAP-88 c-factor	APP D factor	EDE (mrem/yr)	% of Total EDE	
14-C	.0000E+00	.2620E-02	1.E-03	0.000E+00	0.000E+00	1
60-Co	.0000E+00	.2900E-01	1.E-03	0.000E+00	0.000E+00	2
79-Se	.0000E+00	.4380E-01	1.E-03	0.000E+00	0.000E+00	3
89/90-Sr	.0000E+00	.4380E-01	1.E-03	0.000E+00	0.000E+00	4
90-Y	.0000E+00	.3770E-03	1.E-03	0.000E+00	0.000E+00	5
99-Tc	.0000E+00	.1090E-02	1.E-03	0.000E+00	0.000E+00	6
106-Ru/Rh	.0000E+00	.2090E-01	1.E+00	0.000E+00	0.000E+00	7
125-Sb	.0000E+00	.4150E-02	1.E-03	0.000E+00	0.000E+00	8
129-I	.0000E+00	.2910E+00	1.E+00	0.000E+00	0.000E+00	9
134-Cs	.0000E+00	.3130E-01	1.E-03	0.000E+00	0.000E+00	10
137-Cs	.0000E+00	.2390E-01	1.E-03	0.000E+00	0.000E+00	11
144-Ce	.0000E+00	.1370E-01	1.E-03	0.000E+00	0.000E+00	12
147-Pm	.0000E+00	.1140E-02	1.E-03	0.000E+00	0.000E+00	13
154-Eu	.0000E+00	.4380E-01	1.E-03	0.000E+00	0.000E+00	14
Nat-U	.0000E+00	.2840E+01	1.E-03	0.000E+00	0.000E+00	15
237-Np	.0000E+00	.1190E+02	1.E-03	0.000E+00	0.000E+00	16
238-Pu	.0000E+00	.8020E+01	1.E-03	0.000E+00	0.000E+00	17
239/240-Pu	.0000E+00	.8670E+01	1.E-03	0.000E+00	0.000E+00	18
241-Pu	.0000E+00	.1380E+00	1.E-03	0.000E+00	0.000E+00	19
241-Am	.0000E+00	.1310E+02	1.E-03	0.000E+00	0.000E+00	20
242/244-Cm	.0000E+00	.6940E+01	1.E-03	0.000E-00	0.000E+00	21
TOTAL				0.000E-00	1.000E+02	

3.6 STACK 296-A-20

3.6.1 SYSTEM DESCRIPTION / CONFIGURATION

The 296-A-20 stack serves the annulus exhaust system for tanks 241-AZ-101 and 241-AZ-102 in the 241-AZ Tank Farm. The annulus exhaust system provides for air flow in the annuli to minimize corrosion of the outer surface of the primary tanks, remove heat conducted through the tank walls, and provide emergency ventilation for the tanks in the event of failure of primary and backup tank ventilation. The 241-AZ Tank Farm is located in the 200 East area, northeast of the PUREX facility.

The 241-AZ Tank Farm contains double-shell tanks. The 241-AZ Tank Farm received waste from 1971 to 1977. There are a total of two 1 M gallon tanks in the 241-AZ Tank Farm.

Makeup air is drawn in from the outside, heated and filtered through two HEPA filter banks and then sent through four separate distribution ducts to the top and bottom surfaces of each of the primary tanks. Air is removed from the annulus space through a 16-inch diameter duct and through separate HEPA filter banks, one for each tank.

3.6.2 CALCULATION OF SOURCE TERM

It is not expected that the primary containment vessels in the 241-AZ Tank Farm will leak. The design life of these vessels is a minimum of 50 years and the tanks have undergone an integrity assessment. If a leak is found, the annuli source term would be re-evaluated at that time. Therefore, there is no radionuclide source term associated with this stack system.

3.6.3 CALCULATION OF POTENTIAL OFFSITE DOSE

3.6.3.1 Scenario: No loss of primary containment of a tank is expected. No HEPA filter factors are included in the calculations.

Potential offsite dose = 0 mrem/yr

3.6.4 TANK STATUS: NON-DESIGNATED

Stack 296-A-20

241-AZ TANK FARM ANNULUS SOURCE TERM EMISSIONS

R-nuclide	Sum of Ci	CAP-88 c-factor	APP D factor	EDE (mrem/yr)	% of Total EDE	
14-C	.0000E+00	.2620E-02	1.E-03	0.000E+00	0.000E+00	1
60-Co	.0000E+00	.2900E-01	1.E-03	0.000E+00	0.000E+00	2
79-Se	.0000E+00	.4380E-01	1.E-03	0.000E+00	0.000E+00	3
89/90-Sr	.0000E+00	.4380E-01	1.E-03	0.000E+00	0.000E+00	4
90-Y	.0000E+00	.3770E-03	1.E-03	0.000E+00	0.000E+00	5
99-Tc	.0000E+00	.1090E-02	1.E-03	0.000E+00	0.000E+00	6
106-Ru/Rh	.0000E+00	.2090E-01	1.E+00	0.000E+00	0.000E+00	7
125-Sb	.0000E+00	.4150E-02	1.E-03	0.000E+00	0.000E+00	8
129-I	.0000E+00	.2910E+00	1.E+00	0.000E+00	0.000E+00	9
134-Cs	.0000E+00	.3130E-01	1.E-03	0.000E+00	0.000E+00	10
137-Cs	.0000E+00	.2390E-01	1.E-03	0.000E+00	0.000E+00	11
144-Ce	.0000E+00	.1370E-01	1.E-03	0.000E+00	0.000E+00	12
147-Pm	.0000E+00	.1140E-02	1.E-03	0.000E+00	0.000E+00	13
154-Eu	.0000E+00	.4380E-01	1.E-03	0.000E+00	0.000E+00	14
Nat-U	.0000E+00	.2840E+01	1.E-03	0.000E+00	0.000E+00	15
237-Np	.0000E+00	.1190E+02	1.E-03	0.000E+00	0.000E+00	16
238-Pu	.0000E+00	.8020E+01	1.E-03	0.000E+00	0.000E+00	17
239/240-Pu	.0000E+00	.8670E+01	1.E-03	0.000E+00	0.000E+00	18
241-Pu	.0000E+00	.1380E+00	1.E-03	0.000E+00	0.000E+00	19
241-Am	.0000E+00	.1310E+02	1.E-03	0.000E+00	0.000E+00	20
242/244-Cm	.0000E+00	.6940E+01	1.E-03	0.000E-00	0.000E+00	21
TOTAL				0.000E-00	1.000E+02	

3.7 STACK 296-A-21

3.7.1 SYSTEM DESCRIPTION / CONFIGURATION

The 296-A-21 stack system ventilates the 242-A Evaporator building, providing a negative pressure with respect to external areas for the containment of radioactive materials which may escape the primary evaporator vessel containment. The 242-A Evaporator is located to the east of the PUREX facility in the 200 East area.

The 242-A Evaporator is used to remove water from the non-boiling, high-level liquid waste primarily from adjacent tank farms, principally the 241-AW Tank Farm. With the water evaporated, concentrated waste is returned to double-shell tanks in the 200 East area.

The ventilation system for the 242-A Evaporator building provides containment for certain radiologically controlled areas within the facility. The inlet air passes through pre-heater, pre-filter, heater, water scrubber, and blower systems. The inlet air is then split into four air trains, passed through additional heaters and ventilates the evaporator room, pump room, condenser room, loadout/hot storage areas and loading dock areas. Exhaust air passes through two parallel systems consisting of pre-filter, two HEPA filters, and blower before being exhausted at the 296-A-21 stack.

3.7.2 CALCULATION OF SOURCE TERM

Radionuclide inventory is based on levels for "very high removable contamination" per WHC-CM-1-6 assuming worst case alpha (Am-241) and beta (Sr-90/Y-90) as representative nuclides. This level of contamination is assumed to be uniformly distributed over all ventilated surface areas.

NUCLIDE	TOTAL AREA (cm ²)	POSTULATED UNIT ACTIVITY (dpm /100 cm ²)	TOTAL ACTIVITY (Ci)
Am-241	2.11×10^7	2,000	1.89×10^{-4}
Sr-90	2.11×10^7	100,000	9.5×10^{-3}
Y-90	2.11×10^7	100,000	9.5×10^{-3}

3.7.3 CALCULATION OF POTENTIAL OFFSITE DOSE

3.7.3.1 Scenario: Postulated Am-241, Sr-90/Y-90 inventories are included in the calculation. No HEPA filter factors are included in the calculations.

$$\text{Potential offsite dose} = 2.9 \times 10^{-6} \text{ mrem/yr}$$

3.7.4 TANK STATUS: NON-DESIGNATED

Stack 296-A-21

242-A EVAPORATOR BUILDING SOURCE TERM EMISSIONS

R-nuclide	Sum of Ci	CAP-88 c-factor	APP D factor	EDE (mrem/yr)	% of Total EDE	
14-C	.0000E+00	.2620E-02	1.E-03	0.0000E+00	0.0000E+00	1
60-Co	.0000E+00	.2900E-01	1.E-03	0.0000E+00	0.0000E+00	2
79-Se	.0000E+00	.4380E-01	1.E-03	0.0000E+00	0.0000E+00	3
89/90-Sr	.9500E-02	.4380E-01	1.E-03	4.161E-07	1.437E+01	4
90-Y	.9500E-02	.3770E-03	1.E-03	3.581E-09	1.237E-01	5
99-Tc	.0000E+00	.1090E-02	1.E-03	0.0000E+00	0.0000E+00	6
106-Ru/Rh	.0000E+00	.2090E-01	1.E+00	0.0000E+00	0.0000E+00	7
125-Sb	.0000E+00	.4150E-02	1.E-03	0.0000E+00	0.0000E+00	8
129-I	.0000E+00	.2910E+00	1.E+00	0.0000E+00	0.0000E+00	9
134-Cs	.0000E+00	.3130E-01	1.E-03	0.0000E+00	0.0000E+00	10
137-Cs	.0000E+00	.2390E-01	1.E-03	0.0000E+00	0.0000E+00	11
143-Ce	.0000E+00	.1370E-01	1.E-03	0.0000E+00	0.0000E+00	12
147-Pm	.0000E+00	.1140E-02	1.E-03	0.0000E+00	0.0000E+00	13
154-Eu	.0000E+00	.4380E-01	1.E-03	0.0000E+00	0.0000E+00	14
Nat-U	.0000E+00	.2840E+01	1.E-03	0.0000E+00	0.0000E+00	15
237-Np	.0000E+00	.1190E+02	1.E-03	0.0000E+00	0.0000E+00	16
238-Pu	.0000E+00	.8020E+01	1.E-03	0.0000E+00	0.0000E+00	17
239/240-Pu	.0000E+00	.8670E+01	1.E-03	0.0000E+00	0.0000E+00	18
241-Pu	.0000E+00	.1380E+00	1.E-03	0.0000E+00	0.0000E+00	19
241-Am	.1890E-03	.1310E+02	1.E-03	2.476E-06	8.551E+01	20
242/244-Cm	.0000E+00	.6940E+01	1.E-03	0.0000E+00	0.0000E+00	21
TOTAL				2.896E-06	1.000E+02	

Inventory based on "High Contamination Area" definition in WHC-CM-1-6

3.8 STACK 296-A-22

3.8.1 SYSTEM DESCRIPTION / CONFIGURATION

The 296-A-22 stack system ventilates the 242-A Evaporator vessel and associated equipment, providing containment and moisture removal for the system. The 242-A Evaporator is located to the east of the PUREX facility in the 200 East area.

The 242-A Evaporator is used to remove water from the non-boiling, high-level liquid waste primarily from adjacent tank farms, principally the 241-AW Tank Farm. With the water evaporated, concentrated waste is returned to double-shell tanks in the 200 East area.

Vessels which are evacuated via the 296-A-22 stack include the 242-A vacuum condenser, process condensate tank, after-condenser drain, and condensate collection vessel. Inlet air is bled from the Evaporator building air system and is passed through a HEPA filtration system. Vapor extracted from these systems passes through a deentrainer system, a pre-filter/demister system, heater, and two HEPA filters before being exhausted through the 296-A-22 stack.

3.8.2 SOURCE TERM

RADIOISOTOPE	ACTIVITY LEVEL (Ci)*
C-14	3.500E+01
Co-60	1.272E+02
Se-79	1.050E+01
Sr-89/90	2.828E+04
Y-90	2.828E+04
Tc-99	2.700E+02
Ru/Rh-106	2.005E+03
Sb-125	0.000E+00
I-129	3.500E-01
Cs-134	1.104E+03
Cs-137	1.937E+05
Ce-144	0.000E-00
Pm-147	0.000E-00
Eu-154	1.090E+03

RADIOISOTOPE	ACTIVITY LEVEL (Ci)*
Nat-U	0.000E+00
Np-237	0.000E+00
Pu-238	1.800E-01
Pu-239/240	2.160E+01
Pu-241	1.833E+03
Am-241	1.343E+02
Cm-242/244	1.630E+00

* Activities from Facility Effluent Monitoring Plan for the 242-A Evaporator, WHC-EP-0466, 1992.

3.8.3 CALCULATION OF POTENTIAL OFFSITE DOSE

3.8.3.1 Scenario: Evaporator vessel inventory from WHC-EP-0466 are included in the calculations. No HEPA filter factors are included in the calculations.

Potential offsite dose = 50.2 mrem/yr

3.8.4 TANK STATUS: DESIGNATED

Stack 296-A-22

242-A EVAPORATOR SOURCE TERM EMISSIONS

R-nuclide	Sum of Ci*	CAP-88 c-factor	APP D factor	EDE (mrem/yr)	% of Total EDE	
14-C	.3500E+02	.2620E-02	1.E-03	9.170E-05	1.827E-04	1
60-Co	.1272E+03	.2900E-01	1.E-03	3.689E-03	7.349E-03	2
79-Se	.1050E+02	.4380E-01	1.E-03	4.599E-04	9.161E-04	3
89/90-Sr	.2828E+05	.4380E-01	1.E-03	1.239E+00	2.468E+00	4
90-Y	.2828E+05	.3770E-03	1.E-03	1.066E-02	2.124E-02	5
99-Tc	.2700E+03	.1090E-02	1.E-03	2.943E-04	5.836E-04	6
106-Ru/Rh	.2005E+04	.2090E-01	1.E+00	4.190E+01	8.347E+01	7
125-Sb	.0000E+00	.4150E-02	1.E-03	0.000E+00	0.000E+00	8
129-I	.3500E+00	.2910E+00	1.E+00	1.019E-01	2.012E-01	9
134-Cs	.1104E+04	.3130E-01	1.E-03	3.456E-02	6.884E-02	10
137-Cs	.1937E+06	.2390E-01	1.E-03	4.630E+00	9.223E+00	11
144-Cs	.0000E+00	.1370E-01	1.E-03	0.000E+00	0.000E+00	12
147-Pm	.0000E+00	.1140E-02	1.E-03	0.000E+00	0.000E+00	13
154-Eu	.1090E+04	.4380E-01	1.E-03	4.774E-02	9.510E-02	14
Nat-U	.0000E+00	.2840E+01	1.E-03	0.000E+00	0.000E+00	15
237-Np	.0000E+00	.1190E+02	1.E-03	0.000E+00	0.000E+00	16
238-Pu	.1800E+00	.8020E+01	1.E-03	1.444E-03	2.876E-03	17
239/240-Pu	.2160E+02	.8670E+01	1.E-03	1.873E-01	3.731E-01	18
241-Pu	.1833E+04	.1380E+00	1.E-03	2.530E-01	5.040E-01	19
241-Am	.1343E+03	.1310E+02	1.E-03	1.759E+00	3.504E+00	20
242/244-Cm	.1630E+01	.6940E+01	1.E-03	1.131E-02	2.253E-02	21
TOTAL				5.020E+01	1.000E+02	

* - Decay-corrected to 9/93

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3.9 STACK 296-A-25

3.9.1 SYSTEM DESCRIPTION / CONFIGURATION

The 296-A-25 stack system ventilates the 244-A Lift Station catch tank and annulus, providing negative pressure. The 244-A Lift Station is located west of the 241-AN tank farm in the 200 East area.

The 244-A Lift Station is a double-contained receiver tank (DCRT) used to pump liquid waste from 200 East and 200 West to the 200 East double-shell tanks. The 244-A Lift Station started operation in 1975. Potential waste streams which may pass through this DCRT include those from the 244-BX DCRT (BX, BY, B Tank Farms), from the 244-TX DCRT (PFP, T-Plant, TX, TY, and T Tank Farms), from the 244-S DCRT (222-S Lab, U-Plant, S and SX Tank Farms), from the 244-CR Vault (C Tank Farm), 241-AX and 241-A, and certain 242-A Evaporator feeds.

The catch tank is a stainless steel vessel with nominal volume of 19,000 gallons and limited to a maximum operating volume of 13,030 gallons. The catch tank and the concrete pit containing the tank define the annulus space. The catch tank and annulus are ventilated by the 296-A-25 system. Air used to ventilate the tank and annulus is drawn in through a pre-filter, a HEPA filter, and a heater. The air train is split into two trains, with the annulus receiving 80 percent of the airflow and the tank receiving 20 percent. Air which is withdrawn from the tank and annulus passes through a heater and parallel sets of two HEPA filters (2 x 2) before being exhausted through the 296-A-25 stack. The exhauster is operated only when the temperature of the waste is above a specific temperature and/or during the transfer of waste through the facility.

3.9.2 TANKS AND WASTE VOLUME

TANK	WASTE VOLUME (KGAL)	
	TANK TOTAL	PUMPABLE
241-A-101	953	390
241-AX-101	748	298
241-BY-102	341	22
241-BY-109	423	57
241-C-102	423	19
241-C-107	275	20
241-C-110	187	5
TOTAL	3,350	811

3.9.3 CALCULATION OF POTENTIAL OFFSITE DOSE

Refer to Section 2.4, Pages 7-9, for the definitions and examples of *static* and *dynamic* situations.

- 3.9.3.1 Scenario #1: Transfer of waste from Tanks A-101 and AX-101 through this DCRT. No HEPA filter factors are included in the calculations.

Potential offsite doses:

$$\begin{aligned} \text{Static: } & [(5.577 \text{ mrem/yr})(13.03 \text{ Kgal}/688 \text{ Kgal})] \\ & = 0.106 \text{ mrem/yr} \end{aligned}$$

$$\begin{aligned} \text{Dynamic: } & [(5.577 \text{ mrem/yr})(13.03 \text{ Kgal}/688 \text{ Kgal})] \\ & \times (688 \text{ Kgal}) / [(0.5\text{E-}3 \text{ Kgal/min})(60 \text{ min/hr}) \\ & \times (24 \text{ hr/d})(365 \text{ d/yr})] \\ & = 0.277 \text{ mrem over 2.6 years} \end{aligned}$$

- 3.9.3.2 Scenario #2: Transfer of waste from Tanks BY-102, BY-109, C-102, C-107, and C-110 through this DCRT. No HEPA filter factors are included in the calculations.

Potential offsite doses:

$$\begin{aligned} \text{Static: } & [(0.540 \text{ mrem/yr})(13.03 \text{ Kgal}/123 \text{ Kgal})] \\ & = 0.057 \text{ mrem/yr} \end{aligned}$$

$$\begin{aligned} \text{Dynamic: } & [(0.540 \text{ mrem/yr})(13.03 \text{ Kgal}/123 \text{ Kgal})] \\ & \times (123 \text{ Kgal}) / [(0.5\text{E-}3 \text{ Kgal/min})(60 \text{ min/hr}) \\ & \times (24 \text{ hr/d})(365 \text{ d/yr})] \\ & = 0.027 \text{ mrem over 171 days} \end{aligned}$$

- 3.9.4 TANK STATUS: NON-DESIGNATED⁽¹⁾

⁽¹⁾ This transfer system may be determined to be designated in the future depending on the waste that is sent through it. The earliest scheduled transfer for waste that would put the stack into a designated mode is from tanks A-101 and AX-101. This transfer is scheduled to be initiated in April 1996 and is represented by Scenario #1.

Stack 296-A-25 / Scenario #1

244-A DCRT SOURCE TERM EMISSIONS (A-101 / AX-101)

R-nuclide	Sum of Ci*	CAP-88 c-factor	APP D factor	EDE (mrem/yr)	% of Total EDE	
14-C	.3980E-01	.2620E-02	1.E-03	1.043E-07	1.870E-06	1
60-Co	.9840E+02	.2900E-01	1.E-03	2.854E-03	5.117E-02	2
79-Se	.7970E-10	.4380E-01	1.E-03	3.491E-15	6.260E-14	3
89/90-Sr	.1080E-05	.4380E-01	1.E-03	4.730E-11	8.483E-10	4
90-Y	.1080E-05	.3770E-03	1.E-03	4.072E-13	7.301E-12	5
99-Tc	.7970E-08	.1090E-02	1.E-03	8.687E-15	1.558E-13	6
106-Ru/Rh	.2580E+00	.2090E-01	1.E+00	5.392E-03	9.669E-02	7
125-Sb	.2210E+02	.4150E-02	1.E-03	9.172E-05	1.645E-03	8
129-I	.3980E-11	.2910E+00	1.E+00	1.158E-12	2.077E-11	9
134-Cs	.4870E+01	.3130E-01	1.E-03	1.524E-04	2.733E-03	10
137-Cs	.1660E+06	.2390E-01	1.E-03	3.967E+00	7.114E+01	11
144-Ce	.0000E+00	.1370E-01	1.E-03	0.000E+00	0.000E+00	12
147-Pm	.0000E+00	.1140E-02	1.E-03	0.000E+00	0.000E+00	13
154-Eu	.7740E+03	.4380E-01	1.E-03	3.390E-02	6.079E-01	14
Nat-U	.3980E+00	.2840E+01	1.E-03	1.130E-03	2.027E-02	15
237-Np	.2050E-04	.1190E+02	1.E-03	2.440E-07	4.375E-06	16
238-Pu	.7750E+01	.8020E+01	1.E-03	6.216E-02	1.115E+00	17
239/240-Pu	.1510E+03	.8670E+01	1.E-03	1.309E+00	2.348E+01	18
241-Pu	.3230E+03	.1380E+00	1.E-03	4.457E-02	7.993E-01	19
241-Am	.1180E+02	.1310E+02	1.E-03	1.546E-01	2.772E+00	20
242/244-Cm	.1720E-09	.6940E+01	1.E-03	1.194E-12	2.141E-11	21

TOTAL

5.577E+00 1.000E+02

* - Decay-corrected to 9/93

Static: $[(5.577 \text{ mrem/yr})(13.03 \text{ Kgal/688 Kgal})] = 0.106 \text{ mrem/yr}$

Dynamic: $[(5.577 \text{ mrem/yr})(13.03 \text{ Kgal/688 Kgal})]$
 $\times (688 \text{ Kgal}) / [(0.5E-3 \text{ Kgal/min})(60 \text{ min/hr})]$
 $\times (24 \text{ hr/day})(365 \text{ day/yr})]$
 $= 0.277 \text{ mrem over 2.6 years}$

Stack 296-A-25 / Scenario #2

244-A DCRT SOURCE TERM EMISSIONS - (C-102, 107, 110, BY-102, 109)

R-nuclide	Sum of Ci*	CAP-88 c-factor	APP D factor	EDE (mrem/yr)	% of Total EDE	
14-C	.0000E+00	.2620E-02	1.E-03	0.000E+00	0.000E+00	1
60-Co	.8030E+00	.2900E-01	1.E-03	2.329E-05	4.313E-03	2
79-Se	.0000E+00	.4380E-01	1.E-03	0.000E+00	0.000E+00	3
89/90-Sr	.4580E+02	.4380E-01	1.E-03	2.006E-03	3.715E-01	4
90-Y	.4580E+02	.3770E-03	1.E-03	1.727E-05	3.198E-03	5
99-Tc	.2860E+02	.1090E-02	1.E-03	3.117E-05	5.774E-03	6
106-Ru/Rh	.0000E+00	.2090E-01	1.E+00	0.000E+00	0.000E+00	7
125-Sb	.0000E+00	.4150E-02	1.E-03	0.000E+00	0.000E+00	8
129-I	.0000E+00	.2910E+00	1.E+00	0.000E+00	0.000E+00	9
134-Cs	.0000E+00	.3130E-01	1.E-03	0.000E+00	0.000E+00	10
137-Cs	.2090E+05	.2390E-01	1.E-03	4.995E-01	9.252E+01	11
143-Ce	.0000E+00	.1370E-01	1.E-03	0.000E+00	0.000E+00	12
147-Pm	.0000E+00	.1140E-02	1.E-03	0.000E+00	0.000E+00	13
154-Eu	.0000E+00	.4380E-01	1.E-03	0.000E+00	0.000E+00	14
Nat-U	.0000E+00	.2840E+01	1.E-Q3	0.000E+00	0.000E+00	15
237-Np	.0000E+00	.1190E+02	1.E-03	0.000E+00	0.000E+00	16
238-Pu	.0000E+00	.8020E+01	1.E-03	0.000E+00	0.000E+00	17
239/240-Pu	.4410E+01	.8670E+01	1.E-03	3.823E-02	7.082E+00	18
241-Pu	.0000E+00	.1380E+00	1.E-03	0.000E+00	0.000E+00	19
241-Am	.7080E-02	.1310E+02	1.E-03	9.275E-05	1.718E-02	20
242/244-Cm	.0000E+00	.6940E+01	1.E-03	0.000E+00	0.000E+00	21

TOTAL

5.399E-01 1.000E+02

* - Decay Corrected to 9/93

Static: $[(0.540 \text{ mrem/yr})(13.03 \text{ Kgal}/123 \text{ Kgal})] = 0.057 \text{ mrem/yr}$

Dynamic: $[(0.540 \text{ mrem/yr})(13.03 \text{ Kgal}/123 \text{ Kgal})]$
 $\times (123 \text{ Kgal})/[(0.5E-3 \text{ Kgal/min})(60 \text{ min/hr})]$
 $\times (24 \text{ hr/d})(365 \text{ d/yr})]$
 $= 0.027 \text{ mrem over 171 days}$

3.10 STACK 296-A-26

3.10.1 SYSTEM DESCRIPTION / CONFIGURATION

The 296-A-26 stack system ventilates the 204-AR Unloading Facility, providing negative pressure in the unloading area and soiled clothes area. The 204-AR Unloading Facility is located north of the PUREX Plant in the 200 East area.

The 204-AR Unloading Facility is designed to unload liquid radioactive materials from railroad tank cars and trucks in a radiologically controlled area. Railroad tracks enter the Facility from the west and extend to the length of the unloading area. The unloading area has dimensions of 25 feet high x 65 feet long x 40 feet wide. Radioactive liquid wastes are primarily non-complexed and phosphate wastes from T-Plant, 300 and 400 Area operations, from the 222-S lab, and from the N-Reactor.

The unloading area and adjacent soiled clothes area are vented through a single deentrainer, prefilter and two series HEPA filters, and a single blower system. Liquid waste is removed from railroad tank cars and trucks under negative pressure with a closed piping system, so isolation from areas ventilated by the 296-A-26 stack system is maintained.

3.10.2 CALCULATION OF SOURCE TERM

Radionuclide inventory is based on levels for "very high removable contamination" per WHC-CM-1-6 assuming worst case alpha (Am-241) and beta (Sr-90/Y-90) as representative nuclides. This level of contamination is assumed to be uniformly distributed over all ventilated surface areas.

NUCLIDE	TOTAL AREA (cm ²)	POSTULATED UNIT ACTIVITY (dpm/100 cm ²)	TOTAL ACTIVITY (Ci)
Am-241	1.1×10^7	2,000	1.0×10^{-4}
Sr-90	1.1×10^7	100,000	5.0×10^{-3}
Y-90	1.1×10^7	100,000	5.0×10^{-3}

3.10.3 CALCULATION OF POTENTIAL OFFSITE DOSE

3.10.3.1 Scenario: Postulated Am-241, Sr-90/Y-90 inventories are included in the calculation. No HEPA filter factors are included in the calculations.

$$\text{Potential offsite dose} = 1.5 \times 10^{-6} \text{ mrem/yr}$$

3.10.4 TANK STATUS: NON-DESIGNATED

Stack 296-A-26

204-AR UNLOADING FACILITY SOURCE TERM EMISSIONS

R-nuclide	Sum of Ci	CAP-88 c-factor	APP D factor	EDE (mrem/yr)	% of Total EDE	
14-C	.0000E+00	.2620E-02	1.E-03	0.000E+00	0.000E+00	1
60-Co	.0000E+00	.2900E-01	1.E-03	0.000E+00	0.000E+00	2
79-Se	.0000E+00	.4380E-01	1.E-03	0.000E+00	0.000E+00	3
89/90-Sr	.5000E-02	.4380E-01	1.E-03	2.190E-07	1.431E+01	4
90-Y	.5000E-02	.3770E-03	1.E-03	1.885E-09	1.231E-01	5
99-Tc	.0000E+00	.1090E-02	1.E-03	0.000E+00	0.000E+00	6
106-Ru/Rh	.0000E+00	.2090E-01	1.E+00	0.000E+00	0.000E+00	7
125-Sb	.0000E+00	.4150E-02	1.E-03	0.000E+00	0.000E+00	8
129-I	.0000E+00	.2910E+00	1.E+00	0.000E+00	0.000E+00	9
134-Cs	.0000E+00	.3130E-01	1.E-03	0.000E+00	0.000E+00	10
137-Cs	.0000E+00	.2390E-01	1.E-03	0.000E+00	0.000E+00	11
143-Ce	.0000E+00	.1370E-01	1.E-03	0.000E+00	0.000E+00	12
147-Pm	.0000E+00	.1140E-02	1.E-03	0.000E+00	0.000E+00	13
154-Eu	.0000E+00	.4380E-01	1.E-03	0.000E+00	0.000E+00	14
Nat-U	.0000E+00	.2840E+01	1.E-03	0.000E+00	0.000E+00	15
237-Np	.0000E+00	.1190E+02	1.E-03	0.000E+00	0.000E+00	16
238-Pu	.0000E+00	.8020E+01	1.E-03	0.000E+00	0.000E+00	17
239/240-Pu	.0000E+00	.8670E+01	1.E-03	0.000E+00	0.000E+00	18
241-Pu	.0000E+00	.1380E+00	1.E-03	0.000E+00	0.000E+00	19
241-Am	.1000E-03	.1310E+02	1.E-03	1.310E-06	8.557E+01	20
242/244-Cm	.0000E+00	.6940E+01	1.E-03	0.000E+00	0.000E+00	21
TOTAL				1.531E-06	1.000E+02	

Inventory based on "High Contamination Area" definition in WHC-CM-1-6

3.11 STACK 296-A-27

3.11.1 SYSTEM DESCRIPTION / CONFIGURATION

The 296-A-27 stack system ventilates the 241-AW Farm tanks, providing negative pressure and removal of heat and vapor from the primary containment vessels. The 241-AW Tank Farm is located northeast of the PUREX plant in the 200 East area.

Tanks in the 241-AW Tank Farm are double-shell tanks. The Tank Farm was first used to contain waste in 1978. There are a total of six tanks in the Tank Farm, each with a volume of 1.2 M gallons. The tanks received waste primarily from the PUREX waste stream.

The primary ventilation system consists of a deentrainer system for removal of moisture from vented air, an electric heater for lowering the relative humidity of the vented air, a pre-filter system for reducing the number of large particles which load the filter system, and a two-stage HEPA filter system. The primary exhaust system has an automatic switchover to a backup system in the event of failure of the primary system. Each 241-AW tank exhausted through independent 12-inch diameter steel pipelines running to the central exhaust station.

3.11.2 TANKS AND WASTE VOLUME

TANK	WASTE VOLUME (KGAL)	
	TANK TOTAL	PUMPABLE
241-AW-101	1,151	1,067
241-AW-102	876	875
241-AW-103	645	297
241-AW-104	1,124	861
241-AW-105	998	708
241-AW-106	1,074	798
TOTAL	5,868	4,606

3.11.3 CALCULATION OF POTENTIAL OFFSITE DOSE

3.11.3.1 Scenario: The radioactivity in the supernatant of the waste and in the slurry/sludge in tanks 241-AW-101 through 241-AW-106 is included in the calculation. No HEPA filter factors are included in the calculations.

Potential offsite dose = 148 mrem/yr

3.11.4 TANK STATUS: DESIGNATED

Stack 296-A-27

241-AW TANK FARM SOURCE TERM EMISSIONS

R-nuclide	Sum of Ci*	CAP-88 c-factor	APP D factor	EDE (mrem/yr)	% of Total EDE	
14-C	.1600E+01	.2620E-02	1.E-03	4.192E-06	2.833E-06	1
60-Co	.1600E+03	.2900E-01	1.E-03	4.640E-03	3.136E-03	2
79-Se	.0000E+00	.4380E-01	1.E-03	0.000E+00	0.000E+00	3
89/90-Sr	.1610E+06	.4380E-01	1.E-03	7.052E+00	4.765E+00	4
90-Y	.1610E+06	.3770E-03	1.E-03	6.070E-02	4.102E-02	5
99-Tc	.6110E+03	.1090E-02	1.E-03	6.660E-04	4.501E-04	6
106-Ru/Rh	.0000E+00	.2090E-01	1.E+00	0.000E+00	0.000E+00	7
125-Sb	.0000E+00	.4150E-02	1.E-03	0.000E+00	0.000E+00	8
129-I	.1220E+01	.2910E+00	1.E+00	3.550E-01	2.399E-01	9
134-Cs	.3040E+04	.3130E-01	1.E-03	9.515E-02	6.430E-02	10
137-Cs	.5190E+07	.2390E-01	1.E-03	1.240E+02	8.382E+01	11
144-Ce	.0000E+00	.1370E-01	1.E-03	0.000E+00	0.000E+00	12
147-Pm	.2560E+03	.1140E-02	1.E-03	2.918E-04	1.972E-04	13
154-Eu	.0000E+00	.4380E-01	1.E-03	0.000E+00	0.000E+00	14
Nat-U	.0000E+00	.2840E+01	1.E-03	0.000E+00	0.000E+00	15
237-Np	.1550E+02	.1190E+02	1.E-03	1.845E-01	1.246E-01	16
238-Pu	.1180E-03	.8020E+01	1.E-03	9.464E-07	6.395E-07	17
239/240-Pu	.3880E+02	.8670E+01	1.E-03	3.364E-01	2.273E-01	18
241-Pu	.0000E+00	.1380E+00	1.E-03	0.000E+00	0.000E+00	19
241-Am	.1210E+04	.1310E+02	1.E-03	1.585E+01	1.071E+01	20
242/244-Cm	.1330E-01	.6940E+01	1.E-03	9.230E-05	6.237E-05	21
TOTAL				1.480E+02	1.000E+02	

* - Decay-corrected to 9/93

3.12 STACK 296-A-28

3.12.1 SYSTEM DESCRIPTION / CONFIGURATION

The 296-A-28 stack system ventilates the annuli of the 241-AW Farm tanks, providing removal of heat from the outer surface of the primary tanks, and maintenance of a dry environment to minimize corrosion of the primary tank. The 241-AW Tank Farm is located northeast of the PUREX plant in the 200 East area.

Tanks in the 241-AW Tank Farm are double-shell tanks. The Tank Farm was first used to contain waste in 1978. There are a total of six tanks in the Tank Farm, each with a volume of 1.2 M gallons.

The 241-AW tank annuli ventilation system contains an intake stack with prefilter, HEPA filter and manually operated butterfly valve for adjusting inlet air distribution over primary tank surfaces; and exhaust system consisting of dual deentrainer, heater, HEPA filter and blower systems. The annulus exhaust system for each of the tanks consists of four 8-inch diameter risers which merge into one 12-inch diameter independent duct.

3.12.2 CALCULATION OF SOURCE TERM

It is not expected that the primary containment vessels in the 241-AW Tank Farm will leak. The design life of these vessels is a minimum of 50 years and the tanks have undergone an integrity assessment. If a leak is found, the annuli source term would be re-evaluated at that time. Therefore, there is no radionuclide source term associated with this stack system.

3.12.3 CALCULATION OF POTENTIAL OFFSITE DOSE

3.12.3.1 Scenario: No loss of primary containment of a tank is expected. No HEPA filter factors are included in the calculations.

Potential offsite dose = 0 mrem/yr

3.12.4 TANK STATUS: NON-DESIGNATED

Stack 296-A-28

241-AW TANK FARM ANNULUS SOURCE TERM EMISSIONS

R-nuclide	Sum of Ci	CAP-88 c-factor	APP D factor	EDE (mrem/yr)	% of Total EDE	
14-C	.0000E+00	.2620E-02	1.E-03	0.000E+00	0.000E+00	1
60-Co	.0000E+00	.2900E-01	1.E-03	0.000E+00	0.000E+00	2
79-Se	.0000E+00	.4380E-01	1.E-03	0.000E+00	0.000E+00	3
89/90-Sr	.0000E+00	.4380E-01	1.E-03	0.000E+00	0.000E+00	4
90-Y	.0000E+00	.3770E-03	1.E-03	0.000E+00	0.000E+00	5
99-Tc	.0000E+00	.1090E-02	1.E-03	0.000E+00	0.000E+00	6
106-Ru/Rh	.0000E+00	.2090E-01	1.E+00	0.000E+00	0.000E+00	7
125-Sb	.0000E+00	.4150E-02	1.E-03	0.000E+00	0.000E+00	8
129-I	.0000E+00	.2910E+00	1.E+00	0.000E+00	0.000E+00	9
134-Cs	.0000E+00	.3130E-01	1.E-03	0.000E+00	0.000E+00	10
137-Cs	.0000E+00	.2390E-01	1.E-03	0.000E+00	0.000E+00	11
144-Cs	.0000E+00	.1370E-01	1.E-03	0.000E+00	0.000E+00	12
147-Pm	.0000E+00	.1140E-02	1.E-03	0.000E+00	0.000E+00	13
154-Eu	.0000E+00	.4380E-01	1.E-03	0.000E+00	0.000E+00	14
Nat-U	.0000E+00	.2840E+01	1.E-03	0.000E+00	0.000E+00	15
237-Np	.0000E+00	.1190E+02	1.E-03	0.000E+00	0.000E+00	16
238-Pu	.0000E+00	.8020E+01	1.E-03	0.000E+00	0.000E+00	17
239/240-Pu	.0000E+00	.8670E+01	1.E-03	0.000E+00	0.000E+00	18
241-Pu	.0000E+00	.1380E+00	1.E-03	0.000E+00	0.000E+00	19
241-Am	.0000E+00	.1310E+02	1.E-03	0.000E+00	0.000E+00	20
242/244-Cm	.0000E+00	.6940E+01	1.E-03	0.000E-00	0.000E+00	21
		TOTAL		0.000E-00	1.000E+02	

3.13 STACK 296-A-29

3.13.1 SYSTEM DESCRIPTION / CONFIGURATION

The 296-A-29 stack system ventilates the 241-AN Farm tanks, providing negative pressure and removal of heat and vapor from the primary containment vessels. The 241-AN Tank Farm is located near the intersection of Canton Avenue and 7th Street in the 200 East area.

Tanks in the 241-AN Tank Farm are double-shell tanks with continuous monitoring and ventilation of primary tank and annuli. The Tank Farm was first used to contain waste in 1980. There are a total of seven tanks in the Tank Farm, each with a volume of 1.2 M gallons.

The primary ventilation system consists of a deentrainer system for removal of moisture from vented air, an electric heater for lowering the relative humidity of the vented air, a pre-filter system for reducing the number of large particles which load the filter system, and a two-stage HEPA filter system. The primary exhaust system has an automatic switchover to a backup system in the event of failure of the primary system. Each 241-AN tank exhausted through 12-inch diameter steel pipes which travel underground to the central exhaust station.

3.13.2 TANKS AND WASTE VOLUME

TANK	WASTE VOLUME (KGAL)	
	TANK TOTAL	PUMPABLE
241-AN-101	639	639
241-AN-102	1,101	1,012
241-AN-103	952	15
241-AN-104	1,065	804
241-AN-105	1,129	1,129
214-AN-106	23	6
241-AN-107	1,066	932
TOTAL	5,975	4,537

3.13.3 CALCULATION OF POTENTIAL OFFSITE DOSE

3.13.3.1 Scenario: The radioactivity in the supernatant of the waste and in the slurry/sludge in the AN Tank Farm is included in the calculation. No HEPA filter factors are included in the calculations.

Potential offsite dose = 846 mrem/yr

3.13.4 TANK STATUS: DESIGNATED

Stack 296-A-29

241-AN TANK FARM SOURCE TERM EMISSIONS

R-nuclide	Sum of Ci*	CAP-88 c-factor	APP D factor	EDE (mrem/yr)	% of Total EDE	
14-C	.1540E+02	.2620E-02	1.E-03	4.035E-05	4.768E-06	1
60-Co	.1280E+04	.2900E-01	1.E-03	3.712E-02	4.387E-03	2
79-Se	.0000E+00	.4380E-01	1.E-03	0.000E+00	0.000E+00	3
89/90-Sr	.9810E+06	.4380E-01	1.E-03	4.297E+01	5.078E+00	4
90-Y	.9810E+06	.3770E-03	1.E-03	3.698E-01	4.370E-02	5
99-Tc	.2090E+04	.1090E-02	1.E-03	2.278E-03	2.692E-04	6
106-Ru/Rh	.0000E+00	.2090E-01	1.E+00	0.000E+00	0.000E+00	7
125-Sb	.0000E+00	.4150E-02	1.E-03	0.000E+00	0.000E+00	8
129-I	.2650E+01	.2910E+00	1.E+00	7.712E-01	9.113E-02	9
134-Cs	.5040E+03	.3130E-01	1.E-03	1.578E-02	1.864E-03	10
137-Cs	.9410E+07	.2390E-01	1.E-03	2.249E+02	2.658E+01	11
144-Ce	.0000E+00	.1370E-01	1.E-03	0.000E+00	0.000E+00	12
147-Pm	.4300E+04	.1140E-02	1.E-03	4.902E-03	5.793E-04	13
154-Eu	.1310E+05	.4380E-01	1.E-03	5.738E-01	6.781E-02	14
Nat-U	.2590E+00	.2840E+01	1.E-03	7.356E-04	8.692E-05	15
237-Np	.8860E+00	.1190E+02	1.E-03	1.054E-02	1.246E-03	16
238-Pu	.3410E-01	.8020E+01	1.E-03	2.735E-04	3.232E-05	17
239/240-Pu	.7420E+03	.8670E+01	1.E-03	6.433E+00	7.602E-01	18
241-Pu	.2050E+04	.1380E+00	1.E-03	2.829E-01	3.343E-02	19
241-Am	.4350E+05	.1310E+02	1.E-03	5.699E+02	6.734E+01	20
242/244-Cm	.0000E+00	.6940E+01	1.E-03	0.000E+00	0.000E+00	21
TOTAL				8.462E+02	1.000E+02	

* - Decay-corrected to 9/93

3.14 STACK 296-A-30

3.14.1 SYSTEM DESCRIPTION / CONFIGURATION

The 296-A-30 stack system ventilates the annuli of the 241-AN Farm tanks, providing removal of heat from the outer surface of the primary tanks, and maintenance of a dry environment to minimize corrosion of the primary tank. The 241-AN Tank Farm is located near the intersection of Canton Avenue and 7th Street in the 200 East area.

Tanks in the 241-AN Tank Farm are double-shell tanks with continuous monitoring and ventilation of primary tank and annuli. The Tank Farm was first used to contain waste in 1980. There are a total of seven tanks in the Tank Farm, each with a volume of 1.2 M gallons. The tanks received waste primarily from single-shell tanks via Valve Pits 241-AN and from 242-A Evaporator via Valve Pits 241-AX.

The 241-AN tank annuli ventilation system contains an intake stack with prefilter, HEPA filter and manually operated butterfly valve for adjusting inlet air distribution over primary tank surfaces; and exhaust system consisting of parallel deentrainer, heater, HEPA filter and blower systems. The annulus exhaust system for each of the tanks consists of four 8-inch diameter risers. Tanks 241-AN-101, 241-AN-102, and 241-AN-103 exhaust risers are combined into one of the two parallel exhaust systems (DESIGNATED K2-1) while tanks 241-AN-104, 241-AN-105, 241-AN-106, and 241-AN-107 are combined into the second of the two parallel exhaust systems (DESIGNATED K2-2). These systems are each exhausted at the 296-A-30 stack.

3.14.2 CALCULATION OF SOURCE TERM

It is not expected that the primary containment vessels in the 241-AN Tank Farm will leak. The design life of these vessels is a minimum of 50 years and the tanks have undergone an integrity assessment. If a leak is found, the annuli source term would be re-evaluated at that time. Therefore, there is no radionuclide source term associated with this stack system.

3.14.3 CALCULATION OF POTENTIAL OFFSITE DOSE

3.14.3.1 Scenario: No loss of primary containment of a tank is expected. No HEPA filter factors are included in the calculations.

Potential offsite dose = 0 mrem/yr

3.14.4 TANK STATUS: NON-DESIGNATED

Stack 296-A-30

241-AN TANK FARM ANNULUS SOURCE TERM EMISSIONS

R-nuclide	Sum of Ci	CAP-88 c-factor	APP D factor	EDE (mrem/yr)	% of Total EDE	
14-C	.0000E+00	.2620E-02	1.E-03	0.000E+00	0.000E+00	1
60-Co	.0000E+00	.2900E-01	1.E-03	0.000E+00	0.000E+00	2
79-Se	.0000E+00	.4380E-01	1.E-03	0.000E+00	0.000E+00	3
89/90-Sr	.0000E+00	.4380E-01	1.E-03	0.000E+00	0.000E+00	4
90-Y	.0000E+00	.3770E-03	1.E-03	0.000E+00	0.000E+00	5
99-Tc	.0000E+00	.1090E-02	1.E-03	0.000E+00	0.000E+00	6
106-Ru/Rh	.0000E+00	.2090E-01	1.E+00	0.000E+00	0.000E+00	7
125-Sb	.0000E+00	.4150E-02	1.E-03	0.000E+00	0.000E+00	8
129-I	.0000E+00	.2910E+00	1.E+00	0.000E+00	0.000E+00	9
134-Cs	.0000E+00	.3130E-01	1.E-03	0.000E+00	0.000E+00	10
137-Cs	.0000E+00	.2390E-01	1.E-03	0.000E+00	0.000E+00	11
144-Ce	.0000E+00	.1370E-01	1.E-03	0.000E+00	0.000E+00	12
147-Pm	.0000E+00	.1140E-02	1.E-03	0.000E+00	0.000E+00	13
154-Eu	.0000E+00	.4380E-01	1.E-03	0.000E+00	0.000E+00	14
Nat-U	.0000E+00	.2840E+01	1.E-03	0.000E+00	0.000E+00	15
237-Np	.0000E+00	.1190E+02	1.E-03	0.000E+00	0.000E+00	16
238-Pu	.0000E+00	.8020E+01	1.E-03	0.000E+00	0.000E+00	17
239/240-Pu	.0000E+00	.8670E+01	1.E-03	0.000E+00	0.000E+00	18
241-Pu	.0000E+00	.1380E+00	1.E-03	0.000E+00	0.000E+00	19
241-Am	.0000E+00	.1310E+02	1.E-03	0.000E+00	0.000E+00	20
242/244-Cm	.0000E+00	.6940E+01	1.E-03	0.000E-00	0.000E+00	21
TOTAL				0.000E-00	1.000E+02	

3.15 STACK 296-A-40

3.15.1 SYSTEM DESCRIPTION / CONFIGURATION

The 296-A-40 stack system ventilates the 241-AP Tank Farm tanks, providing negative pressure and removal of heat and vapor from the primary containment vessels. The 241-AP Tank Farm is located northeast of the PUREX Plant.

Tanks in the 241-AP Tank Farm are double-shell tanks. The Tank Farm was first used to contain waste in 1983. The tanks received waste from single-shell tanks, from the PUREX wastestream and the 242-A Evaporator via Valve Pits 241-A. There are a total of eight tanks in the Tank Farm, each with a volume of 1.2 M gallons.

The primary ventilation system consists of a deentrainer system for removal of moisture from vented air, an electric heater for lowering the relative humidity of the vented air, a pre-filter system for reducing the number of large particles which load the filter system, and a two-stage HEPA filter system. The primary exhaust system has an automatic switchover to a backup system in the event of failure of the primary system.

Each 241-AP tank is exhausted through 12-inch diameter steel pipes which combine into a common 12-inch diameter duct. This duct passes underground to the central exhaust station and feeds parallel blower systems with deentrainer, heater, prefilter, HEPA filter assemblies.

3.15.2 TANKS AND WASTE VOLUME

TANK	WASTE VOLUME (KGAL)	
	TANK TOTAL	PUMPABLE
241-AP-101	1,061	1,061
241-AP-102	1,107	1,107
241-AP-103	1,132	1,132
241-AP-104	19	19
241-AP-105	821	821
241-AP-106	1,129	1,129
241-AP-107	1,115	1,115
241-AP-108	901	901
TOTAL	7,825	7,825

3.15.3 CALCULATION OF POTENTIAL OFFSITE DOSE

3.15.3.1 Scenario: The radioactivity in the waste in the AP Tank Farm is included in the calculations. No HEPA filter factors are included in the calculation.

Potential offsite dose = 0.21 mrem/yr
3.15.4 TANK STATUS: DESIGNATED

Stack 296-A-40

AP TANK FARM SOURCE TERM EMISSIONS

R-nuclide	Sum of Ci*	CAP-88 c-factor	APP D factor	EDE (mrem/yr)	% of Total EDE	
14-C	.9450E-04	.2620E-02	1.E-03	2.476E-10	3.132E-07	1
60-Co	.1320E+02	.2900E-01	1.E-03	3.828E-04	4.842E-01	2
79-Se	.0000E+00	.4380E-01	1.E-03	0.000E+00	0.000E+00	3
89/90-Sr	.2340E+02	.4380E-01	1.E-03	1.025E-03	1.296E+00	4
90-Y	.2340E+02	.3770E-03	1.E-03	8.822E-06	1.116E-02	5
99-Tc	.4050E-02	.1090E-02	1.E-03	4.415E-09	5.583E-06	6
106-Ru/Rh	.0000E+00	.2090E-01	1.E+00	0.000E+00	0.000E+00	7
125-Sb	.0000E+00	.4150E-02	1.E-03	0.000E+00	0.000E+00	8
129-I	.2700E-02	.2910E+00	1.E+00	7.857E-04	9.938E-01	9
134-Cs	.3120E-02	.3130E-01	1.E-03	9.766E-08	1.235E-04	10
137-Cs	.1520E+02	.2390E-01	1.E-03	3.633E-04	4.595E-01	11
144-Ce	.1410E-01	.1370E-01	1.E-03	1.932E-07	2.443E-04	12
147-Pm	.0000E+00	.1140E-02	1.E-03	0.000E+00	0.000E+00	13
154-Eu	.0000E+00	.4380E-01	1.E-03	0.000E+00	0.000E+00	14
Nat-U	.6490E-04	.2840E+01	1.E-03	1.843E-07	2.331E-04	15
237-Np	.7570E-01	.1190E+02	1.E-03	9.008E-04	1.139E+00	16
238-Pu	.0000E+00	.8020E+01	1.E-03	0.000E+00	0.000E+00	17
239/240-Pu	.7050E-01	.8670E+01	1.E-03	6.112E-04	7.731E-01	18
241-Pu	.0000E+00	.1380E+00	1.E-03	0.000E+00	0.000E+00	19
241-Am	.5660E+01	.1310E+02	1.E-03	7.415E-02	9.378E+01	20
242/244-Cm	.1210E+00	.6940E+01	1.E-03	8.397E-04	1.062E+00	21
TOTAL				7.906E-02**	1.000E+02	

* Decay-corrected to 9/93

** Radiological inventory data were available for only 3 of the 8 tanks that make up AP Tank Farm; therefore, the calculated potential offsite dose based on 3 tanks must be adjusted.

$$(8/3)(7.91E-2 \text{ mrem/yr}) = 0.21 \text{ mrem/yr}$$

This analysis is sufficient to determine that the stack is DESIGNATED.

3.16 STACK 296-A-41

3.16.1 SYSTEM DESCRIPTION / CONFIGURATION

The 296-A-41 stack system ventilates the annuli of the 241-AP Tank Farm tanks, providing removal of heat from the outer surface of the primary tanks, and maintenance of a dry environment to minimize corrosion of the primary tank. The 241-AP Tank Farm is located northeast of the PUREX Plant.

Tanks in the 241-AP Tank Farm are double-shell tanks. The Tank Farm was first used to contain waste in 1983. The tanks received waste from single-shell tanks, from the PUREX wastestream and the 242-A Evaporator via Valve Pits 241-A. There are a total of eight tanks in the Tank Farm, each with a volume of 1.2 M gallons.

The 241-AP tank annuli ventilation system contains four independent air intake stations with heaters, pre-filters and HEPA filter systems. Each of the stations feeds two of the AP tanks. The exhaust portion of the ventilation system consists of one 8-inch diameter riser for each tank. Four of the risers are combined into a common 12-inch diameter duct in two valve pit systems. These two 12-inch diameter ducts are combined into a common 24-inch diameter duct which feeds parallel heater, HEPA filter assemblies in series, and blower systems.

3.16.2 CALCULATION OF SOURCE TERM

It is not expected that the primary containment vessels in the 241-AP Tank Farm will leak. The design life of these vessels is a minimum of 50 years and the tanks have undergone an integrity assessment. If a leak is found, the annuli source term would be re-evaluated at that time. Therefore, there is no radionuclide source term associated with this stack system.

3.16.3 CALCULATION OF POTENTIAL OFFSITE DOSE

3.16.3.1 Scenario: No loss of primary containment of a tank is expected. No HEPA filter factors are included in the calculations.

Potential offsite dose = 0 mrem/yr

3.16.4 TANK STATUS: NON-DESIGNATED

Stack 296-A-41

241-AP TANK FARM ANNULUS SOURCE TERM EMISSIONS

R-nuclide	Sum of Ci	CAP-88 c-factor	APP D factor	EDE (mrem/yr)	% of Total EDE	
14-C	.0000E+00	.2620E-02	1.E-03	0.000E+00	0.000E+00	1
60-Co	.0000E+00	.2900E-01	1.E-03	0.000E+00	0.000E+00	2
79-Se	.0000E+00	.4380E-01	1.E-03	0.000E+00	0.000E+00	3
89/90-Sr	.0000E+00	.4380E-01	1.E-03	0.000E+00	0.000E+00	4
90-Y	.0000E+00	.3770E-03	1.E-03	0.000E+00	0.000E+00	5
99-Tc	.0000E+00	.1090E-02	1.E-03	0.000E+00	0.000E+00	6
106-Ru/Rh	.0000E+00	.2090E-01	1.E+00	0.000E+00	0.000E+00	7
125-Sb	.0000E+00	.4150E-02	1.E-03	0.000E+00	0.000E+00	8
129-I	.0000E+00	.2910E+00	1.E+00	0.000E+00	0.000E+00	9
134-Cs	.0000E+00	.3130E-01	1.E-03	0.000E+00	0.000E+00	10
137-Cs	.0000E+00	.2390E-01	1.E-03	0.000E+00	0.000E+00	11
144-Ce	.0000E+00	.1370E-01	1.E-03	0.000E+00	0.000E+00	12
147-Pm	.0000E+00	.1140E-02	1.E-03	0.000E+00	0.000E+00	13
154-Eu	.0000E+00	.4380E-01	1.E-03	0.000E+00	0.000E+00	14
Nat-U	.0000E+00	.2840E+01	1.E-03	0.000E+00	0.000E+00	15
237-Np	.0000E+00	.1190E+02	1.E-03	0.000E+00	0.000E+00	16
238-Pu	.0000E+00	.8020E+01	1.E-03	0.000E+00	0.000E+00	17
239/240-Pu	.0000E+00	.8670E+01	1.E-03	0.000E+00	0.000E+00	18
241-Pu	.0000E+00	.1380E+00	1.E-03	0.000E+00	0.000E+00	19
241-Am	.0000E+00	.1310E+02	1.E-03	0.000E+00	0.000E+00	20
242/244-Cm	.0000E+00	.6940E+01	1.E-03	0.000E+00	0.000E+00	21
TOTAL				0.000E+00	1.000E+02	

3.17 STACK 296-B-28

3.17.1 SYSTEM DESCRIPTION / CONFIGURATION

The 296-B-28 stack system ventilates the 244-BX Catch Station tank and annulus, providing negative pressure. The 244-BX Catch Station is located east of the 241-BX Tank Farm in the 200 East Area.

The 244-BX Catch Station is a double-contained receiver tank (DCRT) used to pump salt-well waste from single-shell tanks in the 241-B, 241-BX and 241-BY Tank Farms to double-shell tank farms in the 200 East area.

The catch tank is a stainless steel vessel with maximum volume of 31,000 gallons which is limited to an operational capacity of 26,000 gallons. The pit containing the catch tank, with a gross volume of 85,000 gallons, constitutes secondary containment for the Station. The catch tank and the concrete pit containing the tank define the annulus space. The ventilation system draws in air through a heater, pre-filter and HEPA filter. This air train is split into two trains which ventilate the catch tank and annulus. Air withdrawn from these two volumes passes through one of three parallel systems, each containing a pre-filter and two HEPA filters. Air is exhausted through the 296-B-28 stack. The exhauster is operated only when the temperature of the waste is above a specific temperature and/or during any transfer of waste through the facility.

3.17.2 TANKS AND WASTE VOLUME

TANK	WASTE VOLUME (KGAL)	
	TANK TOTAL	PUMPABLE
241-B-104	371	40
241-B-107	165	7
241-B-110	246	17
241-B-111	237	16
241-BX-106	46	15
241-BX-110	199	10
241-BX-111	23	46
241-BY-102	341	22
241-BY-103	400	137
241-BY-105	503	169
241-BY-106	542	213
241-BY-109	423	57
TOTAL	3,396	749

3.17.3 CALCULATION OF POTENTIAL OFFSITE DOSE

Refer to Section 2.4, Pages 7-9, for the definitions and examples of *static* and *dynamic* situations.

- 3.17.3.1 Scenario #1: Transfer of waste from tanks BY-102 and 109 through this DCRT. No HEPA filter factors are included in the calculations.

Potential offsite doses:

$$\begin{aligned} \text{Static: } & [(4.89\text{E-}01 \text{ mrem/yr})(26.0 \text{ Kgal}/79 \text{ Kgal})] \\ & = 0.16 \text{ mrem/yr} \end{aligned}$$

$$\begin{aligned} \text{Dynamic: } & [(4.89\text{E-}01 \text{ mrem/yr})(26.0 \text{ Kgal}/79 \text{ Kgal})] \\ & \times (79 \text{ Kgal}) / [(0.5\text{E-}03 \text{ Kgal/min})(60 \text{ min/hr}) \\ & \times (24 \text{ min/d})(365 \text{ d/yr})] \\ & = 4.8\text{E-}02 \text{ mrem over 108 days} \end{aligned}$$

- 3.17.3.2 Scenario #2: Transfer of waste from tanks BX-106 and BY-103, 105, 106 through this DCRT. No HEPA filter factors are included in the calculations.

Potential offsite doses:

$$\begin{aligned} \text{Static: } & [(4.851 \text{ mrem/yr})(26.0 \text{ Kgal}/534 \text{ Kgal})] \\ & = 0.24 \text{ mrem/yr} \end{aligned}$$

$$\begin{aligned} \text{Dynamic: } & [(4.851 \text{ mrem/yr})(26.0 \text{ Kgal}/534 \text{ Kgal})] \\ & \times (534 \text{ Kgal}) / [(0.5\text{E-}03 \text{ Kgal/min})(60 \text{ min/hr}) \\ & \times (24 \text{ hr/d})(365 \text{ d/yr})] \\ & = 0.48 \text{ mrem over 2.03 years} \end{aligned}$$

- 3.17.3.3 Scenario #3: Transfer of waste from tanks B-104, 107, 110, and 111 through this DCRT. No HEPA filter factors are included in the calculations.

Potential offsite doses:

$$\begin{aligned} \text{Static: } & [(2.59 \text{ mrem/yr})(26.0 \text{ Kgal}/80 \text{ Kgal})] \\ & = 0.84 \text{ mrem/yr} \end{aligned}$$

$$\begin{aligned} \text{Dynamic: } & [(2.59 \text{ mrem/yr})(26.0 \text{ Kgal}/80 \text{ Kgal})] \\ & \times (80 \text{ Kgal}) / [(0.5\text{E-}3 \text{ Kgal/min})(60 \text{ min/hr}) \\ & \times (24 \text{ hr/d})(365 \text{ d/yr})] \\ & = 0.26 \text{ mrem over 111 days} \end{aligned}$$

- 3.17.3.4 Scenario #4: Transfer of waste from tanks BX-110 and 111 through this DCRT. No HEPA filter factors are included in the calculations.

Potential offsite doses:

Static: $[(8.39\text{E-}02 \text{ mrem/yr})(26.0 \text{ Kgal/56 Kgal})]$
= $3.90\text{E-}02 \text{ mrem/yr}$

Dynamic: $[(8.39\text{E-}02 \text{ mrem/yr})(26.0 \text{ Kgal/56 Kgal})]$
 $\times (56 \text{ Kgal}) / [(0.5\text{E-}3 \text{ Kgal/min})(60 \text{ min/hr})]$
 $\times (24 \text{ hr/d})(365 \text{ d/yr})]$
= $8.30\text{E-}03 \text{ mrem over 78 days}$

3.17.4 TANK STATUS: NON-DESIGNATED ⁽¹⁾

- ⁽¹⁾ This transfer system may be determined to be designated in the future depending on when and which waste is scheduled to be sent through it. The earliest scheduled transfer for waste that would put the stack into a designated mode is from tanks BY-102 and 109. This transfer is scheduled to be initiated in April 1994 and is represented by Scenario #1.

Stack 296-B-28 / Scenario #1

244-BX DCRT SOURCE TERM EMISSIONS - (BY-102, 109)

R-nuclide	Sum of Ci*	CAP-88 c-factor	APP D factor	EDE (mrem/yr)	% of Total EDE	
14-C	.0000E+00	.2620E-02	1.E-03	0.000E+00	0.000E+00	1
60-Co	.0000E+00	.2900E-01	1.E-03	0.000E+00	0.000E+00	2
79-Se	.0000E+00	.4380E-01	1.E-03	0.000E+00	0.000E+00	3
89/90-Sr	.3090E+02	.4380E-01	1.E-03	1.353E-03	2.768E-01	4
90-Y	.3090E+02	.3770E-03	1.E-03	1.165E-05	2.382E-03	5
99-Tc	.2760E+02	.1090E-02	1.E-03	3.008E-05	6.153E-03	6
106-Ru/Rh	.0000E+00	.2090E-01	1.E+00	0.000E+00	0.000E+00	7
125-Sb	.0000E+00	.4150E-02	1.E-03	0.000E+00	0.000E+00	8
129-I	.0000E+00	.2910E+00	1.E+00	0.000E+00	0.000E+00	9
134-Cs	.0000E+00	.3130E-01	1.E-03	0.000E+00	0.000E+00	10
137-Cs	.2040E+05	.2390E-01	1.E-03	4.876E-01	9.971E+01	11
144-Ce	.0000E+00	.1370E-01	1.E-03	0.000E+00	0.000E+00	12
147-Pm	.0000E+00	.1140E-02	1.E-03	0.000E+00	0.000E+00	13
154-Eu	.0000E+00	.4380E-01	1.E-03	0.000E+00	0.000E+00	14
Nat-U	.0000E+00	.2840E+01	1.E-03	0.000E+00	0.000E+00	15
237-Np	.0000E+00	.1190E+02	1.E-03	0.000E+00	0.000E+00	16
238-Pu	.0000E+00	.8020E+01	1.E-03	0.000E+00	0.000E+00	17
239/240-Pu	.0000E+00	.8670E+01	1.E-03	0.000E+00	0.000E+00	18
241-Pu	.0000E+00	.1380E+00	1.E-03	0.000E+00	0.000E+00	19
241-Am	.0000E+00	.1310E+02	1.E-03	0.000E+00	0.000E+00	20
242/244-Cm	.0000E+00	.6940E+01	1.E-03	0.000E+00	0.000E+00	21

TOTAL

4.890E-01 1.000E+02

* - Decay-corrected to 9/93

Static: [(4.89E-01 mrem/yr)(26.0 Kgal/79 Kgal)] = 0.16 mrem/yr

Dynamic: [(4.89E-01 mrem/yr)(26.0 Kgal/79 Kgal)]
 x (79 Kgal) / [(0.5E-03 Kgal/min)(60 min/hr)
 x (24 hr/d)(365 d/yr)]
 = 4.8E-02 mrem over 108 days

Stack 296-B-28 / Scenario #2

244-BX DCRT SOURCE TERM EMISSIONS - (BX-106 / BY-103, 105, 106)

R-nuclide	Sum of Ci*	CAP-88 c-factor	APP D factor	EDE (mrem/yr)	% of Total EDE	
14-C	.0000E+00	.2620E-02	1.E-03	0.000E+00	0.000E+00	1
60-Co	.0000E+00	.2900E-01	1.E-03	0.000E+00	0.000E+00	2
79-Se	.0000E+00	.4380E-01	1.E-03	0.000E+00	0.000E+00	3
89/90-Sr	.1130E+03	.4380E-01	1.E-03	4.949E-03	1.020E-01	4
90-Y	.1130E+03	.3770E-03	1.E-03	4.260E-05	8.783E-04	5
99-Tc	.5630E+02	.1090E-02	1.E-03	6.137E-05	1.265E-03	6
106-Ru/Rh	.0000E+00	.2090E-01	1.E+00	0.000E+00	0.000E+00	7
125-Sb	.0000E+00	.4150E-02	1.E-03	0.000E+00	0.000E+00	8
129-I	.0000E+00	.2910E+00	1.E+00	0.000E+00	0.000E+00	9
134-Cs	.0000E+00	.3130E-01	1.E-03	0.000E+00	0.000E+00	10
137-Cs	.1430E+06	.2390E-01	1.E-03	3.418E+00	7.046E+01	11
144-Ce	.0000E+00	.1370E-01	1.E-03	0.000E+00	0.000E+00	12
147-Pm	.0000E+00	.1140E-02	1.E-03	0.000E+00	0.000E+00	13
154-Eu	.0000E+00	.4380E-01	1.E-03	0.000E+00	0.000E+00	14
Nat-U	.9700E-04	.2840E+01	1.E-03	2.755E-07	5.679E-06	15
237-Np	.0000E+00	.1190E+02	1.E-03	0.000E+00	0.000E+00	16
238-Pu	.0000E+00	.8020E+01	1.E-03	0.000E+00	0.000E+00	17
239/240-Pu	.1680E-04	.8670E+01	1.E-03	1.457E-07	3.003E-06	18
241-Pu	.0000E+00	.1380E+00	1.E-03	0.000E+00	0.000E+00	19
241-Am	.1090E+03	.1310E+02	1.E-03	1.428E+00	2.944E+01	20
242/244-Cm	.0000E+00	.6940E+01	1.E-03	0.000E+00	0.000E+00	21

TOTAL

4.851E+00 1.000E+02

* - Decay-corrected to 9/93

Static: [(4.851 mrem/yr)(26.0 Kgal/534 Kgal)] = 0.24 mrem/yr

Dynamic: [(4.851 mrem/yr)(26.0 Kgal/534 Kgal)]
 x (534 Kgal)/(0.5E-03 Kgal/min)(60 min/hr)
 x (24 hr/d)(365 d/yr)]
 = 0.48 mrem over 2.03 years

Stack 296-B-28 / Scenario #3

244-BX DCRT SOURCE TERM EMISSIONS - (B-104, 107, 110, 111)

R-nuclide	Sum of Ci*	CAP-88 c-factor	APP D factor	EDE (mrem/yr)	% of Total EDE	
14-C	.1490E+03	.2620E-02	1.E-03	3.904E-04	1.505E-02	1
60-Co	.0000E+00	.2900E-01	1.E-03	0.000E+00	0.000E+00	2
79-Se	.6590E+01	.4380E-01	1.E-03	2.886E-04	1.113E-02	3
89/90-Sr	.5320E+04	.4380E-01	1.E-03	2.330E-01	8.983E+00	4
90-Y	.5320E+04	.3770E-03	1.E-03	2.006E-03	7.732E-02	5
99-Tc	.2220E+03	.1090E-02	1.E-03	2.420E-04	9.329E-03	6
106-Ru/Rh	.6060E-02	.2090E-01	1.E+00	1.267E-05	4.883E-04	7
125-Sb	.3110E+01	.4150E-02	1.E-03	1.291E-05	4.976E-04	8
129-I	.3810E+00	.2910E+00	1.E+00	1.109E-01	4.274E+00	9
134-Cs	.0000E+00	.3130E-01	1.E-03	0.000E+00	0.000E+00	10
137-Cs	.4080E+05	.2390E-01	1.E-03	9.751E-01	3.759E+01	11
144-Ce	.1490E-04	.1370E-01	1.E-03	2.041E-10	7.869E-09	12
147-Pm	.0000E+00	.1140E-02	1.E-03	0.000E+00	0.000E+00	13
154-Eu	.4140E+02	.4380E-01	1.E-03	1.813E-03	6.990E-02	14
Nat-U	.5810E+00	.2840E+01	1.E-03	1.650E-03	6.361E-02	15
237-Np	.6780E+00	.1190E+02	1.E-03	8.068E-03	3.110E-01	16
238-Pu	.7260E+00	.8020E+01	1.E-03	5.823E-03	2.245E-01	17
239/240-Pu	.3170E+02	.8670E+01	1.E-03	2.748E-01	1.060E+01	18
241-Pu	.4260E+02	.1380E+00	1.E-03	5.879E-03	2.266E-01	19
241-Am	.7400E+02	.1310E+02	1.E-03	9.694E-01	3.737E+01	20
242/244-Cm	.6560E+00	.6940E+01	1.E-03	4.553E-03	1.755E-01	21
TOTAL				2.594E+00	1.000E+02	

* - Decay-corrected to 9/93

Static: $[(2.59 \text{ mrem/yr})(26.0 \text{ Kgal}/80 \text{ Kgal})] = 0.84 \text{ mrem/yr}$

Dynamic: $[(2.59 \text{ mrem/yr})(26.0 \text{ Kgal}/80 \text{ Kgal})]$
 $\times (80 \text{ Kgal})/[(0.5 \text{ Kgal/min})(60 \text{ min/hr})]$
 $\times (24 \text{ hr/d})(365 \text{ d/yr})]$
 $= 0.26 \text{ mrem over 111 days}$

Stack 296-B-28 / Scenario #4

244-BX DCRT SOURCE TERM EMISSIONS - (BX-110, 111)

R-nuclide	Sum of Ci*	CAP-88 c-factor	APP D factor	EDE (mrem/yr)	% of Total EDE	
14-C	.0000E+00	.2620E-02	1.E-03	0.000E+00	0.000E+00	1
60-Co	.0000E+00	.2900E-01	1.E-03	0.000E+00	0.000E+00	2
79-Se	.0000E+00	.4380E-01	1.E-03	0.000E+00	0.000E+00	3
89/90-Sr	.2650E+00	.4380E-01	1.E-03	1.161E-05	1.383E-02	4
90-Y	.2650E+00	.3770E-03	1.E-03	9.990E-08	1.190E-04	5
99-Tc	.0000E+00	.1090E-02	1.E-03	0.000E+00	0.000E+00	6
106-Ru/Rh	.0000E+00	.2090E-01	1.E+00	0.000E+00	0.000E+00	7
125-Sb	.0000E+00	.4150E-02	1.E-03	0.000E+00	0.000E+00	8
129-I	.0000E+00	.2910E+00	1.E+00	0.000E+00	0.000E+00	9
134-Cs	.0000E+00	.3130E-01	1.E-03	0.000E+00	0.000E+00	10
137-Cs	.3510E+04	.2390E-01	1.E-03	8.389E-02	9.994E+01	11
144-Ce	.0000E+00	.1370E-01	1.E-03	0.000E+00	0.000E+00	12
147-Pm	.0000E+00	.1140E-02	1.E-03	0.000E+00	0.000E+00	13
154-Eu	.0000E+00	.4380E-01	1.E-03	0.000E+00	0.000E+00	14
Nat-U	.8660E-03	.2840E+01	1.E-03	2.459E-06	2.930E-03	15
237-Np	.0000E+00	.1190E+02	1.E-03	0.000E+00	0.000E+00	16
238-Pu	.0000E+00	.3020E+01	1.E-03	0.000E+00	0.000E+00	17
239/240-Pu	.1270E-02	.8670E+01	1.E-03	1.101E-05	1.312E-02	18
241-Pu	.0000E+00	.1380E+00	1.E-03	0.000E+00	0.000E+00	19
241-Am	.2100E-02	.1310E+02	1.E-03	2.751E-05	3.277E-02	20
242/244-Cm	.0000E+00	.6940E+01	1.E-03	0.000E+00	0.000E+00	21
TOTAL				8.394E-02	1.000E+02	

* - Decay-corrected to 9/93

Static: [(8.39E-02 mrem/yr)(26.0 Kgal/56 Kgal)] = 3.90E-2 mrem/yr

Dynamic: [(8.39E-02 mrem/yr)(26.0 Kgal/56 Kgal)]
 x (56 Kgal)/[(0.5E-3 Kgal/min)(60 min/hr)]
 x (24 hr/d)(365 d/yr)]
 = 8.30E-03 mrem over 78 days

3.18 STACK 296-C-05

3.18.1 SYSTEM DESCRIPTION / CONFIGURATION

The 296-C-05 stack system ventilates the 244-CR Vault vessels, providing containment and moisture removal for the vessels' offgas. The 244-CR Vault is located north of the PUREX Plant in the 200 East area.

The 244-CR Vault is considered to be a double-contained receiver tank (DCRT) in the Hanford Site Tank Farm Facilities Interim Safety Basis (WHC-SD-WM-ISB-001) based on its functional characteristics, although it is not listed as one of the five DESIGNATED DCRTs in the 200 Area tank system. The 244-CR Vault is used to transfer waste from single-shell tanks in the 241-C Tank Farm to double-shell tanks in the 200 East area.

There are a total of four vessels in the 244-CR Vault which are ventilated by the 296-C-05 stack. Vessels CR-011 and CR-001 have a volume of 45,000 gallons and vessels CR-002 and CR-003 each have a volume of 14,655 gallons, however only tank CR-003 will be used during transfer waste from the C-Tank Farm. Tank CR-003 is limited to an operational volume of 13,500 gallons. Each of the vessels is held in its own cell and isolated from the 244-CR Vault canyon via a cell cover. It is ventilated via a common pipe which passes through ports in the cell walls through HEPA filters and then to the 296-C-05 stack. The exhauster is operated only when the temperature of the waste is above a specific temperature and/or during the transfer of waste through the facility.

3.18.2 POSTULATED WASTE VOLUME PASSING THROUGH DCRT

TANK	WASTE VOLUME (KGAL)	
	TANK TOTAL	PUMPABLE
241-C-102	423	19
241-C-103	195	133
241-C-107	275	20
241-C-110	187	5
TOTAL	1,080	177

3.18.3 CALCULATION OF POTENTIAL OFFSITE DOSE

Refer to Section 2.4, Pages 7-9, for the definitions and examples of *static* and *dynamic* situations.

- 3.18.3.1 Scenario #1: Transfer of waste from tank C-103 through this DCRT. No HEPA filter factors are included in the calculations.

Potential offsite doses:

Static: $[(1.87\text{E}+2 \text{ mrem/year})(13.5 \text{ Kgal}/133 \text{ Kgal})]$
= 19.0 mrem/yr

Dynamic: $[(1.87\text{E}+2 \text{ mrem/year})(13.5 \text{ Kgal}/133 \text{ Kgal})]$
 $\times [133 \text{ Kgal}]/[(0.5\text{E}-3 \text{ Kgal/min})(60 \text{ min/hr})]$
 $\times (24 \text{ hr/d})(365 \text{ d/yr})$
= 9.62 mrem over 185 days

3.18.3.2 Scenario #2: Transfer of waste from tanks C-102, 107, and 110 through this DCRT. No HEPA filter factors are included in the calculations.

Potential offsite doses:

Static: $[(5.16\text{E}-02 \text{ mrem/yr})(13.5 \text{ Kgal})/(44 \text{ Kgal})]$
= 1.58E-02 mrem/yr

Dynamic: $[(5.16\text{E}-02 \text{ mrem/yr})(13.5 \text{ Kgal})/(44 \text{ Kgal})]$
 $\times (44 \text{ Kgal})/[(0.5\text{E}-3 \text{ Kgal/min})(60 \text{ min/hr})]$
 $\times (24 \text{ hr/d})(365 \text{ d/yr})$
= 2.65 E-03 mrem over 61 days

3.18.4 TANK STATUS: NON-DESIGNATED ⁽¹⁾

⁽¹⁾ This transfer system may be determined to be designated in the future depending on when and which waste is scheduled to be sent through it. The earliest scheduled transfer for waste that would put the stack into a designated mode is from tank C-103. This transfer is scheduled to be initiated in September 1998 and is represented by Scenario #1.

Stack 296-C-5 / Scenario #1

244-CR VAULT SOURCE TERM EMISSIONS - (C-103)

R-nuclide	Sum of Ci*	CAP-88 c-factor	APP D factor	EDE (mrem/yr)	% of Total EDE	
14-C	.4860E+00	.2620E-02	1.E-03	1.273E-06	6.817E-07	1
60-Co	.2970E+04	.2900E-01	1.E-03	8.613E-02	4.611E-02	2
79-Se	.0000E+00	.4380E-01	1.E-03	0.000E+00	0.000E+00	3
89/90-Sr	.3510E+07	.4380E-01	1.E-03	1.537E+02	8.230E+01	4
90-Y	.3510E+07	.3770E-03	1.E-03	1.323E+00	7.084E-01	5
99-Tc	.4590E+03	.1090E-02	1.E-03	5.003E-04	2.678E-04	6
106-Ru/Rh	.0000E+00	.2090E-01	1.E+00	0.000E+00	0.000E+00	7
125-Sb	.0000E+00	.4150E-02	1.E-03	0.000E+00	0.000E+00	8
129-I	.5680E-01	.2910E+00	1.E+00	1.653E-02	8.849E-03	9
134-Cs	.0000E+00	.3130E-01	1.E-03	0.000E+00	0.000E+00	10
137-Cs	.1220E+06	.2390E-01	1.E-03	2.916E+00	1.561E+00	11
144-Ce	.0000E+00	.1370E-01	1.E-03	0.000E+00	0.000E+00	12
147-Pm	.0000E+00	.1140E-02	1.E-03	0.000E+00	0.000E+00	13
154-Eu	.0000E+00	.4380E-01	1.E-03	0.000E+00	0.000E+00	14
Nat-U	.0000E+00	.2840E+01	1.E-03	0.000E+00	0.000E+00	15
237-Np	.0000E+00	.1190E+02	1.E-03	0.000E+00	0.000E+00	16
238-Pu	.0000E+00	.8020E+01	1.E-03	0.000E+00	0.000E+00	17
239/240-Pu	.1030E+04	.8670E+01	1.E-03	8.930E+00	4.781E+00	18
241-Pu	.0000E+00	.1380E+00	1.E-03	0.000E+00	0.000E+00	19
241-Am	.1510E+04	.1310E+02	1.E-03	1.978E+01	1.059E+01	20
242/244-Cm	.0000E+00	.6940E+01	1.E-03	0.000E+00	0.000E+00	21
TOTAL				1.868E+02	1.000E+02	

* - Decay-corrected to 9/93

Static: $[(1.87E+2 \text{ mrem/year})(13.5 \text{ Kgal}/133 \text{ Kgal})] = 19.0 \text{ mrem/yr}$

Dynamic: $[(1.87E+2 \text{ mrem/year})(13.5 \text{ Kgal}/133 \text{ Kgal})]$
 $\times (133 \text{ Kgal})/[(0.5E-3 \text{ Kgal/min})(60 \text{ min/hr})]$
 $\times (24 \text{ hr/d})(365 \text{ d/yr})$
 $= 9.62 \text{ mrem over 185 days}$

Stack 296-C-5 / Scenario #2

244-CR VAULT SOURCE TERM EMISSIONS - (C-102, 107, 110)

R-nuclide	Sum of Ci*	CAP-88 c-factor	APP D factor	EDE (mrem/yr)	% of Total EDE	
14-C	.0000E+00	.2620E-02	1.E-03	0.000E+00	0.000E+00	1
60-Co	.8030E+00	.2900E-01	1.E-03	2.325E-05	4.517E-02	2
79-Se	.0000E+00	.4380E-01	1.E-03	0.000E+00	0.000E+00	3
89/90-Sr	.1490E+02	.4380E-01	1.E-03	6.526E-04	1.266E+00	4
90-Y	.1490E+02	.3770E-03	1.E-03	5.617E-06	1.090E-02	5
99-Tc	.1030E+01	.1090E-02	1.E-03	1.123E-06	2.178E-03	6
106-Ru/Rh	.0000E+00	.2090E-01	1.E+00	0.000E+00	0.000E+00	7
125-Sb	.0000E+00	.4150E-02	1.E-03	0.000E+00	0.000E+00	8
129-I	.0000E+00	.2910E+00	1.E+00	0.000E+00	0.000E+00	9
134-Cs	.0000E+00	.3130E-01	1.E-03	0.000E+00	0.000E+00	10
137-Cs	.5250E+03	.2390E-01	1.E-03	1.255E-02	2.434E+01	11
144-Ce	.0000E+00	.1370E-01	1.E-03	0.000E+00	0.000E+00	12
147-Pm	.0000E+00	.1140E-02	1.E-03	0.000E+00	0.000E+00	13
154-Eu	.0000E+00	.4380E-01	1.E-03	0.000E+00	0.000E+00	14
Nat-U	.0000E+00	.2840E+01	1.E-03	0.000E+00	0.000E+00	15
237-Np	.0000E+00	.1190E+02	1.E-03	0.000E+00	0.000E+00	16
238-Pu	.0000E+00	.8020E+01	1.E-03	0.000E+00	0.000E+00	17
239/240-Pu	.4410E+01	.8670E+01	1.E-03	3.823E-02	7.416E+01	18
241-Pu	.0000E+00	.1380E+00	1.E-03	0.000E+00	0.000E+00	19
241-Am	.7080E-02	.1310E+02	1.E-03	9.275E-05	1.799E-01	20
242/244-Cm	.0000E+00	.6940E+01	1.E-03	0.000E+00	0.000E+00	21
TOTAL				5.156E-02	1.000E+02	

* - Decay-corrected to 9/93

Static: $[(5.16E-02 \text{ mrem/yr})(13.5 \text{ Kgal})/(44 \text{ Kgal}) = 1.58E-02 \text{ mrem/yr}$

Dynamic: $[(5.16E-02 \text{ mrem/yr})(13.5 \text{ Kgal})/(44 \text{ Kgal})]$
 $\times (44 \text{ Kgal})/[(0.5E-3 \text{ Kgal/min})(60 \text{ min/hr})]$
 $\times (24 \text{ hr/d})(365 \text{ d/yr})$
 $= 2.65 E-03 \text{ mrem over 61 days}$

3.19 STACK 296-P-16

3.19.1 SYSTEM DESCRIPTION / CONFIGURATION

The 296-P-16 portable exhauster and stack system directly ventilates tanks 241-C-105, 241-C-106, and indirectly ventilates through a cascade effect 241-C-104 in the 241-C Tank Farm, providing negative pressure and removal of heat and vapor from these tanks. The 241-C Tank Farm is located north of the PUREX plant in the 200 East Area.

The 241-C Tank Farm contains single-shell tanks which first received waste in 1943. Tanks 104, 105, and 106 each have a fill volume of 0.5 M gallons.

The ventilation system for the 104, 105, and 106 tanks consists of two exhaust heaters, a pre-filter, two HEPA filters and the 296-P-16 portable exhauster, all in series.

3.19.2 TANKS AND WASTE VOLUME

TANK	WASTE VOLUME (KGAL)	
	TANK TOTAL	PUMPABLE
241-C-104	295	5
241-C-105	150	4
241-C-106	229	42
TOTAL	674	51

3.19.3 CALCULATION OF POTENTIAL OFFSITE DOSE

3.19.3.1 Scenario: The radioactivity in the supernatant of the waste and in the slurry/sludge in the C-104, 105, and 106 tanks of the 241-C Tank Farm is included in the calculation. No HEPA filter factors are included in the calculations.

$$\begin{aligned}
 \text{Potential offsite dose} &= \underline{1.21 \text{ mrem/yr}} \text{ (Supernatant)} \\
 &+ \underline{0.47 \text{ mrem/year}} \text{ (Slurry/Sludge)} \\
 &= \underline{1.68 \text{ mrem/year}} \text{ (Total)}
 \end{aligned}$$

3.19.4 TANK STATUS: DESIGNATED

Stack 296-P-16

241-C-104, 105, 106 SOURCE TERM EMISSIONS (SUPERNATANT ONLY)

R-nuclide	Sum of Ci*	CAP-88 c-factor	APP D factor	EDE (mrem/yr)	% of Total EDE	
14-C	.2690E+00	.2620E-02	1.E-03	7.048E-07	5.848E-05	1
60-Co	.1920E+02	.2900E-01	1.E-03	5.568E-04	4.620E-02	2
79-Se	.0000E+00	.4380E-01	1.E-03	0.000E+00	0.000E+00	3
89/90-Sr	.3700E+03	.4380E-01	1.E-03	1.621E-02	1.345E+00	4
90-Y	.3700E+03	.3770E-03	1.E-03	1.395E-04	1.158E-02	5
99-Tc	.2200E+02	.1090E-02	1.E-03	2.398E-05	1.990E-03	6
106-Ru/Rh	.0000E+00	.2090E-01	1.E+00	0.000E+00	0.000E+00	7
125-Sb	.0000E+00	.4150E-02	1.E-03	0.000E+00	0.000E+00	8
129-I	.1210E-01	.2910E+00	1.E+00	3.521E-03	2.922E-01	9
134-Cs	.0000E+00	.3130E-01	1.E-03	0.000E+00	0.000E+00	10
137-Cs	.2710E+05	.2390E-01	1.E-03	6.477E-01	5.375E+01	11
144-Ce	.0000E+00	.1370E-01	1.E-03	0.000E+00	0.000E+00	12
147-Pm	.0000E+00	.1140E-02	1.E-03	0.000E+00	0.000E+00	13
154-Eu	.0000E+00	.4380E-01	1.E-03	0.000E+00	0.000E+00	14
Nat-U	.2840E-01	.2840E+01	1.E-03	8.066E-05	6.693E-03	15
237-Np	.0000E+00	.1190E+02	1.E-03	0.000E+00	0.000E+00	16
238-Pu	.0000E+00	.8020E+01	1.E-03	0.000E+00	0.000E+00	17
239/240-Pu	.6020E+02	.8670E+01	1.E-03	5.219E-01	4.331E+01	18
241-Pu	.0000E+00	.1380E+00	1.E-03	0.000E+00	0.000E+00	19
241-Am	.1140E+01	.1310E+02	1.E-03	1.493E-02	1.239E+00	20
242/244-Cm	.0000E+00	.6940E+01	1.E-03	0.000E+00	0.000E+00	21
TOTAL				1.205E+00	1.000E+02	

* - Decay-corrected to 9/93

Stack 296-P-16

C-104/105/106 FARM SOURCE TERM EMISSIONS (SLURRY/SLUDGE)

R-nuclide	Sum of Ci*	CAP-88 c-factor	APP D factor	EDE (mrem)	% of Total EDE	
14-C	.2000E+01	.2620E-02	1.E-06	5.240E-09	1.105E-06	1
60-Co	.9570E+03	.2900E-01	1.E-06	2.775E-05	5.858E-03	2
79-Se	.0000E+00	.4380E-01	1.E-06	0.000E+00	0.000E+00	3
89/90-Sr	.2810E+07	.4380E-01	1.E-06	1.231E-01	2.599E+01	4
90-Y	.2810E+07	.3770E-03	1.E-06	1.059E-03	2.236E-01	5
99-Tc	.4110E+04	.1090E-02	1.E-06	4.480E-06	9.457E-04	6
106-Ru/Rh	.0000E+00	.2090E-01	1.E+00	0.000E+00	0.000E+00	7
125-Sb	.0000E+00	.4150E-02	1.E-06	0.000E+00	0.000E+00	8
129-I	.1910E+00	.2910E+00	1.E+00	5.558E-02	1.173E+01	9
134-Cs	.0000E+00	.3130E-01	1.E-06	0.000E+00	0.000E+00	10
137-Cs	.4430E+06	.2390E-01	1.E-06	1.059E-02	2.236E+00	11
144-Ce	.0000E+00	.1370E-01	1.E-06	0.000E+00	0.000E+00	12
147-Pm	.0000E+00	.1140E-02	1.E-06	0.000E+00	0.000E+00	13
154-Eu	.0000E+00	.4380E-01	1.E-06	0.000E+00	0.000E+00	14
Nat-U	.2980E+04	.2840E+01	1.E-06	8.463E-03	1.786E+00	15
237-Np	.0000E+00	.1190E+02	1.E-06	0.000E+00	0.000E+00	16
238-Pu	.0000E+00	.8020E+01	1.E-06	0.000E+00	0.000E+00	17
239/240-Pu	.2190E+05	.8670E+01	1.E-06	1.899E-01	4.009E+01	18
241-Pu	.0000E+00	.1380E+00	1.E-06	0.000E+00	0.000E+00	19
241-Am	.6490E+04	.1310E+02	1.E-06	8.502E-02	1.795E+01	20
242/244-Cm	.0000E+00	.6940E+01	1.E-06	0.000E+00	0.000E+00	21
TOTAL				4.737E-01	1.000E+02	

* - Decay-corrected to 9/93

3.20 STACK 296-P-17

3.20.1 SYSTEM DESCRIPTION / CONFIGURATION

The 296-P-17 portable exhauster and stack system ventilates tanks 241-A-105, 104, and 106 in the 241-A Tank Farm, providing negative pressure and removal of heat and vapor from these tanks. The 241-A Tank Farm is located north of the PUREX plant in the 200 East Area.

The 241-A Tank Farm contains six single-shell tanks which first received waste in 1954. Tanks 101 through 106 each have a fill volume of 1.0 M gallons.

The ventilation system for the 241-A tanks consists of two exhaust heaters, a pre-filter system, and two parallel banks of nine HEPA filters each and the 296-P-17 portable exhauster.

3.20.2 TANKS AND WASTE VOLUME

TANK	WASTE VOLUME (KGAL)	
	TANK TOTAL	PUMPABLE
241-A-101	953	390
241-A-102	41	0
241-A-103	370	0
241-A-104	28	0
241-A-105	19	0
241-A-106	125	0
TOTAL	1,536	390

3.20.3 CALCULATION OF POTENTIAL OFFSITE DOSE

3.20.3.1 Scenario #1: The radioactivity in the waste in the A-104, 105, and 106 tanks of the 241-A Tank Farm is included in the calculation. No HEPA filter factors are included in the calculations.

Potential offsite dose = 202 mrem/yr⁽¹⁾

3.20.4 TANK STATUS: NON-DESIGNATED⁽¹⁾

⁽¹⁾ This system is currently not in operation. If the exhausters would be operated again, the system would become designated.

Stack 296-P-17

A-104/105/106 TANK FARM SOURCE TERM EMISSIONS

R-nuclide	Sum of Ci*	CAP-88 c-factor	APP D factor	EDE (mrem/yr)	% of Total EDE	
14-C	.7080E+03	.2620E-02	1.E-03	1.855E-03	9.190E-04	1
60-Co	.0000E+00	.2900E-01	1.E-03	0.000E+00	0.000E+00	2
79-Se	.2970E+00	.4380E-01	1.E-03	1.301E-05	6.445E-06	3
89/90-Sr	.3780E+07	.4380E-01	1.E-03	1.656E+02	8.203E+01	4
90-Y	.3780E+07	.3770E-03	1.E-03	1.425E+00	7.060E-01	5
99-Tc	.1000E+02	.1090E-02	1.E-03	1.090E-05	5.400E-06	6
106-Ru/Rh	.8160E-01	.2090E-01	1.E+00	1.705E-03	8.450E-04	7
125-Sb	.0000E+00	.4150E-02	1.E-03	0.000E+00	0.000E+00	8
129-I	.1000E-01	.2910E+00	1.E+00	2.910E-03	1.442E-03	9
134-Cs	.0000E+00	.3130E-01	1.E-03	0.000E+00	0.000E+00	10
137-Cs	.3780E+05	.2390E-01	1.E-03	9.034E-01	4.476E-01	11
144-Ce	.0000E+00	.1370E-01	1.E-03	0.000E+00	0.000E+00	12
147-Pm	.0000E+00	.1140E-02	1.E-03	0.000E+00	0.000E+00	13
154-Eu	.0000E+00	.4380E-01	1.E-03	0.000E+00	0.000E+00	14
Nat-U	.6050E+01	.2840E+01	1.E-03	1.718E-02	8.513E-03	15
237-Np	.4640E-01	.1190E+02	1.E-03	5.522E-04	2.736E-04	16
238-Pu	.6810E+02	.8020E+01	1.E-03	5.462E-01	2.706E-01	17
239/240-Pu	.2000E+04	.8670E+01	1.E-03	1.734E+01	8.591E+00	18
241-Pu	.3240E+04	.1380E+00	1.E-03	4.471E-01	2.215E-01	19
241-Am	.1190E+04	.1310E+02	1.E-03	1.559E+01	7.724E+00	20
242/244-Cm	.6570E-02	.6940E+01	1.E-03	4.560E-05	2.259E-05	21
TOTAL				2.018E+02	1.000E+02	

* - Decay-corrected to 9/93

3.21 STACK 296-P-22

3.21.1 SYSTEM DESCRIPTION / CONFIGURATION

The 296-P-22 stack system ventilates the annuli of the 241-SY Farm tanks, providing removal of heat from the outer surface of the primary tanks, and maintenance of a dry environment to minimize corrosion of the primary tank. The 241-SY Tank Farm is located south of the Plutonium Finishing Plant in the 200 West area.

Tanks in the 241-SY Tank Farm are double-shell tanks, first used to contain waste in 1974. There are a total of three tanks in the Tank Farm, each with a volume of 1.2 M gallons.

The 241-SY tank annuli ventilation system contains an inlet system consisting of four inlet ducts per tank originating from parallel banks of pre-filter and HEPA filter systems and an outlet system consisting of deentrainer, heater, pre-filter and HEPA filter. The 296-P-22 annuli exhaust system does not have a backup system as do other double-shell tank farms. Portable exhausters units may be used for this purpose.

3.21.2 CALCULATION OF SOURCE TERM

It is not expected that the primary containment vessels in the 241-SY Tank Farm will leak. The design life of these vessels is a minimum of 50 years and the tanks have undergone an integrity assessment. If a leak is found, the annuli source term would be re-evaluated at that time. Therefore, there is no radionuclide source term associated with this stack system.

3.21.3 CALCULATION OF POTENTIAL OFFSITE DOSE

3.21.3.1 Scenario: No loss of primary containment of a tank is expected. No HEPA filter factors are included in the calculations.

Potential offsite dose = 0 mrem/yr

3.21.4 TANK STATUS: NON-DESIGNATED

Stack 296-P-22

241-SY TANK FARM ANNULUS SOURCE TERM EMISSIONS

R-nuclide	Sum of Ci	CAP-88 c-factor	APP D factor	EDE (mrem/yr)	% of Total EDE	
14-C	.0000E+00	.1650E-02	1.E-03	0.000E+00	0.000E+00	1
60-Co	.0000E+00	.1720E-01	1.E-03	0.000E+00	0.000E+00	2
79-Se	.0000E+00	.2600E-01	1.E-03	0.000E+00	0.000E+00	3
89/90-Sr	.0000E+00	.2600E-01	1.E-03	0.000E+00	0.000E+00	4
90-Y	.0000E+00	.2220E-03	1.E-03	0.000E+00	0.000E+00	5
99-Tc	.0000E+00	.6450E-03	1.E-03	0.000E+00	0.000E+00	6
106-Ru/Rh	.0000E+00	.1200E-01	1.E+00	0.000E+00	0.000E+00	7
125-Sb	.0000E+00	.2470E-02	1.E-03	0.000E+00	0.000E+00	8
129-I	.0000E+00	.1140E+00	1.E+00	0.000E+00	0.000E+00	9
134-Cs	.0000E+00	.1860E-01	1.E-03	0.000E+00	0.000E+00	10
137-Cs	.0000E+00	.1420E-01	1.E-03	0.000E+00	0.000E+00	11
143-Cs	.0000E+00	.8140E-02	1.E-03	0.000E+00	0.000E+00	12
147-Pm	.0000E+00	.6750E-03	1.E-03	0.000E+00	0.000E+00	13
154-Eu	.0000E+00	.2600E-01	1.E-03	0.000E+00	0.000E+00	14
Nat-U	.0000E+00	.1690E+01	1.E-03	0.000E+00	0.000E+00	15
237-Np	.0000E+00	.7050E+01	1.E-03	0.000E+00	0.000E+00	16
238-Pu	.0000E+00	.4760E+01	1.E-03	0.000E+00	0.000E+00	17
239/240-Pu	.0000E+00	.5150E+01	1.E-03	0.000E+00	0.000E+00	18
241-Pu	.0000E+00	.8170E-01	1.E-03	0.000E+00	0.000E+00	19
241-Am	.0000E+00	.7790E+01	1.E-03	0.000E+00	0.000E+00	20
242/244-Cm	.0000E-00	.4120E+01	1.E-03	0.000E-00	0.000E+00	21
TOTAL				0.000E-00	1.000E+02	

3.22 STACK 296-P-23

3.22.1 SYSTEM DESCRIPTION / CONFIGURATION

The 296-P-23 stack system ventilates the 241-SY Farm tanks, providing negative pressure and removal of heat and vapor from the primary containment vessels. The 241-SY Tank Farm is located south of the Plutonium Finishing Plant in the 200 West Area.

Tanks in the 241-SY Tank Farm are doubled shelled tanks, first used to contain waste in 1974. There are a total of three tanks in the Tank Farm, each with a volume of 1.2 M gallons.

The primary ventilation system connects to the tanks through 12-inch diameter risers which run independently to the exhaust system. Manually operated butterfly valves control airflow to each of the three tanks. The exhaust system consists of one deentrainer system, one heater system, a prefilter, two HEPA filters and one blower system. The 296-P-23 tank exhaust system relies on a portable exhaust system, 296-P-28, as a backup.

3.22.2 TANKS AND WASTE VOLUME

TANK	WASTE VOLUME (KGAL)	
	TANK TOTAL	PUMPABLE
241-SY-101	1,118	259
241-SY-102	726	655
241-SY-103	751	174
TOTAL	2,595	1,088

3.22.3 CALCULATION OF POTENTIAL OFFSITE DOSE

3.22.3.1 Scenario #1: The radioactivity in the supernatant of the waste and the slurry/sludge in the SY Tank Farm is included in the calculation. No HEPA filter factors are included in the calculations.

Potential offsite dose = 10.5 mrem/yr

3.22.4 TANK STATUS: DESIGNATED

Stack 296-P-23

241-SY TANK FARM SOURCE TERM EMISSIONS (SUPERNATANT ONLY)

R-nuclide	Sum of Ci*	CAP-88 c-factor	APP D factor	EDE (mrem/yr)	% of Total EDE	
14-C	.0000E+00	.1650E-02	1.E-03	0.000E+00	0.000E+00	1
60-Co	.0000E+00	.1720E-01	1.E-03	0.000E+00	0.000E+00	2
79-Se	.0000E+00	.2600E-01	1.E-03	0.000E+00	0.000E+00	3
89/90-Sr	.5210E+04	.2600E-01	1.E-03	1.355E-01	1.289E+00	4
90-Y	.5210E+04	.2220E-03	1.E-03	1.157E-03	1.101E-02	5
99-Tc	.1040E+02	.6450E-03	1.E-03	6.708E-06	6.383E-05	6
106-Ru/Rh	.0000E+00	.1200E-01	1.E+00	0.000E+00	0.000E+00	7
125-Sb	.0000E+00	.2470E-02	1.E-03	0.000E+00	0.000E+00	8
129-I	.0000E+00	.1140E+00	1.E+00	0.000E+00	0.000E+00	9
134-Cs	.0000E+00	.1860E-01	1.E-03	0.000E+00	0.000E+00	10
137-Cs	.7290E+06	.1420E-01	1.E-03	1.035E+01	9.850E+01	11
144-Ce	.0000E+00	.8140E-02	1.E-03	0.000E+00	0.000E+00	12
147-Pm	.0000E+00	.6750E-03	1.E-03	0.000E+00	0.000E+00	13
154-Eu	.0000E+00	.2600E-01	1.E-03	0.000E+00	0.000E+00	14
Nat-U	.5810E-03	.1690E+01	1.E-03	9.819E-07	9.343E-06	15
237-Np	.0000E+00	.7050E+01	1.E-03	0.000E+00	0.000E+00	16
238-Pu	.0000E+00	.4760E+01	1.E-03	0.000E+00	0.000E+00	17
239/240-Pu	.6750E+00	.5150E+01	1.E-03	3.476E-03	3.308E-02	18
241-Pu	.0000E+00	.8170E-01	1.E-03	0.000E+00	0.000E+00	19
241-Am	.2270E+01	.7790E+01	1.E-03	1.768E-02	1.683E-01	20
242/244-Cm	.0000E+00	.4120E+01	1.E-03	0.000E+00	0.000E+00	21
TOTAL				1.051E+01	1.000E+02	

* - Decay-corrected to 9/93

3.23 STACK 296-P-26

3.23.1 SYSTEM DESCRIPTION / CONFIGURATION

The 296-P-26 stack serves as the 241-A-702 backup ventilation system for tanks in the 241-AZ and 241-AY Tank Farms and several diverter stations and catch tanks associated with these facilities. The 241-A-702 system provides containment of radionuclides, removal of decay heat from radionuclides and removal of water vapor evaporating from the liquid waste. The 241-AY and 241 AZ Tank Farms are located in the 200 East area, northeast of the PUREX facility.

The 241-AY and 241 AZ Tank Farms contain double-shell tanks. The 241-AY Tank Farm received waste from 1968 to 1970 and the 241-AZ Tank received waste from 1971 to 1977. There are a total of four 1 M gallon tanks in the 241-AY/AZ Tank Farm.

The 241-A-702 system serves as primary ventilation for these tanks. Additionally, the 241-AX-152 diverter station, the 241-AZ-151 catch tank and the 241-AZ-154 catch tank are ventilated via this system.

The 241-A-702 backup system serves as backup ventilation for these tanks whenever the primary system is shut down for repair and servicing or in the event of system failure. Ducts from each of the tanks and ancillary stations are joined through isolation valves. The 241-A-702 backup system uses the same ducting, deentrainer and condenser as the primary system, but uses its own backup heater and HEPA filtration system.

3.23.2 TANKS AND WASTE VOLUME

TANK	WASTE VOLUME (KGAL)	
	TANK TOTAL	PUMPABLE
241-AY-101	910	827
241-AY-102	835	803
241-AZ-101	972	937
241-AZ-102	962	871
TOTAL	3,679	3,438

3.23.3 CALCULATION OF POTENTIAL OFFSITE DOSE

3.23.3.1 Scenario: The radioactivity in the supernatant of the waste and in the slurry/sludge in AY and AZ Tank Farms is included in the calculation. No HEPA filter factors are included in the calculations. The time required for the back-up system to be in operation to reach the "designated" status is calculated.

Potential offsite dose = 226 mrem/yr⁽¹⁾

3.23.4 TANK STATUS: DESIGNATED⁽¹⁾

- ⁽¹⁾ This stack could become designated if required to operate for a specific length of time. In order to create a potential dose of 0.1 mrem/yr, this stack would only need to be in operation for 3.88 hours.

The system has operated for several weeks during CY-1993 because of equipment problems with the primary exhausters; therefore, this stack is classified as designated.

Stack 296-P-26

241-AY/AZ TANK FARM BACK-UP EXHAUSTER SOURCE TERM EMISSIONS (SUPERNATANT ONLY)

R-nuclide	Sum of Ci*	CAP-88 c-factor	APP D factor	EDE (mrem/yr)	% of Total EDE	
14-C	.4970E+01	.2620E-02	1.E-03	1.302E-05	5.755E-06	1
60-Co	.1740E+04	.2900E-01	1.E-03	5.046E-02	2.230E-02	2
79-Se	.0000E+00	.4380E-01	1.E-03	0.000E+00	0.000E+00	3
89/90-Sr	.3950E+05	.4380E-01	1.E-03	1.730E+00	7.646E-01	4
90-Y	.3950E+05	.3770E-03	1.E-03	1.489E-02	6.581E-03	5
99-Tc	.1290E+06	.1090E-02	1.E-03	1.406E-01	6.214E-02	6
106-Ru/Rh	.0000E+00	.2090E-01	1.E+00	0.000E+00	0.000E+00	7
125-Sb	.0000E+00	.4150E-02	1.E-03	0.000E+00	0.000E+00	8
129-I	.2480E+01	.2910E+00	1.E+00	7.217E-01	3.190E-01	9
134-Cs	.2890E+01	.3130E-01	1.E-03	9.046E-05	3.998E-05	10
137-Cs	.9240E+07	.2390E-01	1.E-03	2.208E+02	9.760E+01	11
144-Ce	.0000E+00	.1370E-01	1.E-03	0.000E+00	0.000E+00	12
147-Pm	.0000E+00	.1140E-02	1.E-03	0.000E+00	0.000E+00	13
154-Eu	.1880E+05	.4380E-01	1.E-03	8.234E-01	3.639E-01	14
Nat-U	.1880E+01	.2840E+01	1.E-03	5.339E-03	2.360E-03	15
237-Np	.2440E+00	.1190E+02	1.E-03	2.904E-03	1.283E-03	16
238-Pu	.2630E+00	.8020E+01	1.E-03	2.109E-03	9.322E-04	17
239/240-Pu	.2500E+01	.8670E+01	1.E-03	2.168E-02	9.580E-03	18
241-Pu	.1180E+02	.1380E+00	1.E-03	1.628E-03	7.197E-04	19
241-Am	.1460E+03	.1310E+02	1.E-03	1.913E+00	8.453E-01	20
242/244-Cm	.0000E+00	.6940E+01	1.E-03	0.000E+00	0.000E+00	21
TOTAL				2.263E+02	1.000E+02	

* - Decay-corrected to 9/93

Therefore, to reach the "designated" status, the back-up exhauster must be in operation for the following length of time:

$$[0.1 \text{ mrem} / 226 \text{ mrem/yr}] [(365 \text{ days/yr}) (24 \text{ hrs/day})] = \underline{3.88 \text{ hours}}$$

3.24 STACK 296-P-28

3.24.1 SYSTEM DESCRIPTION / CONFIGURATION

The 296-P-28 stack system is a backup, portable exhaust system which ventilates the 241-SY Farm tanks, providing negative pressure and removal of heat and vapor from the primary containment vessels. This system may be manually used in the event of failure of the primary system, 296-P-23. The 241-SY Tank Farm is located south of the Plutonium Finishing Plant in the 200 West Area.

Tanks in the 241-SY Tank Farm are doubled shelled tanks. The Tank Farm was first used to contain waste in 1974. There are a total of three tanks in the Tank Farm, 241-SY-101, 241-SY-102, and 241-SY-103, each with a volume of 1.2 M gallons.

The backup, portable exhaust system may be connected to the primary system on the upstream side of 296-P-23 blower K1-4-1. The exhaust system then relies on the same configuration as the primary system to filter air exhausted from the 241-SY Farm Tanks. Exhaust air exits the tanks through 12-inch diameter risers which run independently to the exhaust system. Manually operated butterfly valves control airflow to each of the three tanks. The exhaust system consists of one deentrainer system, one heater system, two prefilters, two HEPA filters and one blower system.

3.24.2 TANKS AND WASTE VOLUME

TANK	WASTE VOLUME (KGAL)	
	TANK TOTAL	PUMPABLE
241-SY-101	1,118	259
241-SY-102	726	655
241-SY-103	751	174
TOTAL	2,595	1,088

3.24.3 CALCULATION OF POTENTIAL OFFSITE DOSE

3.24.3.1 Scenario: The radioactivity in the supernatant of the waste and in the slurry/sludge in the SY Tank Farm is included in the calculation. No HEPA filter factors are included in the calculations. The time required for the back-up system to be in operation to reach the "designated" status is calculated.

Potential offsite dose = 10.5 mrem/yr ⁽¹⁾

3.24.4 TANK STATUS: NON-DESIGNATED ⁽¹⁾

⁽¹⁾ This stack could become designated if required to operate for a specific length of time. In order to create a potential dose of 0.1 mrem/yr, this stack would need to be in operation for 3.48 days.

Currently, the exhaustor is operated only 4 hr/month to check the operability of the unit for a annual usage of 2 days; therefore, this stack is classified as non-designated.

Stack 296-P-28

241-SY TANK FARM BACK-UP SOURCE TERM EMISSIONS (SUPERNATANT ONLY)

R-nuclide	Sum of Ci*	CAP-88 c-factor	APP D factor	EDE (mrem/yr)	% of Total EDE	
14-C	.0000E+00	.1650E-02	1.E-03	0.000E+00	0.000E+00	1
60-Co	.0000E+00	.1720E-01	1.E-03	0.000E+00	0.000E+00	2
79-Se	.0000E+00	.2600E-01	1.E-03	0.000E+00	0.000E+00	3
89/90-Sr	.5210E+04	.2600E-01	1.E-03	1.355E-01	1.289E+00	4
90-Y	.5210E+04	.2220E-03	1.E-03	1.157E-03	1.101E-02	5
99-Tc	.1040E+02	.6450E-03	1.E-03	6.708E-06	6.383E-05	6
106-Ru/Rh	.0000E+00	.1200E-01	1.E+00	0.000E+00	0.000E+00	7
125-Sb	.0000E+00	.2470E-02	1.E-03	0.000E+00	0.000E+00	8
129-I	.0000E+00	.1140E+00	1.E+00	0.000E+00	0.000E+00	9
134-Cs	.0000E+00	.1860E-01	1.E-03	0.000E+00	0.000E+00	10
137-Cs	.7290E+06	.1420E-01	1.E-03	1.035E+01	9.850E+01	11
144-Ce	.0000E+00	.8140E-02	1.E-03	0.000E+00	0.000E+00	12
147-Pm	.0000E+00	.6750E-03	1.E-03	0.000E+00	0.000E+00	13
154-Eu	.0000E+00	.2600E-01	1.E-03	0.000E+00	0.000E+00	14
Nat-U	.5810E-03	.1690E+01	1.E-03	9.819E-07	9.343E-06	15
237-Np	.0000E+00	.7050E+01	1.E-03	0.000E+00	0.000E+00	16
238-Pu	.0000E+00	.4760E+01	1.E-03	0.000E+00	0.000E+00	17
239/240-Pu	.6750E+00	.5150E+01	1.E-03	3.476E-03	3.308E-02	18
241-Pu	.0000E+00	.8170E-01	1.E-03	0.000E+00	0.000E+00	19
241-Am	.2270E+01	.7790E+01	1.E-03	1.768E-02	1.683E-01	20
242/244-Cm	.0000E+00	.4120E+01	1.E-03	0.000E+00	0.000E+00	21
TOTAL				1.051E+01	1.000E+02	

* - Decay-corrected to 9/93

Therefore, to reach the "designated" status, the back-up exhauster must be in operation for the following length of time:

$$[(0.1 \text{ mrem}) / (10.5 \text{ mrem/yr})] [(365 \text{ days/yr})] = 3.48 \text{ days}$$

3.25 STACK 296-P-31

3.25.1 SYSTEM DESCRIPTION / CONFIGURATION

The 296-P-31 Stack ventilates the 209-E building Critical Mass Lab. The 209-E building is located in the 200 East Area just east of B Plant. This building contains the old PNL Critical Mass Laboratory which is no longer operated. The building was transferred to WHC custodianship on January 20, 1992, and is currently used by Tank Farms Solid Waste Operations and Tank Farms Solid Waste Engineering. Plans are to use the critical assemble room and the mix room to assay, sample, and repackage low-level radioactive solid waste containers. Room air is discharged from these room through the hood assembly filters and through tank inlet filters. Plutonium and uranium residuals reside in these units. Discharged air passes through two HEPA filter assemblies, in series, and out the stack.

This determination was conducted using the inventory method of 40 CFR 61, Appendix D. A building nuclear materials inventory and the contents of a worst-case radioactive solid waste package (CR Vault HEPA filter package assay and sample counting report) were used to determine the maximum inventory. The nuclear materials inventory included 422 grams of residual plutonium and 15 grams of residual depleted uranium (U-238). Plutonium listed on the building nuclear materials inventory is assumed to be Pu-240. It is believed that the assumptions of this evaluation are very conservative. The results of the evaluation are presented on the attached sheet. The HEPA Filter filtration factor (0.01 given in Appendix D) was not used. The conclusion is that this stack is not DESIGNATED.

3.25.2 SOURCE TERM

RADIOISOTOPE	ACTIVITY LEVEL (Ci)
Co-60	8.37E-04
Sr-89/90	1.99E+01
Y-90	1.99E+01
Cs-137	4.59E-02
Eu-152/154/155	1.73E-02
U-238	5.04E-06
Pu-238	2.35E-04
Pu-239/240	4.25E-03
Pu-241	4.55E-02
Am-241	1.16E-03
Pu-240 ⁽¹⁾	9.58E+01

⁽¹⁾ Assumes residual at 209-E is Pu-240 and associated daughter products.

3.25.3 CALCULATION OF POTENTIAL OFFSITE DOSE

3.25.3.1 Scenario: 209-E Building nuclear materials inventory used as the source term. No HEPA filter factors are included in the calculations.

Potential offsite dose = 8.32E-04 mrem/yr

3.25.4 TANK STATUS: NON-DESIGNATED

Stack 296-P-31

BUILDING 209-E SOURCE TERM EMISSIONS

R-nuclide	Sum of Ci	CAP-88 c-factor	APP D factor	EDE (mrem/yr)	% of Total EDE	
14-C	.0000E+00	.2620E-02	1.E-06	0.000E+00	0.000E+00	1
60-Co	.8370E-03	.2900E-01	1.E-06	2.427E-08	2.919E-06	2
79-Se	.0000E+00	.4380E-01	1.E-06	0.000E+00	0.000E+00	3
89/90-Sr	.1990E+02	.4380E-01	1.E-06	8.716E-04	1.048E-01	4
90-Y	.1990E+02	.3770E-03	1.E-06	7.502E-06	9.023E-04	5
99-Tc	.0000E+00	.1090E-02	1.E-06	0.000E+00	0.000E+00	6
106-Ru/Rh	.0000E+00	.2090E-01	1.E+00	0.000E+00	0.000E+00	7
125-Sb	.0000E+00	.4150E-02	1.E-06	0.000E+00	0.000E+00	8
129-I	.0000E+00	.2910E+00	1.E+00	0.000E+00	0.000E+00	9
134-Cs	.0000E+00	.3130E-01	1.E-06	0.000E+00	0.000E+00	10
137-Cs	.4590E-01	.2390E-01	1.E-06	1.097E-06	1.319E-04	11
143-Cs	.0000E+00	.1370E-01	1.E-06	0.000E+00	0.000E+00	12
147-Pm	.0000E+00	.1140E-02	1.E-06	0.000E+00	0.000E+00	13
154-Eu	.1730E-01	.4380E-01	1.E-06	7.577E-07	9.113E-05	14
Nat-U	.5040E-05	.2840E+01	1.E-06	1.431E-08	1.721E-06	15
237-Np	.0000E+00	.1190E+02	1.E-06	0.000E+00	0.000E+00	16
238-Pu	.2350E-03	.8020E+01	1.E-06	1.885E-06	2.267E-04	17
239/240-Pu	.9580E+02	.8670E+01	1.E-06	8.306E-01	9.989E+01	18
241-Pu	.4550E-01	.1380E+00	1.E-06	6.279E-06	7.551E-04	19
241-Am	.1160E-02	.1310E+02	1.E-06	1.520E-05	1.828E-03	20
242/244-Cm	.0000E+00	.6940E+01	1.E-06	0.000E+00	0.000E+00	21
		TOTAL		8.315E-04	1.000E+02	

3.26 STACK 296-S-15

3.26.1 SYSTEM DESCRIPTION / CONFIGURATION

The 296-S-15 stack system ventilates 241-SX Tank Farm, tanks 101 through 112 and 114, providing negative pressure and removal of heat and vapor. The 241-SX Tank Farm is located south of the Plutonium Finishing Plant in the 200 West Area.

The 241-SX tanks are single-shell tanks, first used to contain waste in 1953. The tanks ventilated by the 296-S-15 stack system are each 1 M gallons.

Inlet air enters the ventilation system through heater/pre-filter/HEPA filter units at tanks 107-112 and 114. This air is exhausted through vent lines in each of these tanks through deentrainer/heater/pre-filter/HEPA filters/blowers and stack 296-S-15. Tanks 101-106 have no air inlet system but are maintained at negative pressure through a connection to the ventilation system at tank 109.

3.26.2 TANKS AND WASTE VOLUME

TANK	WASTE VOLUME (KGAL)	
	TANK TOTAL	PUMPABLE
241-SX-101	456	124
241-SX-102	543	177
241-SX-103	652	211
241-SX-104	614	195
241-SX-105	683	238
241-SX-106	538	233
241-SX-107	104	0
241-SX-108	115	0
241-SX-109	250	0
241-SX-110	62	0
241-SX-111	125	0
241-SX-112	92	0
241-SX-113	26	0
241-SX-114	181	0
241-SX-115	12	0
TOTAL	4453	1178

3.26.3 CALCULATION OF POTENTIAL OFFSITE DOSE

3.26.3.1 Scenario: The radioactivity in the supernatant in the waste and in the slurry/sludge in the SX Tank Farm is included in the calculation. No HEPA filter factors are included in the calculations.

3.26.4 Potential offsite dose = 270 mrem/yr
TANK STATUS: DESIGNATED

Stack 296-S-15

SX TANK FARM SOURCE TERM EMISSIONS (SUPERNATANT ONLY⁽¹⁾)

R-nuclide	Sum of Ci*	CAP-88 c-factor	APP D factor	EDE (mrem/yr)	% of Total EDE	
14-C	.8130E+03	.1650E-02	1.E-03	1.341E-03	4.975E-04	1
60-Co	.0000E+00	.1720E-01	1.E-03	0.000E+00	0.000E+00	2
79-Se	.8950E+02	.2600E-01	1.E-03	2.327E-03	8.629E-04	3
89/90-Sr	.6660E+07	.2600E-01	1.E-03	1.732E+02	6.421E+01	4
90-Y	.6660E+07	.2220E-03	1.E-03	1.479E+00	5.483E-01	5
99-Tc	.3100E+04	.6450E-03	1.E-03	2.000E-03	7.415E-04	6
106-Ru/Rh	.5580E-01	.1200E-01	1.E+00	6.696E-04	2.483E-05	7
125-Sb	.8370E+02	.2470E-02	1.E-03	2.067E-04	7.667E-05	8
129-I	.4580E+01	.1140E+00	1.E+00	5.221E-01	1.936E-01	9
134-Cs	.2170E+01	.1860E-01	1.E-03	4.036E-05	1.497E-05	10
137-Cs	.1900E+07	.1420E-01	1.E-03	2.698E+01	1.001E+01	11
144-Ce	.0000E+00	.8140E-02	1.E-03	0.000E+00	0.000E+00	12
147-Pm	.0000E+00	.6750E-03	1.E-03	0.000E+00	0.000E+00	13
154-Eu	.9490E+03	.2600E-01	1.E-03	2.467E-02	9.150E-03	14
Nat-U	.1070E+02	.1690E+01	1.E-03	1.808E-02	6.706E-03	15
237-Np	.3450E+01	.7050E+01	1.E-03	2.432E-02	9.020E-03	16
238-Pu	.1190E+03	.4760E+01	1.E-03	5.664E-01	2.101E-01	17
239/240-Pu	.2330E+04	.5150E+01	1.E-03	1.200E+01	4.450E+00	18
241-Pu	.2720E+04	.8170E-01	1.E-03	2.222E-01	8.241E-02	19
241-Am	.7010E+04	.7790E+01	1.E-03	5.461E+01	2.025E+01	20
242/244-Cm	.1290E+02	.4120E+01	1.E-03	5.315E-02	1.971E-02	21
TOTAL				2.697E+02	1.000E+02	

* - Decay-corrected to 9/93

⁽¹⁾ Total activity adjusted as data were available for specific tanks.

3.27 STACK 296-S-18

3.27.1 SYSTEM DESCRIPTION / CONFIGURATION

The 296-S-18 stack system ventilates the 242-S Evaporator building, providing a negative pressure with respect to external areas for the containment of radioactive material which may have escaped the primary evaporator vessel containment. The 242-S Evaporator building is located on the north side of the S-Tank Farm in the 200 West Area.

The 242-S Evaporator is designed to remove water from non-boiling, high level liquid waste in the nearby 241-SY Tank Farm. The 242-S Evaporator is now in shutdown-standby mode. The 296-S-18 stack system ventilates the 242-S pump room, evaporator room, and condenser room.

The ventilation system for the 242-S Evaporator building provides containment for certain radiologically controlled areas within the facility. Inlet air passes through pre-heater, pre-filter, heater, water scrubber, and blower systems. The inlet air is then split into four air trains, passed through additional heaters and ventilates the evaporator, pump, condenser and loading dock areas. Exhaust air passes through parallel systems consisting of pre-filter, two HEPA filters, and blower before being exhausted at the 296-S-18 stack.

3.27.2 CALCULATION OF SOURCE TERM

Radionuclide inventory is based on levels for "very high removable contamination" per WHC-CM-1-6 assuming worst case alpha (Am-241) and beta (Sr-90/Y-90) as representative nuclides. This level of contamination is conservatively assumed to be uniformly distributed over all ventilated surface areas.

NUCLIDE	TOTAL AREA (cm ²)	POSTULATED UNIT ACTIVITY (dpm /100 cm ²)	TOTAL ACTIVITY (Ci)
Am-241	2.11×10^{-7}	2,000	1.89×10^{-6}
Sr-90	2.11×10^{-7}	100,000	9.5×10^{-3}
Y-90	2.11×10^{-7}	100,000	9.5×10^{-3}

3.27.3 CALCULATION OF POTENTIAL OFFSITE DOSE

3.27.3.1 Scenario: Postulated Am-241, Sr-90/Y-90 inventories are included in the calculation. No HEPA filter factors are included in the calculations.

Potential offsite dose = 1.72×10^{-6} mrem/yr

3.27.4 TANK STATUS: NON-DESIGNATED

Stack 296-S-18

242-S EVAPORATOR BUILDING SOURCE TERM EMISSIONS

R-nuclide	Sum of Ci	CAP-88 c-factor	APP D factor	EDE (mrem/yr)	% of Total EDE	
14-C	.0000E+00	.1650E-02	1.E-03	0.000E+00	0.000E+00	1
60-Co	.0000E+00	.1720E-01	1.E-03	0.000E+00	0.000E+00	2
79-Se	.0000E+00	.2600E-01	1.E-03	0.000E+00	0.000E+00	3
89/90-Sr	.9500E-02	.2600E-01	1.E-03	2.470E-07	1.435E+01	4
90-Y	.9500E-02	.2220E-03	1.E-03	2.109E-09	1.225E-01	5
99-Tc	.0000E+00	.6450E-03	1.E-03	0.000E+00	0.000E+00	6
106-Ru/Rh	.0000E+00	.1200E-01	1.E+00	0.000E+00	0.000E+00	7
125-Sb	.0000E+00	.2470E-02	1.E-03	0.000E+00	0.000E+00	8
129-I	.0000E+00	.1140E+00	1.E+00	0.000E+00	0.000E+00	9
134-Cs	.0000E+00	.1860E-01	1.E-03	0.000E+00	0.000E+00	10
137-Cs	.0000E+00	.1420E-01	1.E-03	0.000E+00	0.000E+00	11
143-Ce	.0000E+00	.8140E-02	1.E-03	0.000E+00	0.000E+00	12
147-Pm	.0000E+00	.6750E-03	1.E-03	0.000E+00	0.000E+00	13
154-Eu	.0000E+00	.2600E-01	1.E-03	0.000E+00	0.000E+00	14
Nat-U	.0000E+00	.1690E+01	1.E-03	0.000E+00	0.000E+00	15
237-Np	.0000E+00	.7050E+01	1.E-03	0.000E+00	0.000E+00	16
238-Pu	.0000E+00	.4760E+01	1.E-03	0.000E+00	0.000E+00	17
239/240-Pu	.0000E+00	.5150E+01	1.E-03	0.000E+00	0.000E+00	18
241-Pu	.0000E+00	.8170E-01	1.E-03	0.000E+00	0.000E+00	19
241-Am	.1890E-03	.7790E+01	1.E-03	1.472E-06	8.553E+01	20
242/244-Cm	.0000E+00	.4120E+01	1.E-03	0.000E+00	0.000E+00	21
TOTAL				1.721E-06	1.000E+02	

Inventory based on "High Contamination Area" definition in WHC-CM-1-6

3.28 STACK 296-S-22

3.28.1 SYSTEM DESCRIPTION / CONFIGURATION

The 296-S-22 stack system ventilates the 244-S Catch Station tank and annulus, providing negative pressure. The 244-S Catch Station is located south of the 241-SY Tank Farms in the 200 West area.

The 244-S Catch Station is a double-contained receiver tank (DCRT) used to transfer liquid waste from 241-S and 241-SX salt wells to the 241-SY Tank Farm. The 244-S Catch Station started operation in 1975.

The catch tank is a stainless steel vessel with maximum volume of 19,000 gallons and limited to an operational limit of 16,213 gallons. The catch tank and the concrete pit containing the tank define the annulus space. The volumen of the pit minus the volume of the tank equals the volume of the annulus space. The pit containing the catch tank constitutes secondary containment for the Station. The catch tank and annulus are ventilated by the 296-S-22 system. Air used to ventilate the tank and annulus is drawn in through heater, pre-filter, HEPA filter. The air train is split into two trains, with the annulus receiving 80 percent of the airflow and the tank receiving 20 percent. Air which is withdrawn from the tank and annulus passes through a heater and parallel trains of two HEPA filters in series (2 x 2) before being exhausted through the 296-S-22 stack. The exhaustor is operated only when the temperature of the waste is above a specific temperature and/or during the transfer of any waste through the facility.

3.28.2 TANKS AND WASTE VOLUME

TANK	WASTE VOLUME (KGAL)	
	TANK TOTAL	PUMPABLE
241-S-101	427	90
241-S-103	248	79
241-S-106	543	162
241-S-107	368	44
241-S-108	604	105
241-S-109	568	119
241-S-110	390	103
241-S-111	596	134
241-S-112	637	112
241-SX-101	456	124
241-SX-102	543	177
241-SX-103	652	211

WASTE VOLUME (KGAL)		
TANK	TANK TOTAL	PUMPABLE
241-SX-104	614	195
241-SX-105	683	238
TOTAL	7,329	1,893

3.28.3 CALCULATION OF POTENTIAL OFFSITE DOSE

Refer to Section 2.4, Pages 7-9, for the definitions and examples of *static* and *dynamic* situations.

3.28.3.1 Scenario #1: Transfer waste from tanks S-101, 103, and 106 through 110 through this DCRT. No HEPA filter factors are included in the calculations.

Potential offsite doses:

Static: $[(14.7 \text{ mrem/yr})(16.2 \text{ Kgal}/702 \text{ Kgal})]$
 $= 0.34 \text{ mrem/yr}$

Dynamic: $[(14.7 \text{ mrem/yr})(16.2 \text{ Kgal}/702 \text{ Kgal})]$
 $\times (702 \text{ Kgal}) / [(0.5\text{E-}3 \text{ Kgal/min})(60 \text{ min/hr})]$
 $\times (24 \text{ hrs/d})(365 \text{ d/yr})]$
 $= 0.906 \text{ mrem over 2.7 years}$

3.28.3.2 Scenario #2: Transfer of waste from tanks S-111 and 112 and from SX-101 through 105. No HEPA filter factors are included in the calculations.

Potential offsite doses:

Static: $[(6.94\text{E}+01 \text{ mrem/yr})(16.2 \text{ Kgal}/1190 \text{ Kgal})]$
 $= 0.95 \text{ mrem/yr}$

Dynamic: $[(6.94\text{E}+01 \text{ mrem/yr})(16.2 \text{ Kgal}/1190 \text{ Kgal})]$
 $\times (1190 \text{ Kgal}) / [(0.5\text{E-}3 \text{ Kgal/min})(60 \text{ min/hr})]$
 $\times (24 \text{ hrs/d})(365 \text{ d/yr})]$
 $= 4.28 \text{ mrem over 4.5 years}$

3.28.4 TANK STATUS: NON-DESIGNATED ⁽¹⁾

- ⁽¹⁾ This transfer system may be determined to be designated in the future depending on when and which waste is scheduled to be sent through it. The earliest scheduled transfer for waste that would put the stack into a designated mode is from tanks S-101, 103, and 106 through 110 or the waste from tanks S-111 and 112 and from SX-101 through 105. These transfers are both scheduled to be initiated in June 1997 and are represented by Scenario #1 and #2, respectively.

Stack 296-S-22 / Scenario #1

244-S DCRT SOURCE TERM EMISSIONS - (S-101,103, 106 through 110)

R-nuclide	Sum of Ci*	CAP-88 c-factor	APP D factor	EDE (mrem/yr)	% of Total EDE	
14-C	.6460E-06	.1650E-02	1.E-03	1.066E-12	7.254E-12	1
60-Co	.0000E+00	.1720E-01	1.E-03	0.000E+00	0.000E+00	2
79-Se	.3190E-08	.2600E-01	1.E-03	8.294E-14	5.645E-13	3
89/90-Sr	.2730E+06	.2600E-01	1.E-03	7.098E+00	4.831E+01	4
90-Y	.2730E+06	.2220E-03	1.E-03	6.061E-02	4.125E-01	5
99-Tc	.1290E-06	.6450E-03	1.E-03	8.321E-14	5.663E-13	6
106-Ru/Rh	.1220E-01	.1200E-01	1.E+00	1.464E-04	9.963E-04	7
125-Sb	.0000E+00	.2470E-02	1.E-03	0.000E+00	0.000E+00	8
129-I	.2240E-09	.1140E+00	1.E+00	2.554E-11	1.738E-10	9
134-Cs	.1270E+01	.1860E-01	1.E-03	2.362E-05	1.608E-04	10
137-Cs	.2820E+06	.1420E-01	1.E-03	4.004E+00	2.725E+01	11
144-Ce	.0000E+00	.8140E-02	1.E-03	0.000E+00	0.000E+00	12
147-Pm	.0000E+00	.6750E-03	1.E-03	0.000E+00	0.000E+00	13
154-Eu	.0000E+00	.2600E-01	1.E-03	0.000E+00	0.000E+00	14
Nat-U	.9460E-02	.1690E+01	1.E-03	1.599E-05	1.088E-04	15
237-Np	.2240E-05	.7050E+01	1.E-03	1.579E-08	1.075E-07	16
238-Pu	.6190E-01	.4760E+01	1.E-03	2.946E-04	2.005E-03	17
239/240-Pu	.6850E+03	.5150E+01	1.E-03	3.528E+00	2.401E+01	18
241-Pu	.7760E+00	.3170E-01	1.E-03	6.340E-05	4.315E-04	19
241-Am	.3190E+00	.7790E+01	1.E-03	2.485E-03	1.691E-02	20
242/244-Cm	.1350E-04	.4120E+01	1.E-03	5.562E-08	3.785E-07	21
TOTAL				1.469E+01	1.000E+02	

* - Decay-corrected to 9/93

Static: $\{(14.7 \text{ mrem/yr})(16.2 \text{ Kgal/702 Kgal})\} = 0.34 \text{ mrem/yr}$

Dynamic: $\{(14.7 \text{ mrem/yr})(16.2 \text{ Kgal/702 Kgal})\}$
 $\times (702 \text{ Kgal}) / \{(0.5\text{E-}3 \text{ Kgal/min})(60 \text{ min/hr})\}$
 $\times (24 \text{ hrs/d})(365 \text{ d/yr})\}$
 $= 0.906 \text{ mrem over 2.67 years}$

Stack 296-S-22 - Scenario #2

244-S DCRT SOURCE TERM EMISSIONS - (S-111, 112 / SX-101 through 105)

R-nuclide	Sum of Ci*	CAP-88 c-factor	APP D factor	EDE (mrem/yr)	% of Total EDE	
14-C	.4570E+03	.1650E-02	1.E-03	7.541E-04	1.087E-03	1
60-Co	.0000E+00	.1720E-01	1.E-03	0.000E+00	0.000E+00	2
79-Se	.4080E+02	.2600E-01	1.E-03	1.061E-03	1.529E-03	3
89/90-Sr	.1230E+07	.2600E-01	1.E-03	3.198E+01	4.608E+01	4
90-Y	.1230E+07	.2220E-03	1.E-03	2.731E-01	3.935E-01	5
99-Tc	.1310E+04	.6450E-03	1.E-03	8.450E-04	1.218E-03	6
106-Ru/Rh	.3100E-04	.1200E-01	1.E+00	3.720E-07	5.360E-08	7
125-Sb	.0000E+00	.2470E-02	1.E-03	0.000E+00	0.000E+00	8
129-I	.2140E+01	.1140E+00	1.E+00	2.440E-01	3.515E-01	9
134-Cs	.0000E+00	.1860E-01	1.E-03	0.000E+00	0.000E+00	10
137-Cs	.1730E+07	.1420E-01	1.E-03	2.457E+01	3.540E+01	11
144-Ce	.0000E+00	.8140E-02	1.E-03	0.000E+00	0.000E+00	12
147-Pm	.0000E+00	.6750E-03	1.E-03	0.000E+00	0.000E+00	13
154-Eu	.0000E+00	.2600E-01	1.E-03	0.000E+00	0.000E+00	14
Nat-U	.3500E+00	.1690E+01	1.E-03	5.915E-04	8.523E-04	15
237-Np	.1570E+01	.7050E+01	1.E-03	1.107E-02	1.595E-02	16
238-Pu	.1290E+02	.4760E+01	1.E-03	6.140E-02	8.848E-02	17
239/240-Pu	.7680E+02	.5150E+01	1.E-03	3.955E-01	5.699E-01	18
241-Pu	.5340E+02	.8170E-01	1.E-03	4.363E-03	6.286E-03	19
241-Am	.1520E+04	.7790E+01	1.E-03	1.184E+01	1.706E+01	20
242/244-Cm	.4840E+01	.4120E+01	1.E-03	1.994E-02	2.873E-02	21
TOTAL				6.940E+01	1.000E+02	

* - Decay-corrected to 9/93

Static: $[(6.94E+01 \text{ mrem/yr})(16.2 \text{ Kgal/1190 Kgal})] = 0.95 \text{ mrem/yr}$

Dynamic: $[(6.94E+01 \text{ mrem/yr})(16.2 \text{ Kgal/1190 Kgal})]$
 $\times (1190 \text{ Kgal}) / [(0.5E-3 \text{ Kgal/min})(60 \text{ min/hr})]$
 $\times (24 \text{ hrs/d})(365 \text{ d/yr})]$
 $= 4.28 \text{ mrem over 4.5 years}$

3.29 STACK 296-T-17

3.29.1 SYSTEM DESCRIPTION / CONFIGURATION

The 296-T-17 stack system ventilates the 242-T Evaporator building, providing a negative pressure with respect to external areas for the containment of radioactive materials which may have escaped the primary evaporator vessel containment. The 242-T Evaporator building is located north of the Plutonium Finishing Plant in the 200 West Area.

The 242-T Evaporator was designed to remove water from non-boiling, high level liquid waste in the nearby single-shell tank farms. The 242-T Evaporator is now in shutdown-standby mode.

The 296-T-17 stack system ventilates the 242-T pump room, evaporator room, and condenser room. Inlet air passes through pre-heater, pre-filter, heater, water scrubber, and blower systems. The inlet air is then split into four air trains, passed through additional heaters and ventilates the evaporator, pump, condenser, loadout and loading dock areas. Exhaust air passes through parallel systems consisting of pre-filter, two HEPA filters in series, and blower before being exhausted at the 296-T-17 stack.

3.29.2 CALCULATION OF SOURCE TERM

Radionuclide inventory is based on levels for "very high removable contamination" per WHC-CM-1-6 assuming worst case alpha (Am-241) and beta (Sr-90/Y-90) as representative nuclides. This level of contamination is conservatively assumed to be uniformly distributed over all ventilated surface areas.

NUCLIDE	TOTAL AREA (cm ²)	POSTULATED UNIT ACTIVITY (dpm /100 cm ²)	TOTAL ACTIVITY (Ci)
Am-241	1.14×10^7	2,000	1.0×10^{-4}
Sr-90	1.14×10^7	100,000	5.1×10^{-3}
Y-90	1.14×10^7	100,000	5.1×10^{-3}

3.29.3 CALCULATION OF POTENTIAL OFFSITE DOSE

3.29.3.1 Scenario: Postulated Am-241, Sr-90/Y-90 inventories are included in the calculation. No HEPA filter factors are included in the calculations.

$$\text{Potential offsite dose} = 9.1 \times 10^{-7} \text{ mrem/yr}$$

3.29.4 TANK STATUS: NON-DESIGNATED

Stack 296-T-17

242-T EVAPORATOR BUILDING SOURCE TERM EMISSIONS

R-nuclide	Sum of Ci	CAP-88 c-factor	APP D factor	EDE (mrem/yr)	% of Total EDE	
14-C	.0000E+00	.1650E-02	1.E-03	0.000E+00	0.000E+00	1
60-Co	.0000E+00	.1720E-01	1.E-03	0.000E+00	0.000E+00	2
79-Se	.0000E+00	.2600E-01	1.E-03	0.000E+00	0.000E+00	3
89/90-Sr	.5100E-02	.2600E-01	1.E-03	1.326E-07	1.453E+01	4
90-Y	.5100E-02	.2220E-03	1.E-03	1.132E-09	1.240E-01	5
99-Tc	.0000E+00	.6450E-03	1.E-03	0.000E+00	0.000E+00	6
106-Ru/Rh	.0000E+00	.1200E-01	1.E+00	0.000E+00	0.000E+00	7
125-Sb	.0000E+00	.2470E-02	1.E-03	0.000E+00	0.000E+00	8
129-I	.0000E+00	.1140E+00	1.E+00	0.000E+00	0.000E+00	9
134-Cs	.0000E+00	.1860E-01	1.E-03	0.000E+00	0.000E+00	10
137-Cs	.0000E+00	.1420E-01	1.E-03	0.000E+00	0.000E+00	11
143-Ce	.0000E+00	.8140E-02	1.E-03	0.000E+00	0.000E+00	12
147-Pm	.0000E+00	.6750E-03	1.E-03	0.000E+00	0.000E+00	13
154-Eu	.0000E+00	.2600E-01	1.E-03	0.000E+00	0.000E+00	14
Nat-U	.0000E+00	.1690E+01	1.E-03	0.000E+00	0.000E+00	15
237-Np	.0000E+00	.7050E+01	1.E-03	0.000E+00	0.000E+00	16
238-Pu	.0000E+00	.4760E+01	1.E-03	0.000E+00	0.000E+00	17
239/240-Pu	.0000E+00	.5150E+01	1.E-03	0.000E+00	0.000E+00	18
241-Pu	.0000E+00	.8170E-01	1.E-03	0.000E+00	0.000E+00	19
241-Am	.1000E-03	.7790E+01	1.E-03	7.790E-07	8.535E+01	20
242/244-Cm	.0000E+00	.4120E+01	1.E-03	0.000E+00	0.000E+00	21
TOTAL				9.127E-07	1.000E+02	

Inventory based on "High Contamination Area" definition in WHC-CM-1-6

3.30 STACK 296-T-18

3.30.1 SYSTEM DESCRIPTION / CONFIGURATION

The 296-T-18 stack system ventilates the 244-TX Catch Station tank and annulus, providing negative pressure. The 244-TX Catch Station is located north of the 241-TX Tank Farm in the 200 West Area.

The 244-TX Catch Station is a double-contained receiver tank (DCRT) used to transfer liquid waste from the Plutonium Finishing Plant and from single-shell tanks in the 241-T, 241-TX, and 241-TY Tank Farms to the 241-SY Tank Farm.

The catch tank is a stainless steel vessel with maximum volume of 31,000 gallons and is limited to an operational volume of 26,000 gallons. The pit containing the catch tank, with a volume of 85,000 gallons, constitutes secondary containment for the Station. The catch tank and the concrete pit containing the tank define the annulus space. The ventilation system draws in air through a heater, pre-filter and HEPA filter. This air train is split into two trains which ventilate the catch tank and annulus. Air withdrawn from these two volumes passes through one or two of the three parallel systems, each containing a pre-filter and two HEPA filters in series. Air is exhausted through the 296-T-18 stack. The exhauster is operated only when the temperature of the waste is above a specific temperature and/or during any transfer of waste through the facility.

3.30.2 TANKS AND WASTE VOLUME

TANK	WASTE VOLUME (KGAL)	
	TANK TOTAL	PUMPABLE
241-T-102	32	13
241-T-104	445	44
241-T-107	180	16
241-T-110	379	36
241-T-111	458	45
241-T-112	67	7
TOTAL	1,561	161

3.30.3 CALCULATION OF POTENTIAL OFFSITE DOSE

Refer to Section 2.4, Pages 7-9, for the definitions and examples of *static* and *dynamic* situations.

3.30.3.1 Scenario #1: Transfer of waste from tank T-107 through this DCRT. No HEPA filter factors are included in the calculations.

Potential offsite doses:

Static: $[(1.76\text{E-}1 \text{ mrem/yr})(16 \text{ Kgal}/16 \text{ Kgal})]$
 $= 0.176 \text{ mrem/yr}$

Dynamic: $[(1.75\text{E-}1 \text{ mrem/yr})(16 \text{ Kgal}/16 \text{ Kgal})]$
 $\times (16 \text{ Kgal})/[(0.5\text{E-}3 \text{ Kgal/min})(60 \text{ min/hr})]$
 $\times (24 \text{ hr/d})(365 \text{ d/yr})]$
 $= 0.011 \text{ mrem over 22 days}$

- 3.30.3.2 Scenario #2: Transfer of waste from tanks T-104, 111, 102, and 112 through this DCRT. No HEPA filter factors are included in the calculations.

Potential offsite doses:

Static: $[(3.41\text{E-}1 \text{ mrem/yr})(26 \text{ Kgal}/109 \text{ Kgal})]$
 $= 8.14\text{E-}2 \text{ mrem/yr}$

Dynamic: $[(3.41\text{E-}1 \text{ mrem/yr})(26 \text{ Kgal}/109 \text{ Kgal})]$
 $\times [109 \text{ Kgal}]/[(0.5\text{E-}3 \text{ Kgal/min})(60 \text{ min/hr})]$
 $\times (24 \text{ hr/d})(365 \text{ d/yr})]$
 $= 3.38\text{E-}2 \text{ mrem over 151 days}$

- 3.30.3.3 Scenario #3: Transfer of waste from tank T-110 through this DCRT. No HEPA filter factors are included in the calculations.

Potential offsite doses:

Static: $[(1.23\text{E-}1 \text{ mrem/yr})(26 \text{ Kgal}/36 \text{ Kgal})]$
 $= 8.88\text{E-}2 \text{ mrem/yr}$

Dynamic: $[(1.23\text{E-}1 \text{ mrem/yr})(26 \text{ Kgal}/36 \text{ Kgal})]$
 $\times (36 \text{ Kgal})/[(0.5\text{E-}3 \text{ Kgal/min})(60 \text{ min/hr})]$
 $\times (24 \text{ hr/d})(365 \text{ d/yr})]$
 $= 1.22 \text{ E-}2 \text{ mrem over 50 days}$

3.30.4 TANK STATUS: NON-DESIGNATED⁽¹⁾

- ⁽¹⁾ This transfer system may be determined to be designated in the future depending on when and which waste is scheduled to be sent through it. The earliest scheduled transfer for waste that would put the stack into a designated mode is from tank T-107. This transfer is scheduled to be initiated in April 1998 and is represented by Scenario #1.

Stack 296-T-18 / Scenario #1
244-TX DCRT SOURCE TERM EMISSIONS - (T-107)

R-nuclide	Sum of Ci*	CAP-88 c-factor	APP D factor	EDE (mrem/yr)	% of Total EDE	
14-C	.0000E+00	.1650E-02	1.E-03	0.000E+00	0.000E+00	1
60-Co	.0000E+00	.1720E-01	1.E-03	0.000E+00	0.000E+00	2
79-Se	.0000E+00	.2600E-01	1.E-03	0.000E+00	0.000E+00	3
89/90-Sr	.4560E+04	.2600E-01	1.E-03	1.186E-01	6.745E+01	4
90-Y	.4560E+04	.2220E-03	1.E-03	1.012E-03	5.759E-01	5
99-Tc	.0000E+00	.6450E-03	1.E-03	0.000E+00	0.000E+00	6
106-Ru/Rh	.0000E+00	.1200E-01	1.E+00	0.000E+00	0.000E+00	7
125-Sb	.1510E+03	.2470E-02	1.E-03	3.730E-04	2.122E-01	8
129-I	.0000E+00	.1140E+00	1.E+00	0.000E+00	0.000E+00	9
134-Cs	.0000E+00	.1860E-01	1.E-03	0.000E+00	0.000E+00	10
137-Cs	.3840E+04	.1420E-01	1.E-03	5.453E-02	3.102E+01	11
144-Ce	.1030E+03	.8140E-02	1.E-03	8.384E-04	4.770E-01	12
147-Pm	.0000E+00	.6750E-03	1.E-03	0.000E+00	0.000E+00	13
154-Eu	.0000E+00	.2600E-01	1.E-03	0.000E+00	0.000E+00	14
Nat-U	.0000E+00	.1690E+01	1.E-03	0.000E+00	0.000E+00	15
237-Np	.0000E+00	.7050E+01	1.E-03	0.000E+00	0.000E+00	16
238-Pu	.0000E+00	.4760E+01	1.E-03	0.000E+00	0.000E+00	17
239/240-Pu	.3600E-01	.5150E+01	1.E-03	1.854E-04	1.055E-01	18
241-Pu	.0000E+00	.8170E-01	1.E-03	0.000E+00	0.000E+00	19
241-Am	.3600E-01	.7790E+01	1.E-03	2.804E-04	1.595E-01	20
242/244-Cm	.0000E+00	.4120E+01	1.E-03	0.000E+00	0.000E+00	21

TOTAL

1.758E-01 1.000E+02

* - Decay-corrected to 9/93

Static: $[(1.76E-1 \text{ mrem/yr})(16 \text{ Kgal/16 Kgal})] = 0.176 \text{ mrem/yr}$

Dynamic: $[(1.75E-1 \text{ mrem/yr})(16 \text{ Kgal/16 Kgal})]$
 $\times (16 \text{ Kgal}) / [(0.5E-3 \text{ Kgal/min})(60 \text{ min/hr})]$
 $\times (24 \text{ hr/d})(365 \text{ d/yr})]$
 $= 0.011 \text{ mrem over 22 days}$

Stack 296-T-18 / Scenario #2
244-TX DCRT SOURCE TERM EMISSIONS - (T-104, T-111, T-102, T-112)

R-nuclide	Sum of Ci*	CAP-88 c-factor	APP D factor	EDE (mrem/yr)	% of Total EDE	
14-C	.4060E+00	.1650E-02	1.E-03	6.699E-07	1.963E-04	1
60-Co	.0000E+00	.1720E-01	1.E-03	0.000E+00	0.000E+00	2
79-Se	.1650E-01	.2600E-01	1.E-03	4.290E-07	1.257E-04	3
89/90-Sr	.8430E+03	.2600E-01	1.E-03	2.192E-02	6.424E+00	4
90-Y	.8430E+03	.2220E-03	1.E-03	1.871E-04	5.485E-02	5
99-Tc	.4060E+00	.6450E-03	1.E-03	2.619E-07	7.675E-05	6
106-Ru/Rh	.1150E-06	.1200E-01	1.E+00	1.380E-09	4.044E-08	7
125-Sb	.0000E+00	.2470E-02	1.E-03	0.000E+00	0.000E+00	8
129-I	.8120E-03	.1140E+00	1.E+00	9.257E-05	2.713E-02	9
134-Cs	.0000E+00	.1860E-01	1.E-03	0.000E+00	0.000E+00	10
137-Cs	.1720E+03	.1420E-01	1.E-03	2.442E-03	7.158E-01	11
144-Ce	.0000E+00	.8140E-02	1.E-03	0.000E+00	0.000E+00	12
147-Pm	.0000E+00	.6750E-03	1.E-03	0.000E+00	0.000E+00	13
154-Eu	.1760E+03	.2600E-01	1.E-03	4.576E-03	1.341E+00	14
Nat-U	.1440E-01	.1690E+01	1.E-03	2.434E-05	7.132E-03	15
237-Np	.4060E-03	.7050E+01	1.E-03	2.862E-06	8.389E-04	16
238-Pu	.1980E-03	.4760E+01	1.E-03	9.425E-07	2.762E-04	17
239/240-Pu	.5900E+02	.5150E+01	1.E-03	3.039E-01	8.905E+01	18
241-Pu	.7690E-06	.8170E-01	1.E-03	6.283E-11	1.841E-08	19
241-Am	.1040E+01	.7790E+01	1.E-03	8.102E-03	2.374E+00	20
242/244-Cm	.2860E-02	.4120E+01	1.E-03	1.178E-05	3.453E-03	21

TOTAL

3.412E-01 1.000E+02

* - Decay-corrected to 9/93

Static: [(3.41E-1 mrem/yr)(26 Kgal/109 Kgal)]
= 8.14E-2 mrem/yr

Dynamic: [(3.41E-1 mrem/yr)(26 Kgal/109 Kgal)]
x (109 Kgal)/[(0.5E-3 Kgal/min)(60 min/hr)]
x (24 hr/d)(365 d/yr)]
= 3.38E-2 mrem over 151 days

Stack 296-T-18 / Scenario #3

244-TX DCRT SOURCE TERM EMISSIONS - (T-110)

R-nuclide	Sum of Ci*	CAP-88 c-factor	APP D factor	EDE (mrem/yr)	% of Total EDE	
14-C	.1900E-12	.1650E-02	1.E-03	3.135E-19	2.549E-16	1
60-Co	.0000E+00	.1720E-01	1.E-03	0.000E+00	0.000E+00	2
79-Se	.2820E-12	.2600E-01	1.E-03	7.332E-18	5.961E-15	3
89/90-Sr	.3590E+03	.2600E-01	1.E-03	9.334E-03	7.589E+00	4
90-Y	.3590E+03	.2220E-03	1.E-03	7.970E-05	6.480E-02	5
99-Tc	.9500E-11	.6450E-03	1.E-03	6.128E-18	4.982E-15	6
106-Ru/Rh	.1490E-09	.1200E-01	1.E+00	1.788E-12	1.454E-10	7
125-Sb	.0000E+00	.2470E-02	1.E-03	0.000E+00	0.000E+00	8
129-I	.7700E-14	.1140E+00	1.E+00	8.778E-16	7.137E-13	9
134-Cs	.0000E+00	.1860E-01	1.E-03	0.000E+00	0.000E+00	10
137-Cs	.1750E-07	.1420E-01	1.E-03	2.485E-13	2.020E-10	11
144-Ce	.0000E+00	.8140E-02	1.E-03	0.000E+00	0.000E+00	12
147-Pm	.0000E+00	.6750E-03	1.E-03	0.000E+00	0.000E+00	13
154-Eu	.0000E+00	.2600E-01	1.E-03	0.000E+00	0.000E+00	14
Nat-U	.1900E-01	.1690E+01	1.E-03	3.211E-05	2.611E-02	15
237-Np	.6670E-05	.7050E+01	1.E-03	4.702E-08	3.823E-05	16
238-Pu	.3850E-01	.4760E+01	1.E-03	1.833E-04	1.490E-01	17
239/240-Pu	.2080E+02	.5150E+01	1.E-03	1.071E-01	8.709E+01	18
241-Pu	.3080E+01	.8170E-01	1.E-03	2.516E-04	2.046E-01	19
241-Am	.7700E+00	.7790E+01	1.E-03	5.998E-03	4.877E+00	20
242/244-Cm	.2260E-08	.4120E+01	1.E-03	9.311E-12	7.570E-09	21
TOTAL				1.230E-01	1.000E+02	

* - Decay-corrected to 9/93

Static: $[(1.23E-1 \text{ mrem/yr})(26 \text{ Kgal}/36 \text{ Kgal})] = 8.88E-2 \text{ mrem/yr}$

Dynamic: $[(1.23E-1 \text{ mrem/yr})(26 \text{ Kgal}/36 \text{ Kgal})]$
 $\times (36 \text{ Kgal}) / [(0.5E-3 \text{ Kgal/min})(60 \text{ min/hr})]$
 $\times (24 \text{ hr/d})(365 \text{ d/yr})]$
 $= 1.22 E-2 \text{ mrem over 50 days}$

3.31 STACK 296-U-11

3.31.1 SYSTEM DESCRIPTION / CONFIGURATION

The 296-U-11 stack system will be used to ventilate the 244-U Catch Station tank and annulus providing containment of airborne radioactive materials. The 244-U Catch Station is located adjacent to the U-Tank Farm in the 200 West Area.

The 244-U Catch Station is a double-contained receiver tank (DCRT) which has never been used, but is scheduled to begin pre-startup activities in FY 1994. The Catch Station will be used to transfer waste from single-shell tanks in the 241-U Tank Farm to double-shell tanks in the 241-SY Tank Farm.

Design review of the system is currently being done. The DCRT is expected to retain a design similar to that of the 244-TX system. The exhaustor will be operated only when the temperature of the waste is above a specific temperature and/or during the transfer of waste through the facility.

3.31.2 TANKS AND WASTE VOLUME

TANK	WASTE VOLUME (KGAL)	
	TANK TOTAL	PUMPABLE
241-U-102	374	122
241-U-103	468	166
241-U-105	418	157
241-U-106	226	61
241-U-107	406	156
241-U-108	468	174
241-U-109	463	160
241-U-110	186	9
241-U-111	329	99
TOTAL	3,338	1,104

3.31.3 CALCULATION OF POTENTIAL OFFSITE DOSE

Refer to Section 2.4, Pages 7-9, for the definitions and examples of *static* and *dynamic* situations.

3.31.3.1 Scenario #1: Transfer of waste from tanks U-102 and 110 through this DCRT. No HEPA filter factors are included in the calculations.

Potential offsite doses:

$$\text{Static: } [(1.871 \text{ mrem/yr})(26 \text{ Kgal}/131 \text{ Kgal})] \\ = 0.371 \text{ mrem/yr}$$

$$\text{Dynamic: } [(1.871 \text{ mrem/yr})(26 \text{ Kgal}/131 \text{ Kgal})] \\ \times (131 \text{ Kgal}) / [(0.5\text{E-}3 \text{ Kgal/min})(60 \text{ min/hr})] \\ \times (24 \text{ hrs/d})(365 \text{ d/yr}) \\ = 0.185 \text{ mrem over 182 days}$$

- 3.31.3.2 Scenario #2: Transfer of waste from tanks U-103, 105, 108, and 109 through this DCRT. No HEPA filter factors are included in the calculations.

Potential offsite doses:

$$\text{Static: } [(5.831\text{E-}1 \text{ mrem/yr})(26 \text{ Kgal}/657 \text{ Kgal})] \\ = 2.31 \text{ E-}2 \text{ mrem/yr}$$

$$\text{Dynamic: } [(5.831\text{E-}1 \text{ mrem/yr})(26 \text{ Kgal}/657 \text{ Kgal})] \\ \times (657 \text{ Kgal}) / (0.5\text{E-}3 \text{ Kgal/min})(60 \text{ min/hr}) \\ \times (24 \text{ hrs/d})(365 \text{ d/yr}) \\ = 5.77\text{E-}2 \text{ mrem over 2.5 years}$$

- 3.31.3.3 Scenario #3: Transfer of waste from tanks U-106, 107, and 111 through this DCRT. No HEPA filter factors are included in the calculations.

Potential offsite doses:

$$\text{Static: } [(5.143\text{E-}1 \text{ mrem/yr})(26 \text{ Kgal}) / (316 \text{ Kgal})] = 4.23\text{E-}2 \text{ mrem/yr}$$

$$\text{Dynamic: } [(5.143\text{E-}1 \text{ mrem/yr})(26 \text{ Kgal}) / (316 \text{ Kgal})] \\ \times (316 \text{ Kgal}) / (0.5\text{E-}3 \text{ Kgal/min})(60 \text{ min/hr}) \\ \times (24 \text{ hrs/d})(365 \text{ d/yr}) \\ = 5.09\text{E-}2 \text{ mrem over 1.2 years}$$

- 3.31.4 TANK STATUS: NON-DESIGNATED ⁽¹⁾

⁽¹⁾ This transfer system may be determined to be designated in the future depending on when and which waste is scheduled to be sent through it. The earliest scheduled transfer for waste that would put the stack into a designated mode is from tanks U-102 and 110. This transfer is scheduled to be initiated in April 1995 and is represented by Scenario #1.

Stack 296-U-11 / Scenario #1

244-U DCRT SOURCE TERM EMISSIONS - (U-102, U110)

R-nuclide	Sum of Ci	CAP-88 c-factor	APP D factor	EDE (mrem/yr)	% of Total EDE	
14-C	.1240E-01	.1650E-02	1.E-03	2.046E-08	1.093E-06	1
60-Co	.1150E+03	.1720E-01	1.E-03	1.978E-03	1.057E-01	2
79-Se	.4390E-03	.2600E-01	1.E-03	1.141E-08	6.099E-07	3
89/90-Sr	.3450E+05	.2600E-01	1.E-03	8.970E-01	4.793E+01	4
90-Y	.3450E+05	.2220E-03	1.E-03	7.659E-03	4.093E-01	5
99-Tc	.1460E-01	.6450E-03	1.E-03	9.417E-09	5.032E-07	6
106-Ru/Rh	.9700E-02	.1200E-01	1.E+00	1.164E-04	6.220E-03	7
125-Sb	.0000E+00	.2470E-02	1.E-03	0.000E+00	0.000E+00	8
129-I	.2530E-04	.1140E+00	1.E+00	2.884E-06	1.541E-04	9
134-Cs	.0000E+00	.1860E-01	1.E-03	0.000E+00	0.000E+00	10
137-Cs	.5470E+05	.1420E-01	1.E-03	7.767E-01	4.151E+01	11
144-Ce	.1150E-02	.8140E-02	1.E-03	9.361E-09	5.002E-07	12
147-Pm	.0000E+00	.6750E-03	1.E-03	0.000E+00	0.000E+00	13
154-Eu	.7490E+03	.2600E-01	1.E-03	1.947E-02	1.041E+00	14
Nat-U	.1460E+01	.1690E+01	1.E-03	2.467E-03	1.319E-01	15
237-Np	.9300E-04	.7050E+01	1.E-03	6.557E-07	3.504E-05	16
238-Pu	.1990E+01	.4760E+01	1.E-03	9.472E-03	5.062E-01	17
239/240-Pu	.3020E+02	.5150E+01	1.E-03	1.555E-01	8.311E+00	18
241-Pu	.1200E+02	.8170E-01	1.E-03	9.804E-04	5.239E-02	19
241-Am	.9840E-03	.7790E+01	1.E-03	7.665E-06	4.096E-04	20
242/244-Cm	.1370E-04	.4120E+01	1.E-03	5.644E-08	3.016E-06	21
TOTAL				1.871E+03	1.000E+02	

* - Decay-corrected to 9/93

Static: $[(1.871 \text{ mrem/yr})(26 \text{ Kgal/131 Kgal})] = 0.371 \text{ mrem/yr}$

Dynamic: $[(1.871 \text{ mrem/yr})(26 \text{ Kgal/131 Kgal})]$
 $\times (131 \text{ Kgal}) / [(0.5E-3 \text{ Kgal/min})(60 \text{ min/hr})]$
 $\times (24 \text{ hr/d})(365 \text{ d/yr})$
 $= 0.185 \text{ mrem over 182 days}$

Stack 296-U-11 / Scenario #2

244-U DCRT SOURCE TERM EMISSIONS - (U-103, 105, 108, 109)

R-nuclide	Sum of Ci*	CAP-88 c-factor	APP D factor	EDE (mrem/yr)	% of Total EDE	
14-C	.1040E+01	.1650E-02	1.E-03	1.716E-06	2.943E-04	1
60-Co	.0000E+00	.1720E-01	1.E-03	0.000E+00	0.000E+00	2
79-Se	.6950E-01	.2600E-01	1.E-03	1.807E-06	3.099E-04	3
89/90-Sr	.1740E+05	.2600E-01	1.E-03	4.524E-01	7.759E+01	4
90-Y	.1740E+05	.2220E-03	1.E-03	3.863E-03	6.625E-01	5
99-Tc	.2070E+01	.6450E-03	1.E-03	1.335E-06	2.290E-04	6
106-Ru/Rh	.2910E-04	.1200E-01	1.E+00	3.492E-07	5.989E-06	7
125-Sb	.0000E+00	.2470E-02	1.E-03	0.000E+00	0.000E+00	8
129-I	.3100E-02	.1140E+00	1.E+00	3.534E-04	6.061E-02	9
134-Cs	.0000E+00	.1860E-01	1.E-03	0.000E+00	0.000E+00	10
137-Cs	.6400E+04	.1420E-01	1.E-03	9.088E-02	1.559E+01	11
144-Ce	.0000E+00	.8140E-02	1.E-03	0.000E+00	0.000E+00	12
147-Pm	.0000E+00	.6750E-03	1.E-03	0.000E+00	0.000E+00	13
154-Eu	.0000E+00	.2600E-01	1.E-03	0.000E+00	0.000E+00	14
Nat-U	.3430E+00	.1690E+01	1.E-03	5.797E-04	9.942E-02	15
237-Np	.1870E-01	.7050E+01	1.E-03	1.318E-04	2.261E-02	16
238-Pu	.1720E+00	.4760E+01	1.E-03	8.187E-04	1.404E-01	17
239/240-Pu	.1120E+01	.5150E+01	1.E-03	5.768E-03	9.893E-01	18
241-Pu	.1210E+02	.8170E-01	1.E-03	9.886E-04	1.695E-01	19
241-Am	.3500E+01	.7790E+01	1.E-03	2.727E-02	4.676E+00	20
242/244-Cm	.6140E-03	.4120E+01	1.E-03	2.530E-06	4.339E-04	21
TOTAL				5.831E-01	1.000E+02	

* - Decay-corrected to 9/93

Static: $[(5.831E-1 \text{ mrem/yr})(26 \text{ Kgal/ 657 Kgal})] = 2.31 E-2 \text{ mrem/yr}$

Dynamic: $[(5.831E-1 \text{ mrem/yr})(26 \text{ Kgal/ 657 Kgal})]$
 $\times (657 \text{ Kgal}) / [(0.5E-3 \text{ Kgal/min})(60 \text{ min/hr})]$
 $\times (24 \text{ hr/d})(365 \text{ d/yr})$
 $= 5.77E-2 \text{ mrem over 2.5 years}$

Stack 296-U-11 / Scenario 3

244-DCRT SOURCE TERM EMISSIONS - (U-106, 107, 111)

R-nuclide	Sum of Ci*	CAP-88 c-factor	APP D factor	EDE (mrem/yr)	% of Total EDE	
14-C	.0000E+00	.1650E-02	1.E-03	0.000E+00	0.000E+00	1
60-Co	.8930E-03	.1720E-01	1.E-03	1.536E-08	2.986E-06	2
79-Se	.0000E+00	.2600E-01	1.E-03	0.000E+00	0.000E+00	3
89/90-Sr	.1700E+05	.2600E-01	1.E-03	4.420E-01	8.594E+01	4
90-Y	.1700E+05	.2220E-03	1.E-03	3.774E-03	7.338E-01	5
99-Tc	.0000E+00	.6450E-03	1.E-03	0.000E+00	0.000E+00	6
106-Ru/Rh	.0000E+00	.1200E-01	1.E+00	0.000E+00	0.000E+00	7
125-Sb	.0000E+00	.2470E-02	1.E-03	0.000E+00	0.000E+00	8
129-I	.0000E+00	.1140E+00	1.E+00	0.000E+00	0.000E+00	9
134-Cs	.1550E+01	.1860E-01	1.E-03	2.883E-05	5.605E-03	10
137-Cs	.8730E+03	.1420E-01	1.E-03	1.240E-02	2.410E+00	11
144-Ce	.0000E+00	.8140E-02	1.E-03	0.000E+00	0.000E+00	12
147-Pm	.0000E+00	.6750E-03	1.E-03	0.000E+00	0.000E+00	13
154-Eu	.0000E+00	.2600E-01	1.E-03	0.000E+00	0.000E+00	14
Nat-U	.0000E+00	.1690E+01	1.E-03	0.000E+00	0.000E+00	15
237-Np	.0000E+00	.7050E+01	1.E-03	0.000E+00	0.000E+00	16
238-Pu	.0000E+00	.4760E+01	1.E-03	0.000E+00	0.000E+00	17
239/240-Pu	.1090E+02	.5150E+01	1.E-03	5.614E-02	1.091E+01	18
241-Pu	.0000E+00	.8170E-01	1.E-03	0.000E+00	0.000E+00	19
241-Am	.0000E+00	.7790E+01	1.E-03	0.000E+00	0.000E+00	20
242/244-Cm	.0000E+00	.4120E+01	1.E-03	0.000E+00	0.000E+00	21
TOTAL				5.143E-01	1.000E+02	

* - Decay-corrected to 9/93

Static: $[(5.143E-1 \text{ mrem/yr})(26 \text{ Kgal})/(316 \text{ Kgal})] = 4.23E-2 \text{ mrem/yr}$

Dynamic: $[(5.143E-1 \text{ mrem/yr})(26 \text{ Kgal}/316 \text{ Kgal})]$
 $\times (316 \text{ Kgal})/[(0.5E-3 \text{ Kgal/min})(60 \text{ min/hr})]$
 $\times (24 \text{ hr/d})(365 \text{ d/yr})$
 $= 5.09E-2 \text{ mrem over 1.2 years}$

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APPENDIX A-2

DECAY-CORRECTED SOURCE TERMS FOR
SINGLE-SHELL AND DOUBLE-SHELL TANKS

Five sections are included in Appendix A-2. These include:

- Radioisotope Required Input - Type and Half Life (A-2.1)
- Raw Data for Single-Shell and Double-Shell Tank Farms (A-2.2)
- Calculations for Single-Shell Tank Farms (A-2.3)
- Calculations for Double-Shell Tank Farms (A-2.4)
- Decay-Corrected Radioisotope Totals by Tank Farm (A-2.5).

Calculations were performed using a commercially-available spreadsheet.

APPENDIX A-2.1
RADIOISOTOPE REQUIRED INPUT -
TYPE AND HALF LIFE

Tank Farms Radioisotope Summary

REQUIRED INPUT

Half-Life Summary

Radioisotope	Half Life
C-14	5.7E+03
Co-60	5.3E+00
Se-79	6.5E+04
Sr-89/90	2.7E+01
Y-90	2.7E+01
Zr-95	1.8E-01
Tc-99	2.1E+05
Ru/Rh-106	1.0E+00
Sb-125	2.7E+00
I-129	1.6E+07
Cs-134	2.1E+00
Cs-137	3.0E+01
Ce-144	7.8E-01
Pm-147	2.6E+00
Eu-154/155	1.6E+01
U-Natural	4.5E+09
Np-237	2.1E+07
Pu-238	8.6E+01
Pu-239/240	2.4E+04
Pu-241	1.3E+01
Am-241	4.3E+02
Am-242m	1.5E+02
Am-243	7.4E+03
Cm-242	4.5E-01
Cm-244	1.8E+01

Decay To

Month	Year
9	93

Range: DATA

All values in Bq unless otherwise noted
Half Life Specified is in YEARS

Print Ranges:

CALC A:K36..S839
DATA A:A1..I838
SUM A:U1..AC187

APPENDIX A-2.2
RAW DATA FOR SINGLE-SHELL AND
DOUBLE-SHELL TANK FARMS

Tank Farms Raw Data
Single Shell Tanks

PAGE 1

Tank Name	A-101	A-102	A-103	A-104	A-105	A-106	AX-101	AX-102
Month	6	1	1	1	1	1	1	11
Year	74	90	90	90	90	90	90	88
ISOTOPES								
C-14		1.5E+13	1.1E+12	2.6E+13	1.9E+11	2.2E+09	3.7E+09	
Co-60	1.1E+14							3.0E+11
Sr-79		2.2E+11	7.4E+10	7.4E-08	1.1E+10	1.9E+02	7.4E+00	
Sr-89/90		2.6E+17	7.4E+14	1.5E+17	1.1E+09	1.9E+08	1.1E+05	7.2E+13
Y-90		2.6E+17	7.4E+14	1.5E+17	1.1E+09	1.9E+08	1.1E+05	7.2E+13
Zr-95								
Tc-99		7.4E+12	2.6E+12	2.2E-06	3.7E+11	7.4E+03	7.4E+02	
Ru/Rh-106		1.1E+10	7.4E+10	1.5E+09	3.7E+03	3.7E+10	3.0E+11	
Sb-125	2.8E+14							
I-129		1.1E+10	3.7E+09	3.7E-09	3.7E+08	1.1E+01	3.7E-01	
Cs-134	2.5E+14							
Cs-137	2.4E+16	1.1E+16	7.4E+14	3.7E-03	1.5E+15	1.1E+07	1.1E+05	1.5E+14
Ce-144								
Pm-147								
Eu-154/155	1.6E+14							3.5E+12
U-Natural		3.7E+10	3.7E+10	7.4E+10	1.9E+02	1.5E+11	3.7E+10	
Np-237		1.1E+10	3.7E+08	1.8E+08	1.5E+09	3.7E+07	1.9E+06	
Pu-238		3.8E+11	7.4E+11	7.4E+11	1.5E+07	1.9E+12	7.4E+11	
Pu-239/240		1.4E+13	1.4E+13	2.6E+13	5.9E+05	4.8E+13	1.4E+13	
Pu-241		2.6E+13	3.7E+13	3.7E+13	7.5E+04	1.1E+14	3.7E+13	
Am-241		1.1E+14	1.9E+13	3.0E+13	3.7E+05	1.1E+13	1.1E+12	4.2E+11
Am-242m		1.9E+11	3.3E+10	3.0E+10	3.7E+02	7.4E+09	3.3E+00	
Am-243		7.4E+10	2.2E+10	1.1E+10	1.5E+02	2.5E+09	2.2E+00	
Cm-242		1.5E+11	2.6E+10	2.6E+10	3.3E+02	7.4E+09	2.6E+00	
Cm-244		1.9E+11	1.5E+11	7.4E-10	1.5E+08	3.0E+01	1.9E+01	
TOTAL (Bq)	2.5E+16	5.3E+17	2.3E+15	3.0E+17	1.5E+15	1.7E+14	5.3E+13	3.0E+14

Tank Farms Raw Data

Single Shell Tanks

PAGE 2

Tank Name	AX-103	AX-104	B-101	B-102	B-103	B-104	B-105	B-106
Month	1	10	2	1	1	1	6	1
Year	90	74	76	90	90	90	76	90
ISOTOPES								
C-14	3.3E+11			5.2E+10	1.1E+11	1.5E+10		1.9E+10
Co-60		9.9E+14						
Se-79	1.5E+10			1.1E+09	3.7E+09	1.9E+09		7.4E+08
Sr-89/90	7.4E+14	6.2E+17	3.6E+16	1.1E+13	3.3E+14	3.0E+14	2.3E+14	4.1E+12
Y-90	7.4E+14	6.2E+17	3.6E+16	1.1E+13	3.3E+14	3.0E+14	2.3E+14	4.1E+12
Zr-95								
Tc-99	3.7E+11			3.3E+10	1.9E+11	7.4E+10		2.6E+10
Ru/Rh-106	2.6E+08	5.2E+16		3.7E+09	7.4E+08	1.1E+03		1.9E+03
Sb-125		1.6E+16						
I-129	7.4E+08			3.7E+07	3.0E+08	1.1E+08		3.7E+07
Cs-134		3.7E+15						
Cs-137	7.4E+14	2.2E+17	9.7E+15	1.1E+14	3.7E+14	1.9E+14	2.5E+13	7.4E+13
Ce-144								
Pm-147								
Eu-154/155		3.4E+15						
U-Natural	1.9E+02			3.0E+10	7.4E+10	1.1E+10		1.1E+10
Np-237	7.4E+08			1.1E+08	7.5E+08	2.2E+08		7.4E+07
Pu-238	7.8E+07			1.5E+11	1.9E+11	7.4E+09		1.5E+08
Pu-239/240	4.6E+06	3.0E+13	1.7E+13	2.3E+12	9.3E+12	4.1E+12	5.4E+11	4.1E+10
Pu-241	3.3E+06			1.1E+13	2.2E+13	7.4E+11		7.4E+09
Am-241	7.4E+11			3.8E+11	2.5E+12	1.5E+11		9.3E+09
Am-242m	1.1E+09			1.5E+07	1.1E+09	1.1E+06		1.1E+07
Am-243	3.7E+08			1.1E+07	4.4E+09	1.5E+06		7.4E+06
Cm-242	1.1E+09			1.5E+07	1.0E+09	1.1E+06		1.1E+07
Cm-244	2.2E+09			7.4E+07	7.4E+08	1.5E+05		3.7E+07
TOTAL (Bq)	2.2E+15	1.5E+18	8.2E+16	1.5E+14	1.1E+15	8.0E+14	4.9E+14	8.2E+13

Tank Farms Raw Data

Single Shell Tanks

PAGE 3

Tank Name	B-107	B-108	B-109	B-110	B-111	B-112	B-201	B-202
Month	4	1	1	1	1	1	1	1
Year	78	90	90	90	90	90	90	90
ISOTOPES								
C-14		3.7E+11	2.6E+11	3.7E+12	7.8E+13	3.0E+12		
Co-60								
Se-79		2.6E+10	1.1E+10	3.0E+11	3.3E+12	2.2E+11		
Sr-89/90	5.8E+14	1.9E+15	2.0E+14	2.4E+15	3.7E+08	3.7E+15		
Y-90	5.8E+14	1.9E+15	2.0E+14	2.4E+15	3.7E+08	3.7E+15		
Zr-95								
Tc-99		1.1E+12	3.3E+11	1.1E+13	1.1E+14	7.4E+12		
Ru/Rh-106	1.0E+14	3.7E+05	1.5E+05	3.7E+10	4.4E+06	3.7E+08		
Sb-125	2.4E+14							
I-129		1.5E+09	3.7E+08	1.9E+10	1.9E+11	1.1E+10		
Cs-134								
Cs-137	1.4E+14	1.1E+15	3.7E+14	2.2E+15	2.2E+16	7.4E+15		
Ce-144	6.7E+13							
Pm-147								
Eu-154/155	7.6E+13							
U-Natural		3.0E+11	7.4E+10	2.8E+11	1.5E+10	2.2E+10		1.1E+11
Np-237		3.0E+09	1.1E+09	1.1E+09	3.7E+11	2.2E+10		7.4E+08
Pu-238		7.8E+08	3.8E+08	3.8E+11	7.4E+09	3.7E+10		1.5E+11
Pu-239/240		1.6E+11	2.1E+10	9.3E+12	1.3E+12	1.7E+11		9.3E+12
Pu-241		1.9E+10	1.9E+09	2.6E+13	1.1E+12	1.1E+11		1.9E+13
Am-241		1.9E+11	7.5E+10	3.9E+13	1.5E+11	1.5E+12		1.5E+12
Am-242m		3.7E+08	1.5E+08	1.5E+11	7.5E+06	3.3E+09		
Am-243		2.6E+08	7.4E+07	7.4E+10	1.9E+06	1.9E+09		
Cm-242		3.3E+08	1.1E+08	1.1E+11	7.5E+06	2.6E+09		
Cm-244		3.7E+09	1.1E+09	3.7E+11	3.7E+10	2.6E+10		
TOTAL (Bq)	1.8E+15	4.9E+15	7.7E+14	7.1E+15	2.2E+16	1.5E+16	0.0E+00	3.0E+13

Tank Farms Raw Data

Single Shell Tanks

PAGE 4

Tank Name	B-203	B-204	BX-101	BX-102	BX-103	BX-104	BX-105	BX-106
Month	1	1	3	1	10	1	3	3
Year	90	90	76	90	75	90	86	90
ISOTOPEs								
C-14				2.2E+13		3.7E+13	2.7E+10	
Co-60							3.7E+12	
Se-79				7.4E+11		3.3E+12		
Sr-89/90			1.2E+16	4.4E+15	2.8E+14	7.4E+14	2.6E+15	5.3E+12
Y-90			1.2E+16	4.4E+15	2.8E+14	7.4E+14	2.6E+15	5.3E+12
Zr-95								
Tc-99				2.2E+13		1.1E+14	8.0E+11	
Ru/Rh-106				2.2E+07	1.0E+15	7.7E+07		
Sb-125								
I-129				3.7E+10		1.9E+11	4.9E+08	
Cs-134					4.2E+12			
Cs-137			7.7E+15	1.1E+16	3.0E+15	2.2E+16	1.5E+15	1.8E+15
Ce-144								
Pm-147								
Eu-154/155					4.6E+12			
U-Natural				1.5E+09		3.0E+10		1.1E+07
Np-237	3.3E+04	3.3E+05		3.3E+10		3.7E+11		
Pu-238	1.9E+08	1.9E+09		4.1E+10		7.4E+10		
Pu-239/240	3.0E+10	3.2E+11	5.7E+11	1.4E+12		2.9E+12	5.5E+12	1.9E+09
Pu-241	3.0E+10	3.0E+11		7.4E+12		7.4E+12		
Am-241	3.7E+09	3.7E+10		2.6E+13		7.4E+11	1.9E+13	3.0E+09
Am-242m				3.7E+10		3.0E+08		
Am-243				2.2E+10		1.1E+08		
Cm-242				3.7E+10		2.2E+08		
Cm-244				1.1E+11		7.4E+10		
TOTAL (Bq)	6.4E+10	6.6E+11	3.2E+16	2.0E+16	4.6E+15	2.4E+16	6.7E+15	1.8E+15

Tank Farms Raw Data
Single Shell Tanks PAGE 5

Tank Name	BX-107	BX-108	BX-109	BX-110	BX-111	BX-112	BY-101	BY-102
Month	3	1	3	3	3	3	1	6
Year	90	90	90	90	90	90	90	91
ISOTOPEs								
C-14		3.0E+09					7.4E+12	
Co-60								
Se-79		1.1E+08					3.7E+11	
Sr-89/90	7.2E+10	1.9E+14	1.8E+13	4.2E+09	5.3E+10	1.6E+12	1.3E+16	1.1E+13
Y-90	7.2E+10	1.9E+14	1.8E+13	4.2E+09	5.3E+10	1.6E+12	1.3E+16	1.1E+13
Zr-95								
Tc-99		3.7E+09					1.5E+13	1.1E+13
Ru/Rh-106		2.6E+02					7.4E+06	
Sb-125								
I-129		7.4E+06					2.2E+10	
Cs-134								
Cs-137	3.1E+13	1.9E+13	4.3E+14	3.8E+13	6.9E+14	9.3E+13	1.9E+16	5.1E+15
Ce-144								
Pm-147								
Eu-154/155								
U-Natural	7.6E+08	3.7E+09	5.0E+07	8.5E+05	1.6E+08	9.9E+08	1.9E+09	
Np-237		1.9E+07					3.7E+10	
Pu-238		3.7E+08					4.4E+09	
Pu-239/240	7.2E+10	2.1E+11	2.8E+10	2.2E+07	2.3E+08	2.1E+10	1.9E+09	
Pu-241		3.7E+10					7.4E+08	
Am-241	3.1E+08	1.1E+10	5.8E+09	7.3E+07	3.7E+08	2.2E+09	3.0E+12	
Am-242m		1.5E+05					7.4E+09	
Am-243		3.3E+05					3.7E+09	
Cm-242		1.1E+05					3.7E+09	
Cm-244		1.9E+06					7.4E+10	
TOTAL (Bq)	3.1E+13	4.0E+14	4.7E+14	3.8E+13	6.9E+14	9.6E+13	4.5E+16	5.1E+15

Tank Farms Raw Data
Single Shell Tanks PAGE 6

Tank Name	BY-103	BY-104	BY-105	BY-106	BY-107	BY-108	BY-109	BY-110
Month	6	10	6	6	1	1	6	1
Year	91	92	91	91	90	90	91	90
ISOTOPES								
C-14					2.2E+12	2.2E+12		3.7E+12
Co-60								
Se-79					1.5E+11	1.9E+11		3.7E+11
Sr-89/90	3.5E+12	7.7E+15	3.8E+11	4.3E+12	5.6E+15	1.9E+15	3.9E+12	1.0E+16
Y-90	3.5E+12	7.7E+15	3.8E+11	4.3E+12	5.6E+15	1.9E+15	3.9E+12	1.0E+16
Zr-95								
Tc-99	1.8E+12		8.2E+11	3.6E+12	7.4E+12	7.4E+12	2.3E+12	1.5E+13
Ru/Rh-106					3.3E+06	3.9E+06		8.5E+06
Sb-125								
I-129					7.4E+09	1.1E+10		2.2E+10
Cs-134								
Cs-137	3.0E+15	7.4E+15	2.0E+15	1.0E+16	7.4E+15	7.4E+15	3.5E+15	1.9E+16
Ce-144								
Pm-147								
Eu-154/155								
U-Natural					1.9E+11	3.3E+10		2.2E+09
Np-237					1.9E+10	2.6E+10		3.7E+10
Pu-238					2.6E+11	3.7E+11		3.7E+11
Pu-239/240		3.7E+12			1.3E+12	2.3E+12		2.3E+12
Pu-241					1.1E+12	1.5E+12		2.2E+12
Am-241		5.6E+12			2.2E+12	3.3E+12		4.4E+12
Am-242m					3.0E+09	4.1E+09		8.5E+09
Am-243			1.2E+13		2.2E+09	3.3E+09		4.4E+09
Cm-242					2.2E+09	3.7E+09		4.4E+09
Cm-244					2.2E+10	3.3E+10		3.7E+10
TOTAL (Bq)	3.0E+15	2.3E+16	2.0E+15	1.0E+16	1.9E+16	1.1E+16	3.5E+15	3.9E+16

Tank Farms Raw Data

Single Shell Tanks

PAGE 7

Tank Name	BY-111	BY-112	C-101	C-102	C-103	C-104	C-105	C-106
Month	1	1	1	11	1	1	4	5
Year	90	90	90	90	88	88	86	86
ISOTOPES								
C-14	7.5E+12	1.1E+12	7.4E+11		1.8E+10	4.2E+10	3.2E+10	9.9E+09
Co-60				9.5E+11	2.4E+14	2.9E+13	2.4E+13	3.5E+13
Se-79	3.7E+11	7.4E+10	3.7E+10					
Sr-89/90	1.3E+16	2.6E+15	2.6E+15	1.2E+11	1.5E+17	1.8E+16	2.8E+16	7.8E+16
Y-90	1.3E+16	2.6E+15	2.6E+15	1.2E+11	1.5E+17	1.8E+16	2.8E+16	7.8E+16
Zr-95								
Tc-99	1.5E+13	3.0E+12	1.9E+12	1.2E+11	1.7E+13	1.4E+14	3.8E+12	9.0E+12
Ru/Rh-106	7.4E+06	1.5E+06	7.4E+07					
Sb-125								
I-129	2.6E+10	3.7E+09	2.6E+09		2.1E+09		4.3E+09	3.2E+09
Cs-134								
Cs-137	1.9E+16	3.3E+15	7.4E+15	1.0E+14	5.1E+15	2.0E+15	5.5E+15	1.3E+16
Ce-144								
Pm-147								
Eu-154/155								
U-Natural	3.7E+10	1.9E+09	7.4E+10				2.9E+11	1.1E+14
Np-237	3.7E+10	7.4E+09	7.4E+09					
Pu-238	4.4E+09	3.8E+09	7.4E+10					
Pu-239/240	9.3E+09	6.0E+07	4.8E+12	3.7E+10	3.8E+13	6.1E+14	9.5E+13	1.1E+14
Pu-241	1.1E+10	3.0E+07	1.1E+13					
Am-241	3.0E+12	3.7E+11	1.9E+12		5.7E+13	1.5E+14	4.9E+13	4.2E+13
Am-242m	7.4E+09	1.1E+09	1.1E+09					
Am-243	3.7E+09	7.4E+08	3.7E+08					
Cm-242	7.4E+09	1.1E+09	7.4E+09					
Cm-244	7.4E+10	1.1E+10	7.4E+08					
TOTAL (Bq)	4.5E+16	8.5E+15	1.3E+16	1.0E+14	3.1E+17	3.9E+16	6.2E+16	1.7E+17

Tank Farms Raw Data

Single Shell Tanks

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Tank Name	C-107	C-108	C-109	C-110	C-111	C-112	C-201	C-202
Month	11	1	1	11	1	1	12	1
Year	90	90	90	90	90	90	78	90
ISOTOPES								
C-14		1.1E+10	7.0E+10		2.8E+10	8.9E+10		1.1E+08
Co-60								
Se-79		1.5E+06	1.5E+09		1.1E+09	1.1E+09		1.9E-07
Sr-89/90	8.1E+12	7.4E+14	2.6E+12	1.9E+10	3.3E+15	1.5E+15	2.7E+13	1.9E-03
Y-90	8.1E+12	7.4E+14	2.6E+12	1.9E+10	3.3E+15	1.5E+15	2.7E+13	1.9E-03
Zr-95								
Tc-99	3.9E+11	3.7E+07	3.7E+10	1.6E+11	3.7E+10	3.3E+10		7.4E-06
Ru/Rh-106		3.7E+07	1.5E+03		1.1E+06	1.9E+07		3.3E+01
Sb-125								
I-129		7.4E+04	7.4E+07		7.4E+07	3.7E+07		1.1E-08
Cs-134								
Cs-137	2.0E+14	1.5E+11	1.9E+14	5.5E+13	1.5E+14	1.5E+14	2.8E+12	1.5E-02
Ce-144								
Pm-147								
Eu-154/155								
U-Natural		3.7E+10	7.8E+09		3.7E+10	4.0E+10		7.4E+09
Np-237		1.1E+07	2.2E+08		1.9E+08	1.6E+08		1.5E+04
Pu-238		7.4E+10	3.7E+09		1.1E+11	3.7E+10		3.7E+06
Pu-239/240	2.2E+12	4.4E+12	4.4E+10	9.9E+10	3.0E+12	2.6E+12	1.4E+12	2.4E+09
Pu-241		7.4E+12	3.7E+09		3.7E+12	3.7E+12		2.6E+08
Am-241	3.6E+09	1.5E+12	3.7E+09		7.4E+11	7.4E+11		1.1E+09
Am-242m		1.1E+09	1.2E+05		3.3E+08	7.4E+08		1.9E+04
Am-243		3.0E+08	2.2E+05		1.5E+08	1.5E+08		3.7E+04
Cm-242		7.4E+08	7.8E+04		2.6E+08	7.4E+08		1.5E+04
Cm-244		3.7E+03	2.2E+07		1.9E+07	2.2E+07		3.7E-12
TOTAL (Bq)	2.2E+14	1.5E+15	2.0E+14	5.5E+13	6.8E+15	3.2E+15	5.8E+13	1.1E+10

Tank Farms Raw Data

Single Shell Tanks

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Tank Name	C-203	C-204	S-101	S-102	S-103	S-104	S-105	S-106
Month	1	1	7	1	1	2	9	9
Year	90	90	75	90	90	76	74	74
ISOTOPES								
C-14	1.1E+07	7.4E+04		3.0E+03	7.5E+04			
Co-60								
Se-79	1.9E+00	3.0E+04		2.6E+02	3.7E+02			
Sr-89/90	2.2E+13	1.1E+10	4.9E+16	1.9E+15	1.1E+07	1.6E+16		
Y-90	2.2E+13	1.1E+10	4.9E+16	1.9E+15	1.1E+07	1.6E+16		
Zr-95								
Tc-99	7.4E+01	1.1E+06		1.1E+04	1.5E+04			
Ru/Rh-106	3.0E+00	7.4E-03		1.9E+07	3.7E-03			
Sb-125								
I-129	1.1E-01	1.5E+03		1.9E+01	2.6E+01			
Cs-134								
Cs-137	2.2E+05	3.0E+09	1.4E+16	1.5E+07	1.1E+07	4.6E+15	8.6E+14	1.4E+16
Ce-144								
Pm-147								
Eu-154/155								
U-Natural	7.4E+08	3.3E+06		1.1E+10	1.1E+09			
Np-237	1.5E+03	3.3E+03		3.7E+06	2.6E+05			
Pu-238	7.4E+05	1.5E+03		7.4E+10	7.4E+09			
Pu-239/240	2.4E+08	8.1E+05	1.8E+13	8.9E+11	8.9E+10	1.2E+13		
Pu-241	2.6E+07	1.1E+05		7.4E+11	1.1E+11			
Am-241	1.1E+08	3.4E+05		3.7E+11	3.7E+10			
Am-242m	1.9E+03	3.7E+00		3.3E+08	3.7E+07			
Am-243	3.7E+03	1.1E+01		7.4E+07	1.1E+07			
Cm-242	1.5E+03	3.7E+00		2.6E+08	3.0E+07			
Cm-244	3.7E-05	7.4E-01		3.7E+01	7.4E+01			
TOTAL (Bq)	4.4E+13	2.5E+10	1.1E+17	3.8E+15	2.4E+11	3.7E+16	8.6E+14	1.4E+16

Tank Farms Raw Data

Single Shell Tanks

PAGE 10

Tank Name	S-107	S-108	S-109	S-110	S-111	S-112	SX-101	SX-102
Month	10	3	12	10	1	1	1	9
Year	78	74	76	74	90	90	90	74
ISOTOPEs								
C-14					7.4E+12	3.7E+13	2.2E+02	
Co-60								
Se-79					3.7E+11	2.6E+12	1.1E+01	
Sr-89/90	2.0E+15	5.0E+13	1.7E+15	2.0E+16	2.6E+16	3.7E+16	2.6E+16	2.3E+16
Y-90	2.0E+15	5.0E+13	1.7E+15	2.0E+16	2.6E+16	3.7E+16	2.6E+16	2.3E+16
Zr-95								
Tc-99					1.1E+13	7.4E+13	3.7E+02	
Ru/Rh-106		1.9E+15			3.4E+06	1.5E+07	3.7E+06	
Sb-125								
I-129					1.9E+10	1.5E+11	7.4E-01	
Cs-134		1.7E+14						
Cs-137	4.7E+15	3.3E+16	8.2E+15	3.4E+15	3.7E+16	1.9E+17	3.7E+05	7.4E+15
Ce-144								
Pm-147								
Eu-154/155								
U-Natural					3.7E+09	7.4E+08	3.7E+10	
Np-237					1.1E+10	1.5E+11	7.4E+07	
Pu-238					1.1E+10	1.1E+10	1.5E+12	
Pu-239/240	1.8E+14	1.2E+11			4.0E+11	4.5E+10	8.9E+12	
Pu-241					3.7E+11	3.7E+10	7.4E+12	
Am-241					5.6E+11	3.7E+13	3.7E+12	
Am-242m					5.6E+08	7.4E+10	1.1E+10	
Am-243					2.9E+08	3.3E+10	2.2E+09	
Cm-242					5.2E+08	3.7E+10	7.4E+09	
Cm-244					7.4E+09	1.9E+11	1.5E+00	
TOTAL (Bq)	8.9E+15	3.5E+16	1.2E+16	4.3E+16	8.9E+16	2.6E+17	5.2E+16	5.3E+16

Tank Farms Raw Data

Single Shell Tanks

PAGE 11

Tank Name	SX-103	SX-104	SX-105	SX-106	SX-107	SX-108	SX-109	SX-110
Month	1	9	1	1	3	1	1	1
Year	90	74	90	90	77	90	90	90
ISOTOPES								
C-14	2.3E+13		3.7E+12	7.7E+11		1.5E+05	7.4E+04	4.1E+04
Co-60					9.6E+16			
Se-79	2.2E+12		7.4E+11	2.6E+11		7.4E+03	3.3E+03	1.9E+02
Sr-89/90	2.6E+16	6.0E+16	1.1E+16	7.4E+15		3.7E+16	1.1E+16	2.6E+16
Y-90	2.6E+16	6.0E+16	1.1E+16	7.4E+15		3.7E+16	1.1E+16	2.6E+16
Zr-95								
Tc-99	7.4E+13		2.6E+13	1.1E+13		2.2E+05	1.1E+05	7.4E+03
Ru/Rh-106	2.3E+07		7.7E+06	3.0E+06		1.9E+09	7.4E+08	1.5E+10
Sb-125								
I-129	1.1E+11		3.7E+10	1.5E+10		1.9E+02	1.9E+02	7.4E+00
Cs-134								
Cs-137	7.4E+16	3.1E+15	7.4E+15	7.4E+15	2.6E+18	3.7E+08	3.7E+08	1.1E+07
Ce-144					1.2E+18			
Pm-147								
Eu-154/155								
U-Natural	1.9E+09		3.7E+09	7.4E+09		7.4E+10	3.7E+10	7.4E+10
Np-237	7.4E+10		1.5E+10	1.9E+10		1.5E+08	7.4E+07	1.5E+08
Pu-238	4.4E+10		1.5E+11	1.8E+09		7.4E+11	7.4E+11	2.2E+11
Pu-239/240	9.0E+10		8.5E+11	6.6E+07	3.4E+08	1.3E+13	8.9E+12	1.4E+13
Pu-241	1.1E+11		7.4E+11	4.1E+07		2.2E+13	1.1E+13	3.0E+13
Am-241	1.1E+14		3.7E+13	1.5E+13		1.9E+13	7.4E+12	2.6E+13
Am-242m	1.9E+11		7.5E+10	2.2E+10		2.2E+10	1.1E+10	3.0E+10
Am-243	7.4E+10		3.0E+10	7.4E+09		7.4E+09	3.0E+09	7.4E+09
Cm-242	1.5E+11		3.8E+10	1.9E+10		1.9E+10	1.1E+10	2.2E+10
Cm-244	3.7E+11		1.5E+11	3.0E+10		1.5E+02	3.7E+01	2.6E+01
TOTAL (Bq)	1.3E+17	1.2E+17	2.9E+16	2.2E+16	3.9E+18	7.4E+16	2.2E+16	5.2E+16

Tank Farms Raw Data
Single Shell Tanks PAGE 12

Tank Name	SX-111	SX-112	SX-113	SX-114	SX-115	T-101	T-102	T-103
Month	9	1	1	1	4	8	1	1
Year	75	90	90	90	75	89	90	90
ISOTOPES								
C-14		1.5E+10	2.6E+12	2.2E-03			3.7E+10	2.6E+11
Co-60					2.7E+13			
Se-79		7.4E+08	1.1E+11	7.4E-05			1.5E+09	7.4E+09
Sr-89/90	5.9E+16	3.7E+16	1.1E+16	3.7E+16	4.0E+16	2.1E+11	1.5E+12	7.4E+14
Y-90	5.9E+16	3.7E+16	1.1E+16	3.7E+16	4.0E+16	2.1E+11	1.5E+12	7.4E+14
Zr-95								
Tc-99		2.6E+10	3.7E+12	3.7E-03		4.5E+11	3.7E+10	2.6E+11
Ru/Rh-106		1.1E+09	1.9E+07	7.4E+09			1.9E+04	1.1E+05
Sb-125					3.5E+14			
I-129		3.7E+07	7.4E+09	7.4E-06			7.4E+07	3.7E+08
Cs-134					3.5E+13			
Cs-137	3.8E+15	1.1E+14	1.5E+16	1.9E+01	5.9E+13		1.5E+13	7.4E+13
Ce-144								
Pm-147								
Eu-154/155					7.8E+13			
U-Natural		3.7E+10	1.5E+10	1.1E+11			1.9E+08	7.4E+08
Np-237		8.9E+07	1.9E+10	1.9E+08			3.7E+07	2.2E+08
Pu-238		7.4E+11	3.0E+10	3.7E+11			1.9E+07	3.0E+09
Pu-239/240	1.4E+12	8.9E+12	2.6E+12	1.9E+13	1.0E+13	6.5E+08	1.2E+06	4.4E+09
Pu-241		1.5E+13	3.0E+12	3.3E+13			8.5E+04	3.0E+09
Am-241		1.1E+13	1.5E+12	3.0E+13		4.8E+08	7.4E+10	3.3E+11
Am-242m		1.1E+10	7.4E+08	3.3E+10			1.1E+08	7.4E+08
Am-243		3.7E+09	2.6E+08	1.1E+10			3.7E+07	3.0E+08
Cm-242		1.1E+10	7.4E+08	2.6E+10			7.4E+07	3.7E+08
Cm-244		1.1E+07	3.7E+08	1.1E-06			3.0E+08	1.5E+09
TOTAL (Bq)	1.2E+17	7.4E+16	3.7E+16	7.4E+16	8.1E+16	8.7E+11	1.8E+13	1.6E+15

Tank Farms Raw Data
Single Shell Tanks PAGE 13

Tank Name	T-104	T-105	T-106	T-107	T-108	T-109	T-110	T-111
Month	11	9	4	8	3	1	1	3
Year	79	65	75	89	65	90	90	65
ISOTOPEs								
C-14						3.7E+09	7.4E-02	
Co-60								
Se-79						1.9E+09	1.1E-01	
Sr-89/90	4.4E+14			2.1E+15	4.2E+11	2.6E+12	1.5E+14	
Y-90	4.4E+14			2.1E+15	4.2E+11	2.6E+12	1.5E+14	
Zr-95		2.2E+16						4.0E+12
Tc-99						7.4E+10	3.7E+00	
Ru/Rh-106						1.5E+03	7.4E+02	1.4E+13
Sb-125				1.8E+14				
I-129						1.1E+08	3.0E-03	
Cs-134								
Cs-137			5.0E+16	1.8E+15	2.8E+13	1.9E+14	7.4E+03	1.3E+13
Ce-144				1.6E+15				
Pm-147								
Eu-154/155	1.2E+14							
U-Natural	4.6E+09					1.5E+09	7.4E+09	
Np-237						2.6E+08	2.6E+06	
Pu-238						7.4E+07	1.5E+10	
Pu-239/240	2.2E+13		1.5E+12	1.5E+10		2.1E+10	8.1E+12	
Pu-241						2.2E+09	1.5E+12	
Am-241				1.5E+10		7.5E+08	3.0E+11	
Am-242m						1.1E+04	3.0E+05	
Am-243						2.3E+04	7.4E+05	
Cm-242						7.8E+03	2.6E+05	
Cm-244						7.4E+05	2.2E-05	
TOTAL (Bq)	1.0E+15	2.2E+16	5.0E+16	7.8E+15	2.9E+13	2.0E+14	3.1E+14	3.1E+13

Tank Farms Raw Data

Single Shell Tanks

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Tank Name	T-112	T-201	T-202	T-203	T-204	TX-101	TX-102	TX-103
Month	10	1	1	1	12	1	2	9
Year	87	90	90	90	78	90	81	79
ISOTOPES								
C-14						7.4E+11		
Co-60								
Se-79						1.1E+02		
Sr-89/90					8.2E+10	3.0E+14		1.2E+14
Y-90					8.2E+10	3.0E+14		1.2E+14
Zr-95								
Tc-99						3.7E+03		
Ru/Rh-106						1.1E+05		
Sb-125								
I-129						3.3E+00		
Cs-134								
Cs-137					7.2E+09	2.6E+06	8.1E+15	1.2E+16
Ce-144								
Pm-147								
Eu-154/155								
U-Natural					4.7E+05	3.0E+03		
Np-237			1.5E+04	1.5E+05		3.0E+02		
Pu-238			7.4E+07	7.4E+08		1.1E+07		
Pu-239/240	6.8E+10		1.3E+10	1.3E+11	4.5E+10	2.0E+07		8.1E+11
Pu-241			1.1E+10	1.1E+11		3.7E+06		
Am-241	8.0E+10		1.9E+09	1.9E+10		3.7E+07		
Am-242m						3.7E+04		
Am-243						1.5E+04		
Cm-242						3.3E+04		
Cm-244						7.4E+00		
TOTAL (Bq)	1.5E+11	0.0E+00	2.6E+10	2.6E+11	2.2E+11	6.0E+14	8.1E+15	1.2E+16

Tank Farms Raw Data
Single Shell Tanks PAGE 15

Tank Name	TX-104	TX-105	TX-106	TX-107	TX-108	TX-109	TX-110	TX-111
Month	3	1	1	1	1	1	1	1
Year	65	90	90	90	90	90	90	90
ISOTOPES								
C-14		1.1E+12	1.9E+11	3.7E+02	3.7E+11	1.1E+13	3.7E+12	3.7E+11
Co-60								
Se-79		1.1E+11	1.1E+10	3.0E+02	3.7E+10	1.1E+12	3.3E+11	3.7E+10
Sr-89/90		1.1E+14	1.9E+05	3.7E+07	1.9E+14	4.4E+15	3.7E+15	1.9E+15
Y-90		1.1E+14	1.9E+05	3.7E+07	1.9E+14	4.4E+15	3.7E+15	1.9E+15
Zr-95								
Tc-99		3.7E+12	3.3E+11	1.9E+04	1.5E+12	3.3E+13	1.1E+13	1.9E+12
Ru/Rh-106		2.6E+06	7.4E+02	1.9E-02	1.1E+04	7.5E+06	2.2E+06	2.2E+05
Sb-125								
I-129		3.7E+09	3.7E+08	1.9E+01	2.2E+09	3.7E+10	1.9E+10	2.6E+09
Cs-134								
Cs-137	4.5E+16	7.4E+14	1.1E+15	3.7E+07	3.7E+15	3.3E+16	1.5E+16	3.3E+15
Ce-144								
Pm-147								
Eu-154/155								
U-Natural		3.7E-02	1.1E+04	7.4E+03	7.4E+09	3.7E+10	1.5E+10	7.4E+09
Np-237		7.4E+09	1.5E+09	7.4E+01	3.0E+09	7.4E+10	3.0E+10	3.7E+09
Pu-238		3.0E+07	3.7E+05	7.4E+03	3.7E+09	1.9E+11	7.7E+09	7.7E+08
Pu-239/240		3.1E+07	2.6E+05	4.0E+04	2.6E+10	8.5E+12	4.4E+11	4.4E+10
Pu-241		1.2E+08	1.9E+03	7.4E+04	3.7E+10	3.7E+12	3.3E+11	3.3E+10
Am-241		1.1E+08	2.2E+06	2.5E+04	3.7E+10	4.8E+12	1.6E+12	1.9E+11
Am-242m		1.9E+04	7.4E+03	3.7E-01	1.1E+06	7.4E+09	3.0E+09	3.0E+08
Am-243		7.4E+03	1.1E+03	1.1E+01	2.2E+07	3.8E+09	1.9E+09	1.9E+08
Cm-242		1.5E+04	3.7E+03	3.3E-01	7.5E+05	7.4E+09	2.6E+09	2.6E+08
Cm-244		1.9E+09	7.4E+07	7.4E+00	1.9E+09	3.7E+10	1.5E+10	1.9E+09
TOTAL (Bq)	4.5E+16	9.6E+14	1.1E+15	1.1E+08	4.1E+15	4.2E+16	2.2E+16	7.1E+15

Tank Farms Raw Data

Single Shell Tanks

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Tank Name	TX-112	TX-113	TX-114	TX-115	TX-116	TX-117	TX-118	TY-101
Month	1	1	1	1	1	1	10	9
Year	90	90	90	90	90	90	81	85
ISOTOPES								
C-14	7.4E+10	3.8E+11	1.2E+11	2.6E+11	3.7E+10	3.7E+11		2.4E+10
Co-60								2.7E+11
Se-79	2.6E+10	7.4E+09	2.2E+10	1.1E+10	7.4E+09	2.2E+09		
Sr-89/90	3.0E+14	3.0E+14	3.0E+13	1.1E+15	1.5E+15	2.6E+15	2.1E+11	3.4E+14
Y-90	3.0E+14	3.0E+14	3.0E+13	1.1E+15	1.5E+15	2.6E+15	2.1E+11	3.4E+14
Zr-95								
Tc-99	7.4E+11	3.0E+11	7.4E+11	3.7E+11	2.2E+11	7.4E+10		2.0E+11
Ru/Rh-106	1.5E+04	1.1E+04	1.1E+03	7.4E+04	2.2E+01	1.1E+02		
Sb-125								
I-129	1.5E+09	3.7E+08	1.1E+09	7.4E+08	3.0E+08	1.1E+08		1.3E+09
Cs-134								
Cs-137	2.6E+15	7.4E+14	2.6E+15	1.5E+15	7.4E+14	2.2E+14	2.5E+14	7.7E+12
Ce-144								
Pm-147								
Eu-154/155								
U-Natural	1.5E+09	3.7E+12	1.1E+11	7.4E+11	1.1E+11	7.4E+11		4.5E+10
Np-237	3.0E+09	1.1E+09	3.0E+09	1.1E+09	7.4E+08	3.0E+08		
Pu-238	3.0E+07	1.1E+10	3.7E+09	2.2E+09	1.7E+08	7.4E+08		
Pu-239/240	2.5E+09	2.2E+12	2.2E+11	2.2E+10	2.8E+04	3.7E+05		
Pu-241	7.4E+08	1.1E+12	1.1E+11	1.1E+10	4.1E+01	7.4E+02		
Am-241	1.1E+10	2.2E+11	2.2E+10	2.6E+09	3.5E+08	7.5E+08		3.5E+11
Am-242m	1.9E+07	7.4E+08	7.4E+07	7.4E+06	7.6E+04	7.4E+05		
Am-243	1.1E+07	1.5E+07	1.1E+06	1.6E+05	2.7E+04	1.5E+05		
Cm-242	1.5E+09	7.4E+08	7.4E+07	7.4E+06	3.8E+04	7.4E+05		
Cm-244	1.1E+08	1.5E+06	7.4E+06	1.1E+08	1.5E+06	7.4E+05		
TOTAL (Bq)	3.2E+15	1.3E+15	2.7E+15	3.7E+15	3.7E+15	5.4E+15	2.5E+14	6.9E+14

Tank Farms Raw Data

Single Shell Tanks

PAGE 17

Tank Name	TY-102	TY-103	TY-104	TY-105	TY-106	U-101	U-102	U-103
Month	9	8	1	9	7	1	4	1
Year	85	85	88	85	85	90	76	90
ISOTOPES								
C-14	1.5E+10	4.8E+10	2.5E+10	4.0E+10	5.3E+09	3.7E+11		1.5E+08
Co-60	4.0E+10	1.5E+11	1.8E+11	7.5E+11	5.8E+10		1.3E+14	
Se-79						1.9E+10		7.4E+06
Sr-89/90	7.7E+13	4.4E+15	2.1E+15	1.2E+16	5.6E+14	3.7E+14	3.7E+15	7.4E+10
Y-90	7.7E+13	4.4E+15	2.1E+15	1.2E+16	5.6E+14	3.7E+14	3.7E+15	7.4E+10
Zr-95	3.4E+10							
Tc-99	1.3E+10	6.1E+11	2.8E+11	1.7E+12	7.9E+11	7.4E+11		2.5E+08
Ru/Rh-106						3.3E+05	2.0E+14	3.0E+02
Sb-125								
I-129	3.2E+08	1.9E+12	5.2E+11	1.8E+09	4.1E+11	1.1E+09		3.7E+05
Cs-134								
Cs-137	8.8E+13	9.6E+14	1.0E+15	4.8E+14	7.6E+13	2.2E+15	9.3E+15	7.4E+11
Ce-144							6.6E+14	
Pm-147								
Eu-154/155							1.8E+14	
U-Natural				1.9E+11		7.4E+10		1.9E+02
Np-237						3.0E+09		1.1E+06
Pu-238						7.4E+09		3.7E+08
Pu-239/240		6.8E+12	1.5E+12	1.2E+12	7.2E+10	8.9E+10	3.2E+12	7.4E+06
Pu-241		4.7E+08				1.1E+11		1.1E+04
Am-241	2.0E+11	1.1E+12	2.5E+11	1.6E+12	1.5E+11	3.3E+11		3.7E+06
Am-242m						1.1E+06		1.1E+04
Am-243						2.2E+08		2.6E+03
Cm-242						1.1E+06		7.4E+03
Cm-244						3.0E+08		7.4E+04
TOTAL (Bq)	2.4E+14	9.8E+15	5.2E+15	2.4E+16	1.2E+15	2.9E+15	1.8E+16	8.9E+11

Tank Farms Raw Data

Single Shell Tanks

PAGE 18

Tank Name	U-104	U-105	U-106	U-107	U-108	U-109	U-110	U-111
Month	1	1	2	12	1	1	1	9
Year	90	90	74	74	90	90	90	80
ISOTOPES								
C-14	7.4E+01	2.6E+08			3.7E+08	1.1E+11	9.3E+09	
Co-60				1.0E+09				
Sr-79	1.1E+02	1.5E+07			1.9E+07	7.4E+09	3.3E+08	
Sr-89/90	1.5E+07	1.1E+11	3.6E+15	1.5E+14	1.9E+15	3.4E+13	1.1E+16	9.6E+12
Y-90	1.5E+07	1.1E+11	3.6E+15	1.5E+14	1.9E+15	3.4E+13	1.1E+16	9.6E+12
Zr-95								
Tc-99	3.7E+03	3.7E+08			7.4E+08	2.2E+11	1.1E+10	
Ru/Rh-106	3.3E-03	3.7E+00			3.7E+07	3.7E+03	2.2E+06	
Sb-125								
I-129	7.4E+00	7.4E+05			1.1E+06	3.3E+08	1.9E+07	
Cs-134				1.1E+08				1.4E+13
Cs-137	1.5E+07	1.9E+12	1.1E+05	5.2E+13	2.6E+12	7.4E+14	3.7E+13	8.6E+13
Ce-144								
Pm-147								
Eu-154/155								
U-Natural	3.0E+03	3.7E+08			3.3E+10	7.4E+08	1.1E+12	
Np-237	1.5E+01	1.5E+06			4.8E+06	3.7E+08	7.0E+07	
Pu-238	7.4E+02	3.3E+08			1.5E+10	1.5E+09	1.5E+12	
Pu-239/240	1.1E+03	3.7E+08	4.8E+08	1.0E+12	1.1E+11	3.7E+08	1.5E+12	5.9E+10
Pu-241	3.7E+03	2.6E+09			1.5E+12	2.6E+09	1.1E+13	
Am-241	4.1E+03	7.4E+09			3.3E+11	1.1E+10	3.7E+12	
Am-242m	1.5E-01	2.2E+05			3.7E+08	1.9E+06	2.6E+09	
Am-243	1.9E+00	2.2E+06			1.1E+08	7.4E+06	7.4E+08	
Cm-242	1.1E-01	1.9E+05			3.0E+08	1.5E+06	2.2E+09	
Cm-244	7.4E-01	3.3E+05			2.2E+05	7.4E+07	3.3E+06	
TOTAL (Bq)	4.5E+07	2.1E+12	7.2E+15	3.5E+14	3.8E+15	8.1E+14	2.2E+16	1.2E+14

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Tank Farms Raw Data
Single Shell Tanks PAGE 19

Tank Name	U-112	U-201	U-202	U-203	U-204
Month	1	1	1	12	12
Year	90	90	90	78	78
ISOTOPES					
C-14	7.4E+11	1.1E+11	1.1E+11		
Co-60					
Se-79	3.3E+10	3.7E+09	3.7E+09		
Sr-89/90	1.1E+14	7.4E+11	7.4E+11	9.6E+11	2.4E+10
Y-90	1.1E+14	7.4E+11	7.4E+11	9.6E+11	2.4E+10
Zr-95					
Tc-99	1.1E+12	1.9E+11	1.9E+11		
Ru/Rh-106	1.1E+04	3.7E+01	3.3E+01		
Sb-125					
I-129	1.9E+09	3.0E+08	3.0E+08		
Cs-134					
Cs-137	3.7E+15	7.4E+14	7.4E+14	4.5E+11	2.5E+13
Ce-144				1.8E+10	
Pm-147					
Eu-154/155					
U-Natural	2.6E+09	7.4E+01	1.1E+12		3.6E+06
Np-237	3.7E+09	7.4E+08	7.4E+08		
Pu-238	2.6E+09	7.4E+07	1.1E+08		
Pu-239/240	1.3E+10	1.8E+05	2.2E+05		5.5E+08
Pu-241	1.1E+10	5.9E+02	7.4E+02		
Am-241	1.9E+10	4.4E+06	4.4E+06		
Am-242m	1.9E+07	1.7E+04	4.4E+03		
Am-243	3.7E+06	2.9E+03	3.0E+03		
Cm-242	1.5E+07	1.3E+04	3.7E+03		
Cm-244	1.5E+08	2.6E+07	3.3E+07		
TOTAL (Bq)	3.9E+15	7.4E+14	7.4E+14	2.4E+12	2.5E+13

Tank Farms Raw Data

Double Shell Tanks PAGE 20

Tank Name	AN-101	AN-102	AN-103	AN-104	AN-105	AN-106	AN-107	AP-101
Month	7	8	2	1	11	3	2	NO
Year	88	91	90	85	84	91	85	DATA
ISOTOPES								
C-14		2.7E+11	2.6E+11			9.1E+10		
Co-60		2.3E+12	5.0E+12				1.3E+14	
Se-79								
Sr-89/90	1.6E+14	2.5E+16	1.7E+15	1.7E+14	3.5E+14	6.2E+14	2.3E+16	
Y-90	1.6E+14	2.5E+16	1.7E+15	1.7E+14	3.5E+14	6.2E+14	2.3E+16	
Zr-95								
Tc-99		6.4E+13	2.2E+13			1.2E+13		
Ru/Rh-106								
Sb-125								
I-129			7.0E+10			2.8E+10		
Cs-134	7.9E+13		1.4E+13					
Cs-137	1.8E+16	6.1E+16	9.8E+16	8.2E+16	5.6E+16	3.8E+16	5.5E+16	
Ce-144								
Pm-147	6.3E+14							
Eu-154/155		3.3E+14					4.1E+14	
U-Natural			8.9E+09			6.7E+08		
Np-237	8.2E+09		2.6E+09			2.2E+10		
Pu-238			1.3E+09					
Pu-239/240	3.7E+10	3.1E+13	2.5E+09	1.3E+12		6.2E+10	1.6E+13	
Pu-241							1.2E+14	
Am-241	1.3E+11	1.4E+14	3.0E+09	1.5E+15		2.1E+11	1.2E+14	
Am-242m								
Am-243								
Cm-242		7.0E+10						
Cm-244			5.5E+08				7.8E+11	
TOTAL (Bq)	1.9E+16	1.1E+17	1.0E+17	8.4E+16	5.7E+16	3.9E+16	1.0E+17	0.0E+00

Tank Farms Raw Data

Double Shell Tanks PAGE 21

Tank Name	AP-102	AP-103	AP-104	AP-105	AP-106	AP-107	AP-108	AW-101
Month	5	4	6	NO	NO	NO	NO	6
Year	88	88	88	DATA	DATA	DATA	DATA	90
ISOTOPES								
C-14			3.5E+06					5.5E+10
Co-60	9.6E+11		2.1E+10					9.0E+12
Se-79								
Sr-89/90	5.1E+09	9.9E+11	1.0E+08					1.6E+14
Y-90	5.1E+09	9.9E+11	1.0E+08					1.6E+14
Zr-95								
Tc-99			1.5E+08					2.2E+13
Ru/Rh-106								
Sb-125								
I-129			1.0E+08					4.5E+10
Cs-134		6.9E+08						2.2E+14
Cs-137	7.4E+10	5.6E+11	1.8E+09					7.9E+16
Ce-144		6.4E+10						
Pm-147								
Eu-154/155								
U-Natural			2.4E+06					5.7E+09
Np-237		2.8E+09	1.2E+06					3.2E+11
Pu-238								
Pu-239/240		2.6E+09	9.9E+06					2.0E+12
Pu-241								
Am-241	1.1E+09	2.1E+11	2.4E+06					5.1E+12
Am-242m								
Am-243								4.4E+13
Cm-242	1.4E+09							
Cm-244	5.5E+09		4.1E+06					
TOTAL (Bq)	1.1E+12	2.8E+12	2.3E+10	0.0E+00	0.0E+00	0.0E+00	0.0E+00	8.0E+16

Tank Farms Raw Data

Double Shell Tanks

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Tank Name	AW-102	AW-103	AW-104	AW-105	AW-106	AY-101	AY-102	AZ-101
Month	6	8	11	7	8	7	6	4
Year	90	88	84	88	88	88	88	89
ISOTOPES								
C-14		1.0E+11					6.3E+09	2.0E+11
Co-60							9.1E+12	2.0E+14
Se-79								
Sr-89/90	2.1E+13		5.4E+15		1.7E+15	1.2E+17	1.9E+17	1.7E+17
Y-90	2.1E+13		5.4E+15		1.7E+15	1.2E+17	1.9E+17	1.7E+17
Zr-95								
Tc-99		9.8E+11					1.6E+11	5.5E+13
Ru/Rh-106								
Sb-125								
I-129		3.0E+09					7.5E+09	9.6E+10
Cs-134	1.1E+14		8.9E+13		1.5E+14		5.7E+11	4.8E+15
Cs-137	8.7E+15		1.3E+17		1.6E+16	1.3E+16	2.2E+15	2.7E+17
Ce-144	1.7E+13				1.3E+13			
Pm-147								
Eu-154/155							3.2E+14	1.4E+15
U-Natural							1.3E+11	
Np-237	2.4E+09				1.8E+09			1.7E+11
Pu-238		5.4E+12					7.2E+12	4.8E+12
Pu-239/240	2.9E+09	8.4E+13			2.2E+10		2.3E+13	3.0E+13
Pu-241								2.6E+14
Am-241	5.4E+11	1.2E+13			5.0E+10		1.1E+14	4.1E+14
Am-242m								
Am-243								
Cm-242							4.0E+12	9.0E+11
Cm-244		5.7E+08						4.6E+12
TOTAL (Bq)	8.9E+15	1.0E+14	1.4E+17	0.0E+00	2.0E+16	2.5E+17	3.8E+17	6.2E+17

Tank Farms Raw Data

Double Shell Tanks

PAGE 23

Tank Name	AZ-102	SY-101	SY-102	SY-103
Month	10	5	6	6
Year	87	91	89	85
ISOTOPES				
C-14			3.2E+10	
Co-60			2.0E+12	
Se-79				
Sr-89/90	5.9E+15	4.5E+15	1.2E+15	2.9E+14
Y-90	5.9E+15	4.5E+15	1.2E+15	2.9E+14
Zr-95				
Tc-99	4.7E+15		4.0E+12	
Ru/Rh-106				
Sb-125				
I-129			4.3E+09	
Cs-134			1.1E+12	
Cs-137	1.1E+17	7.7E+16	3.4E+15	1.5E+17
Ce-144				
Pm-147				
Eu-154/155			2.7E+13	
U-Natural	6.3E+09	3.5E+09		
Np-237			1.1E+10	
Pu-238			6.6E+11	
Pu-239/240		1.8E+12	3.0E+12	3.6E+11
Pu-241			2.2E+13	
Am-241	7.3E+13	2.3E+13	1.7E+13	3.3E+11
Am-242m				
Am-243				
Cm-242				
Cm-244			7.7E+11	
TOTAL (Bq)	1.3E+17	8.6E+16	5.9E+15	1.5E+17

APPENDIX A-2.3
CALCULATIONS FOR SINGLE-SHELL TANK FARMS

Tank Farms Calculations

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Single Shell Tanks

PAGE 1

Tank Name	A-101	A-102	A-103	A-104	A-105	A-106	AX-101	AX-102
Month	6	1	1	1	1	1	1	11
Year	74	90	90	90	90	90	90	88
Time	19.25	3.67	3.67	3.67	3.67	3.67	3.67	4.83
C-14	0.0E+00	1.5E+13	1.1E+12	2.6E+13	1.9E+11	2.2E+09	3.7E+09	0.0E+00
Co-60	8.9E+12	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.6E+11
Se-79	0.0E+00	2.2E+11	7.4E+10	7.4E-08	1.1E+10	1.9E+02	7.4E+00	0.0E+00
Sr-89/90	0.0E+00	2.4E+17	6.7E+14	1.4E+17	1.0E+09	1.7E+08	1.0E+05	6.4E+13
Y-90	0.0E+00	2.4E+17	6.7E+14	1.4E+17	1.0E+09	1.7E+08	1.0E+05	6.4E+13
Zr-95	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Tc-99	0.0E+00	7.4E+12	2.6E+12	2.2E-06	3.7E+11	7.4E+03	7.4E+02	0.0E+00
Ru/Rh-106	0.0E+00	8.7E+08	5.8E+09	1.2E+08	2.9E+02	2.9E+09	2.4E+10	0.0E+00
Sb-125	2.0E+12	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
I-129	0.0E+00	1.1E+10	3.7E+09	3.7E-09	3.7E+08	1.1E+01	3.7E-01	0.0E+00
Cs-134	4.4E+11	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Cs-137	1.5E+16	1.0E+16	6.8E+14	3.4E-03	1.4E+15	1.0E+07	1.0E+05	1.3E+14
Ce-144	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Pm-147	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Eu-154/155	7.0E+13	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.8E+12
U-Natural	0.0E+00	3.7E+10	3.7E+10	7.4E+10	1.9E+02	1.5E+11	3.7E+10	0.0E+00
Np-237	0.0E+00	1.1E+10	3.7E+08	1.8E+08	1.5E+09	3.7E+07	1.9E+06	0.0E+00
Pu-238	0.0E+00	3.7E+11	7.2E+11	7.2E+11	1.5E+07	1.8E+12	7.2E+11	0.0E+00
Pu-239/240	0.0E+00	1.4E+13	1.4E+13	2.6E+13	5.9E+05	4.8E+13	1.4E+13	0.0E+00
Pu-241	0.0E+00	2.1E+13	3.0E+13	3.0E+13	6.2E+04	9.0E+13	3.0E+13	0.0E+00
Am-241	0.0E+00	1.1E+14	1.9E+13	3.0E+13	3.7E+05	1.1E+13	1.1E+12	4.2E+11
Am-242m	0.0E+00	1.9E+11	3.2E+10	3.0E+10	3.6E+02	7.3E+09	3.2E+00	0.0E+00
Am-243	0.0E+00	7.4E+10	2.2E+10	1.1E+10	1.5E+02	2.5E+09	2.2E+00	0.0E+00
Cm-242	0.0E+00	5.1E-08	3.3E-07	3.3E-07	1.1E+00	2.5E+07	8.8E-03	0.0E+00
Cm-244	0.0E+00	1.6E+11	1.3E+11	6.4E-10	1.3E+08	2.6E+01	1.6E+01	0.0E+00
TOTAL (Bq)	1.5E+16	4.8E+17	2.1E+15	2.7E+17	1.4E+15	1.5E+14	4.6E+13	2.6E+14

Tank Farms Calculations

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Single Shell Tanks

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Tank Name	AX-103	AX-104	B-101	B-102	B-103	B-104	B-105	B-106
Month	1	10	2	1	1	1	6	1
Year	90	74	76	90	90	90	76	90
Time	3.67	18.92	17.58	3.67	3.67	3.67	17.25	3.67
C-14	3.3E+11	0.0E+00	0.0E+00	5.2E+10	1.1E+11	1.5E+10	0.0E+00	1.9E+10
Co-60	0.0E+00	8.3E+13	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Se-79	1.5E+10	0.0E+00	0.0E+00	1.1E+09	3.7E+09	1.9E+09	0.0E+00	7.4E+08
Sr-89/90	6.7E+14	3.8E+17	2.3E+16	1.0E+13	3.0E+14	2.7E+14	1.5E+14	3.7E+12
Y-90	6.7E+14	3.8E+17	2.3E+16	1.0E+13	3.0E+14	2.7E+14	1.5E+14	3.7E+12
Zr-95	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Tc-99	3.7E+11	0.0E+00	0.0E+00	3.3E+10	1.9E+11	7.4E+10	0.0E+00	2.6E+10
Ru/Rh-106	2.0E+07	1.1E+11	0.0E+00	2.9E+08	5.8E+07	8.7E+01	0.0E+00	1.5E+02
Sb-125	0.0E+00	1.2E+14	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
I-129	7.4E+08	0.0E+00	0.0E+00	3.7E+07	3.0E+08	1.1E+08	0.0E+00	3.7E+07
Cs-134	0.0E+00	7.2E+12	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Cs-137	6.8E+14	1.4E+17	6.5E+15	1.0E+14	3.4E+14	1.7E+14	1.7E+13	6.8E+13
Ce-144	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Pm-147	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Eu-154/155	0.0E+00	1.5E+15	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
U-Natural	1.9E+02	0.0E+00	0.0E+00	3.0E+10	7.4E+10	1.1E+10	0.0E+00	1.1E+10
Np-237	7.4E+08	0.0E+00	0.0E+00	1.1E+08	7.5E+08	2.2E+08	0.0E+00	7.4E+07
Pu-238	7.6E+07	0.0E+00	0.0E+00	1.5E+11	1.8E+11	7.2E+09	0.0E+00	1.5E+08
Pu-239/240	4.6E+06	3.0E+13	1.7E+13	2.3E+12	9.3E+12	4.1E+12	5.4E+11	4.1E+10
Pu-241	2.7E+06	0.0E+00	0.0E+00	9.0E+12	1.8E+13	6.1E+11	0.0E+00	6.1E+09
Am-241	7.4E+11	0.0E+00	0.0E+00	3.8E+11	2.5E+12	1.5E+11	0.0E+00	9.2E+09
Am-242m	1.1E+09	0.0E+00	0.0E+00	1.5E+07	1.1E+09	1.1E+06	0.0E+00	1.1E+07
Am-243	3.7E+08	0.0E+00	0.0E+00	1.1E+07	4.4E+09	1.5E+06	0.0E+00	7.4E+06
Cm-242	3.7E+06	0.0E+00	0.0E+00	5.1E+04	3.4E+06	3.7E+03	0.0E+00	3.7E+04
Cm-244	1.9E+09	0.0E+00	0.0E+00	6.4E+07	6.4E+08	1.3E+05	0.0E+00	3.2E+07
TOTAL (Bq)	2.0E+15	9.1E+17	5.2E+16	1.3E+14	9.7E+14	7.3E+14	3.1E+14	7.6E+13

Tank Farms Calculations
Single Shell Tanks

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Tank Name	B-107	B-108	B-109	B-110	B-111	B-112	B-201	B-202
Month	4	1	1	1	1	1	1	1
Year	76	90	90	90	90	90	90	90
Time	17.42	3.67	3.67	3.67	3.67	3.67	3.67	3.67
C-14	0.0E+00	3.7E+11	2.6E+11	3.7E+12	7.8E+13	3.0E+12	0.0E+00	0.0E+00
Co-60	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Se-79	0.0E+00	2.6E+10	1.1E+10	3.0E+11	3.3E+12	2.2E+11	0.0E+00	0.0E+00
Sr-89/90	3.7E+14	1.7E+15	1.8E+14	2.2E+15	3.4E+06	3.4E+15	0.0E+00	0.0E+00
Y-90	3.7E+14	1.7E+15	1.8E+14	2.2E+15	3.4E+06	3.4E+15	0.0E+00	0.0E+00
Zr-95	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Tc-99	0.0E+00	1.1E+12	3.3E+11	1.1E+13	1.1E+14	7.4E+12	0.0E+00	0.0E+00
Ru/Rh-106	5.7E+08	2.9E+04	1.2E+04	2.9E+09	3.5E+05	2.9E+05	0.0E+00	0.0E+00
Sb-125	2.7E+12	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
I-129	0.0E+00	1.5E+09	3.7E+08	1.9E+10	1.9E+11	1.1E+10	0.0E+00	0.0E+00
Cs-134	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Cs-137	9.4E+13	1.0E+15	3.4E+14	2.0E+15	2.0E+16	6.8E+15	0.0E+00	0.0E+00
Ce-144	1.3E+07	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Pm-147	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Eu-154/155	3.6E+13	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
U-Natural	0.0E+00	3.0E+11	7.4E+10	2.8E+11	1.5E+10	2.2E+10	0.0E+00	1.1E+11
Np-237	0.0E+00	3.0E+09	1.1E+09	1.1E+09	3.7E+11	2.2E+10	0.0E+00	7.4E+06
Pu-238	0.0E+00	7.6E+08	3.7E+08	3.7E+11	7.2E+09	3.6E+10	0.0E+00	1.5E+11
Pu-239/240	0.0E+00	1.6E+11	2.1E+10	9.3E+12	1.3E+12	1.7E+11	0.0E+00	9.3E+12
Pu-241	0.0E+00	1.6E+10	1.6E+09	2.1E+13	9.0E+11	9.0E+10	0.0E+00	1.6E+13
Am-241	0.0E+00	1.9E+11	7.5E+10	3.9E+13	1.5E+11	1.5E+12	0.0E+00	1.5E+12
Am-242m	0.0E+00	3.6E+08	1.5E+08	1.5E+11	7.4E+06	3.2E+09	0.0E+00	0.0E+00
Am-243	0.0E+00	2.6E+08	7.4E+07	7.4E+10	1.9E+06	1.9E+09	0.0E+00	0.0E+00
Cm-242	0.0E+00	1.1E+06	3.7E+05	3.7E+08	2.5E+04	8.8E+06	0.0E+00	0.0E+00
Cm-244	0.0E+00	3.2E+09	9.5E+08	3.2E+11	3.2E+10	2.3E+10	0.0E+00	0.0E+00
TOTAL (Bq)	8.7E+14	4.5E+15	7.0E+14	3.5E+15	2.0E+16	1.4E+16	0.0E+00	2.7E+13

WHC-SD-EN-RPT-007

Tank Farms Calculations

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Single Shell Tanks

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Tank Name	B-203	B-204	EX-101	EX-102	EX-103	EX-104	EX-105	EX-106
Month	1	1	3	1	10	1	3	3
Year	90	90	76	90	75	90	86	90
Time	3.67	3.67	17.50	3.67	17.92	3.67	7.50	3.50
C-14	0.0E+00	0.0E+00	0.0E+00	2.2E+13	0.0E+00	3.7E+13	2.7E+10	0.0E+00
Co-60	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.4E+12	0.0E+00
Se-79	0.0E+00	0.0E+00	0.0E+00	7.4E+11	0.0E+00	3.3E+12	0.0E+00	0.0E+00
Sr-89/90	0.0E+00	0.0E+00	7.7E+15	4.0E+15	1.8E+14	6.7E+14	2.1E+15	4.8E+12
Y-90	0.0E+00	0.0E+00	7.7E+15	4.0E+15	1.8E+14	6.7E+14	2.1E+15	4.8E+12
Zr-95	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Tc-99	0.0E+00	0.0E+00	0.0E+00	2.2E+13	0.0E+00	1.1E+14	8.0E+11	0.0E+00
Ru/Rh-106	0.0E+00	0.0E+00	0.0E+00	1.7E+06	4.1E+09	6.1E+06	0.0E+00	0.0E+00
Sb-125	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
I-129	0.0E+00	0.0E+00	0.0E+00	3.7E+10	0.0E+00	1.9E+11	4.9E+08	0.0E+00
Cs-134	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.1E+10	0.0E+00	0.0E+00	0.0E+00
Cs-137	0.0E+00	0.0E+00	5.1E+15	1.0E+16	2.0E+15	2.0E+16	1.3E+15	1.7E+15
Ce-144	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Pm-147	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Eu-154/155	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.1E+12	0.0E+00	0.0E+00	0.0E+00
U-Natural	0.0E+00	0.0E+00	0.0E+00	1.5E+09	0.0E+00	3.0E+10	0.0E+00	1.1E+07
Np-237	3.3E+04	3.3E+05	0.0E+00	3.3E+10	0.0E+00	3.7E+11	0.0E+00	0.0E+00
Pu-238	1.8E+08	1.8E+09	0.0E+00	4.0E+10	0.0E+00	7.2E+10	0.0E+00	0.0E+00
Pu-239/240	3.0E+10	3.2E+11	5.7E+11	1.4E+12	0.0E+00	2.9E+12	5.5E+12	1.9E+09
Pu-241	2.5E+10	2.5E+11	0.0E+00	6.1E+12	0.0E+00	6.1E+12	0.0E+00	0.0E+00
Am-241	3.7E+09	3.7E+10	0.0E+00	2.6E+13	0.0E+00	7.4E+11	1.9E+13	3.0E+09
Am-242m	0.0E+00	0.0E+00	0.0E+00	3.6E+10	0.0E+00	3.0E+08	0.0E+00	0.0E+00
Am-243	0.0E+00	0.0E+00	0.0E+00	2.2E+10	0.0E+00	1.1E+08	0.0E+00	0.0E+00
Cm-242	0.0E+00	0.0E+00	0.0E+00	1.3E+08	0.0E+00	7.4E+05	0.0E+00	0.0E+00
Cm-244	0.0E+00	0.0E+00	0.0E+00	9.5E+10	0.0E+00	6.4E+10	0.0E+00	0.0E+00
TOTAL (Bq)	5.9E+10	6.1E+11	2.0E+16	1.8E+16	2.3E+15	2.2E+16	5.6E+15	1.7E+15

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Single Shell Tanks

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Tank Name	BX-107	BX-108	BX-109	BX-110	BX-111	BX-112	BY-101	BY-102
Month	3	1	3	3	3	3	1	6
Year	90	90	90	90	90	90	90	91
Time	3.50	3.67	3.50	3.50	3.50	3.50	3.67	2.25
C-14	0.0E+00	3.0E+09	0.0E+00	0.0E+00	0.0E+00	0.0E+00	7.4E+12	0.0E+00
Co-60	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Se-79	0.0E+00	1.1E+08	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.7E+11	0.0E+00
Sr-89/90	6.6E+10	1.7E+14	1.6E+13	3.8E+09	4.8E+10	1.5E+12	1.2E+16	1.0E+13
Y-90	6.6E+10	1.7E+14	1.6E+13	3.8E+09	4.8E+10	1.5E+12	1.2E+16	1.0E+13
Zr-95	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Tc-99	0.0E+00	3.7E+09	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.5E+13	1.1E+13
Ru/Rh-106	0.0E+00	2.0E+01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	5.8E+05	0.0E+00
Sb-125	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
I-129	0.0E+00	7.4E+06	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.2E+10	0.0E+00
Cs-134	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Cs-137	2.9E+13	1.7E+13	4.0E+14	3.5E+13	6.4E+14	8.6E+13	1.7E+16	4.8E+15
Ce-144	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Pm-147	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Eu-154/155	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
U-Natural	7.6E+08	3.7E+09	5.0E+07	8.5E+05	1.6E+08	9.9E+08	1.9E+09	0.0E+00
Np-237	0.0E+00	1.9E+07	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.7E+10	0.0E+00
Pu-238	0.0E+00	3.6E+08	0.0E+00	0.0E+00	0.0E+00	0.0E+00	4.3E+09	0.0E+00
Pu-239/240	7.2E+10	2.1E+11	2.8E+10	2.2E+07	2.3E+08	2.1E+10	1.9E+09	0.0E+00
Pu-241	0.0E+00	3.0E+10	0.0E+00	0.0E+00	0.0E+00	0.0E+00	6.1E+08	0.0E+00
Am-241	3.1E+08	1.1E+10	5.8E+09	7.3E+07	3.7E+08	2.2E+09	3.0E+12	0.0E+00
Am-242m	0.0E+00	1.5E+05	0.0E+00	0.0E+00	0.0E+00	0.0E+00	7.3E+09	0.0E+00
Am-243	0.0E+00	3.3E+05	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.7E+09	0.0E+00
Cm-242	0.0E+00	3.7E+02	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.3E+07	0.0E+00
Cm-244	0.0E+00	1.6E+06	0.0E+00	0.0E+00	0.0E+00	0.0E+00	6.4E+10	0.0E+00
TOTAL (Bq)	2.9E+13	3.6E+14	4.3E+14	3.5E+13	6.4E+14	8.9E+13	4.1E+16	4.9E+15

Tank Farms Calculations

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Single Shell Tanks

PAGE 6

Tank Name	BY-103	BY-104	BY-105	BY-106	BY-107	BY-108	BY-109	BY-110
Month	6	10	6	6	1	1	6	1
Year	91	92	91	91	90	90	91	90
Time	2.25	0.92	2.25	2.25	3.67	3.67	2.25	3.67
C-14	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.2E+12	2.2E+12	0.0E+00	3.7E+12
Co-60	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Se-79	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.5E+11	1.9E+11	0.0E+00	3.7E+11
Sr-89/90	3.3E+12	7.5E+15	3.6E+11	4.1E+12	5.1E+15	1.7E+15	3.7E+12	9.1E+15
Y-90	3.3E+12	7.5E+15	3.6E+11	4.1E+12	5.1E+15	1.7E+15	3.7E+12	9.1E+15
Zr-95	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Tc-99	1.8E+12	0.0E+00	8.2E+11	3.6E+12	7.4E+12	7.4E+12	2.3E+12	1.5E+13
Ru/Rh-106	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.6E+05	3.1E+05	0.0E+00	6.7E+05
Sb-125	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
I-129	0.0E+00	0.0E+00	0.0E+00	0.0E+00	7.4E+09	1.1E+10	0.0E+00	2.2E+10
Cs-134	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Cs-137	2.8E+15	7.2E+15	1.9E+15	9.5E+15	6.8E+15	6.8E+15	3.3E+15	1.7E+16
Ce-144	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Pm-147	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Eu-154/155	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
U-Natural	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.9E+11	3.3E+10	0.0E+00	2.2E+09
Np-237	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.9E+10	2.6E+10	0.0E+00	3.7E+10
Pu-238	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.5E+11	3.6E+11	0.0E+00	3.6E+11
Pu-239/240	0.0E+00	3.7E+12	0.0E+00	0.0E+00	1.3E+12	2.3E+12	0.0E+00	2.3E+12
Pu-241	0.0E+00	0.0E+00	0.0E+00	0.0E+00	9.0E+11	1.2E+12	0.0E+00	1.8E+12
Am-241	0.0E+00	5.6E+12	0.0E+00	0.0E+00	2.2E+12	3.3E+12	0.0E+00	4.4E+12
Am-242m	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.0E+09	4.0E+09	0.0E+00	8.4E+09
Am-243	0.0E+00	0.0E+00	1.2E+13	0.0E+00	2.2E+09	3.3E+09	0.0E+00	4.4E+09
Cm-242	0.0E+00	0.0E+00	0.0E+00	0.0E+00	7.4E+06	1.3E+07	0.0E+00	1.5E+07
Cm-244	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.9E+10	2.9E+10	0.0E+00	3.2E+10
TOTAL (Bq)	2.9E+15	2.2E+16	1.9E+15	9.5E+15	1.7E+16	1.0E+16	3.3E+15	3.6E+16

Tank Farms Calculations

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Single Shell Tanks

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Tank Name	BY-111	BY-112	C-101	C-102	C-103	C-104	C-105	C-106
Month	1	1	1	11	1	1	4	5
Year	90	90	90	90	88	88	86	86
Time	3.67	3.67	3.67	2.83	5.67	5.67	7.42	7.33
C-14	7.5E+12	1.1E+12	7.4E+11	0.0E+00	1.8E+10	4.2E+10	3.2E+10	9.9E+09
Co-60	0.0E+00	0.0E+00	0.0E+00	6.6E+11	1.1E+14	1.4E+13	9.1E+12	1.3E+13
Se-79	3.7E+11	7.4E+10	3.7E+10	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Sr-89/90	1.2E+16	2.4E+15	2.4E+15	1.1E+11	1.3E+17	1.6E+16	2.3E+16	6.5E+16
Y-90	1.2E+16	2.4E+15	2.4E+15	1.1E+11	1.3E+17	1.6E+16	2.3E+16	6.5E+16
Zr-95	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Tc-99	1.5E+13	3.0E+12	1.9E+12	1.2E+11	1.7E+13	1.4E+14	3.8E+12	9.0E+12
Ru/Rh-106	5.8E+05	1.2E+05	5.8E+06	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Sb-125	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
I-129	2.6E+10	3.7E+09	2.6E+09	0.0E+00	2.1E+09	0.0E+00	4.3E+09	3.2E+09
Cs-134	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Cs-137	1.7E+16	3.0E+15	6.8E+15	9.4E+13	4.5E+15	1.8E+15	4.6E+15	1.1E+16
Ce-144	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Pm-147	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Eu-154/155	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
U-Natural	3.7E+10	1.9E+09	7.4E+10	0.0E+00	0.0E+00	0.0E+00	2.9E+11	1.1E+14
Np-237	3.7E+10	7.4E+09	7.4E+09	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Pu-238	4.3E+09	3.7E+09	7.2E+10	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Pu-239/240	9.3E+09	6.0E+07	4.8E+12	3.7E+10	3.8E+13	6.1E+14	9.5E+13	1.1E+14
Pu-241	9.0E+09	2.5E+07	9.0E+12	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Am-241	3.0E+12	3.7E+11	1.9E+12	0.0E+00	5.6E+13	1.5E+14	4.8E+13	4.2E+13
Am-242m	7.3E+09	1.1E+09	1.1E+09	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Am-243	3.7E+09	7.4E+08	3.7E+08	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Cm-242	2.5E+07	3.7E+06	2.5E+06	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Cm-244	6.4E+10	9.5E+09	6.4E+08	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
TOTAL (Bq)	4.1E+16	7.8E+15	1.2E+16	9.6E+13	2.6E+17	3.4E+16	5.1E+16	1.4E+17

Tank Farms Calculations

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Single Shell Tanks

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Tank Name	C-107	C-108	C-109	C-110	C-111	C-112	C-201	C-202
Month	11	1	1	11	1	1	12	1
Year	90	90	90	90	90	90	78	90
Time	2.83	3.67	3.67	2.83	3.67	3.67	14.75	3.67
C-14	0.0E+00	1.1E+10	7.0E+10	0.0E+00	2.8E+10	8.9E+10	0.0E+00	1.1E+08
Co-60	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Se-79	0.0E+00	1.5E+06	1.5E+09	0.0E+00	1.1E+09	1.1E+09	0.0E+00	1.9E-07
Sr-89/90	7.5E+12	6.7E+14	2.4E+12	1.8E+10	3.0E+15	1.4E+15	1.8E+13	1.7E-03
Y-90	7.5E+12	6.7E+14	2.4E+12	1.8E+10	3.0E+15	1.4E+15	1.8E+13	1.7E-03
Zr-95	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Tc-99	3.9E+11	3.7E+07	3.7E+10	1.6E+11	3.7E+10	3.3E+10	0.0E+00	7.4E-06
Ru/Rh-106	0.0E+00	2.9E+06	1.2E+02	0.0E+00	8.7E+04	1.5E+06	0.0E+00	2.6E+00
Sb-125	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
I-129	0.0E+00	7.4E+04	7.4E+07	0.0E+00	7.4E+07	3.7E+07	0.0E+00	1.1E-08
Cs-134	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Cs-137	1.9E+14	1.4E+11	1.7E+14	5.2E+13	1.4E+14	1.4E+14	2.0E+12	1.4E-02
Ce-144	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Pm-147	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Eu-154/155	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
U-Natural	0.0E+00	3.7E+10	7.8E+09	0.0E+00	3.7E+10	4.0E+10	0.0E+00	7.4E+09
Np-237	0.0E+00	1.1E+07	2.2E+08	0.0E+00	1.9E+08	1.6E+08	0.0E+00	1.5E+04
Pu-238	0.0E+00	7.2E+10	3.6E+09	0.0E+00	1.1E+11	3.6E+10	0.0E+00	3.6E+06
Pu-239/240	2.2E+12	4.4E+12	4.4E+10	9.9E+10	3.0E+12	2.6E+12	1.4E+12	2.4E+09
Pu-241	0.0E+00	6.1E+12	3.0E+09	0.0E+00	3.0E+12	3.0E+12	0.0E+00	2.1E+08
Am-241	3.6E+09	1.5E+12	3.7E+09	0.0E+00	7.4E+11	7.4E+11	0.0E+00	1.1E+09
Am-242m	0.0E+00	1.1E+09	1.2E+05	0.0E+00	3.2E+08	7.3E+08	0.0E+00	1.9E+04
Am-243	0.0E+00	3.0E+08	2.2E+05	0.0E+00	1.5E+08	1.5E+08	0.0E+00	3.7E+04
Cm-242	0.0E+00	2.5E+06	2.3E+02	0.0E+00	8.8E+05	2.5E+06	0.0E+00	5.1E+01
Cm-244	0.0E+00	3.2E+03	1.9E+07	0.0E+00	1.6E+07	1.9E+07	0.0E+00	3.2E-12
TOTAL (Bq)	2.0E+14	1.4E+15	1.8E+14	5.2E+13	6.2E+15	2.9E+15	4.0E+13	1.1E+10

Tank Farms Calculations

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Single Shell Tanks

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Tank Name	C-203	C-204	S-101	S-102	S-103	S-104	S-105	S-106
Month	1	1	7	1	1	2	9	9
Year	90	90	75	90	90	76	74	74
Time	3.67	3.67	18.17	3.67	3.67	17.58	19.00	19.00
C-14	1.1E+07	7.4E+04	0.0E+00	3.0E+03	7.5E+04	0.0E+00	0.0E+00	0.0E+00
Co-60	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Se-79	1.9E+00	3.0E+04	0.0E+00	2.6E+02	3.7E+02	0.0E+00	0.0E+00	0.0E+00
Sr-89/90	2.0E+13	1.0E+10	3.1E+16	1.7E+15	1.0E+07	1.0E+16	0.0E+00	0.0E+00
Y-90	2.0E+13	1.0E+10	3.1E+16	1.7E+15	1.0E+07	1.0E+16	0.0E+00	0.0E+00
Zr-95	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Tc-99	7.4E+01	1.1E+06	0.0E+00	1.1E+04	1.5E+04	0.0E+00	0.0E+00	0.0E+00
Ru/Rh-106	2.4E-01	5.8E-04	0.0E+00	1.5E+06	2.9E-04	0.0E+00	0.0E+00	0.0E+00
Sb-125	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
I-129	1.1E-01	1.5E+03	0.0E+00	1.9E+01	2.6E+01	0.0E+00	0.0E+00	0.0E+00
Cs-134	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Cs-137	2.0E+05	2.8E+09	9.2E+15	1.4E+07	1.0E+07	3.1E+15	5.5E+14	9.0E+15
Ce-144	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Pm-147	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Eu-154/155	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
U-Natural	7.4E+08	3.3E+06	0.0E+00	1.1E+10	1.1E+09	0.0E+00	0.0E+00	0.0E+00
Np-237	1.5E+03	3.3E+03	0.0E+00	3.7E+06	2.6E+05	0.0E+00	0.0E+00	0.0E+00
Pu-238	7.2E+05	1.5E+03	0.0E+00	7.2E+10	7.2E+09	0.0E+00	0.0E+00	0.0E+00
Pu-239/240	2.4E+08	8.1E+05	1.8E+13	8.9E+11	8.9E+10	1.2E+13	0.0E+00	0.0E+00
Pu-241	2.1E+07	9.0E+04	0.0E+00	6.1E+11	9.0E+10	0.0E+00	0.0E+00	0.0E+00
Am-241	1.1E+08	3.4E+05	0.0E+00	3.7E+11	3.7E+10	0.0E+00	0.0E+00	0.0E+00
Am-242m	1.9E+03	3.6E+00	0.0E+00	3.2E+08	3.6E+07	0.0E+00	0.0E+00	0.0E+00
Am-243	3.7E+03	1.1E+01	0.0E+00	7.4E+07	1.1E+07	0.0E+00	0.0E+00	0.0E+00
Cm-242	5.1E+00	1.3E-02	0.0E+00	8.8E+05	1.0E+05	0.0E+00	0.0E+00	0.0E+00
Cm-244	3.2E-05	6.4E-01	0.0E+00	3.2E-01	6.4E-01	0.0E+00	0.0E+00	0.0E+00
TOTAL (Bq)	4.0E+13	2.3E+10	7.1E+16	3.5E+15	2.2E+11	2.3E+16	5.5E+14	9.0E+15

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Single Shell Tanks

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Tank Name	S-107	S-108	S-109	S-110	S-111	S-112	SX-101	SX-102
Month	10	3	12	10	1	1	1	9
Year	78	74	76	74	90	90	90	74
Time	14.92	19.50	16.75	18.92	3.67	3.67	3.67	19.00
C-14	0.0E+00	0.0E+00	0.0E+00	0.0E+00	7.4E+12	3.7E+13	2.2E+02	0.0E+00
Co-60	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Se-79	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.7E+11	2.6E+12	1.1E+01	0.0E+00
Sr-89/90	1.4E+15	3.0E+13	1.1E+15	1.2E+16	2.4E+16	3.4E+16	2.4E+16	1.4E+16
Y-90	1.4E+15	3.0E+13	1.1E+15	1.2E+16	2.4E+16	3.4E+16	2.4E+16	1.4E+16
Zr-95	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Tc-99	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.1E+13	7.4E+13	3.7E+02	0.0E+00
Ru/Rh-106	0.0E+00	2.6E+09	0.0E+00	0.0E+00	2.7E+05	1.2E+06	2.9E+05	0.0E+00
Sb-125	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
I-129	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.9E+10	1.5E+11	7.4E-01	0.0E+00
Cs-134	0.0E+00	2.7E+11	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Cs-137	3.3E+15	2.1E+16	5.6E+15	2.2E+15	3.4E+16	1.7E+17	3.4E+05	4.8E+15
Ce-144	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Pm-147	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Eu-154/155	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
U-Natural	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.7E+09	7.4E+08	3.7E+10	0.0E+00
Np-237	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.1E+10	1.5E+11	7.4E+07	0.0E+00
Pu-238	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.1E+10	1.1E+10	1.5E+12	0.0E+00
Pu-239/240	1.8E+14	1.2E+11	0.0E+00	0.0E+00	4.0E+11	4.5E+10	8.9E+12	0.0E+00
Pu-241	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.0E+11	3.0E+10	6.1E+12	0.0E+00
Am-241	0.0E+00	0.0E+00	0.0E+00	0.0E+00	5.6E+11	3.7E+13	3.7E+12	0.0E+00
Am-242m	0.0E+00	0.0E+00	0.0E+00	0.0E+00	5.5E+08	7.3E+10	1.1E+10	0.0E+00
Am-243	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.8E+08	3.3E+10	2.2E+09	0.0E+00
Cm-242	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.3E+06	1.3E+08	2.5E+07	0.0E+00
Cm-244	0.0E+00	0.0E+00	0.0E+00	0.0E+00	6.4E+09	1.6E+11	1.3E+00	0.0E+00
TOTAL (Bq)	6.2E+15	2.1E+16	7.8E+15	2.7E+16	8.1E+16	2.4E+17	4.7E+16	3.3E+16

Tank Farms Calculations

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Single Shell Tanks

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Tank Name	SX-103	SX-104	SX-105	SX-106	SX-107	SX-108	SX-109	SX-110
Month	1	9	1	1	3	1	1	1
Year	90	74	90	90	77	90	90	90
Time	3.67	19.00	3.67	3.67	16.50	3.67	3.67	3.67
C-14	2.3E+13	0.0E+00	3.7E+12	7.7E+11	0.0E+00	1.5E+05	7.4E+04	4.1E+04
Co-60	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.1E+16	0.0E+00	0.0E+00	0.0E+00
Se-79	2.2E+12	0.0E+00	7.4E+11	2.0E+11	0.0E+00	7.4E+03	3.3E+03	1.9E+02
Sr-89/90	2.4E+16	3.7E+16	1.0E+16	6.7E+15	0.0E+00	3.4E+16	1.0E+16	2.4E+16
Y-90	2.4E+16	3.7E+16	1.0E+16	6.7E+15	0.0E+00	3.4E+16	1.0E+16	2.4E+16
Zr-95	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Tc-99	7.4E+13	0.0E+00	2.6E+13	1.1E+13	0.0E+00	2.2E+05	1.1E+05	7.4E+03
Ru/Rh-106	1.8E+06	0.0E+00	6.1E+05	2.4E+05	0.0E+00	1.5E+08	5.8E+07	1.2E+09
Sb-125	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
I-129	1.1E+11	0.0E+00	3.7E+10	1.5E+10	0.0E+00	1.9E+02	1.9E+02	7.4E+00
Cs-134	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Cs-137	6.8E+16	2.0E+15	6.8E+15	6.8E+15	1.8E+18	3.4E+08	3.4E+08	1.0E+07
Ce-144	0.0E+00	0.0E+00	0.0E+00	0.0E+00	5.2E+11	0.0E+00	0.0E+00	0.0E+00
Pm-147	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Eu-154/155	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
U-Natural	1.9E+09	0.0E+00	3.7E+09	7.4E+09	0.0E+00	7.4E+10	3.7E+10	7.4E+10
Np-237	7.4E+10	0.0E+00	1.5E+10	1.9E+10	0.0E+00	1.5E+08	7.4E+07	1.5E+08
Pu-238	4.3E+10	0.0E+00	1.5E+11	1.7E+09	0.0E+00	7.2E+11	7.2E+11	2.1E+11
Pu-239/240	9.0E+10	0.0E+00	8.5E+11	6.6E+07	3.4E+08	1.3E+13	8.9E+12	1.4E+13
Pu-241	9.0E+10	0.0E+00	6.1E+11	3.4E+07	0.0E+00	1.8E+13	9.0E+12	2.5E+13
Am-241	1.1E+14	0.0E+00	3.7E+13	1.5E+13	0.0E+00	1.9E+13	7.4E+12	2.6E+13
Am-242m	1.9E+11	0.0E+00	7.4E+10	2.2E+10	0.0E+00	2.2E+10	1.1E+10	3.0E+10
Am-243	7.4E+10	0.0E+00	3.0E+10	7.4E+09	0.0E+00	7.4E+09	3.0E+09	7.4E+09
Cm-242	5.1E+08	0.0E+00	1.3E+08	6.4E+07	0.0E+00	6.4E+07	3.7E+07	7.4E+07
Cm-244	3.2E+11	0.0E+00	1.3E+11	2.6E+10	0.0E+00	1.3E+02	3.2E+01	2.3E+01
TOTAL (Bq)	1.2E+17	7.6E+16	2.7E+16	2.0E+16	1.8E+18	6.7E+16	2.0E+16	4.7E+16

Tank Farms Calculations
Single Shell Tanks

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Tank Name	SX-111	SX-112	SX-113	SX-114	SX-115	T-101	T-102	T-103
Month	9	1	1	1	4	8	1	1
Year	75	90	90	90	75	89	90	90
Time	18.00	3.67	3.67	3.67	18.42	4.08	3.67	3.67
C-14	0.0E+00	1.5E+10	2.6E+12	2.2E-03	0.0E+00	0.0E+00	3.7E+10	2.6E+11
Co-60	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.4E+12	0.0E+00	0.0E+00	0.0E+00
Se-79	0.0E+00	7.4E+08	1.1E+11	7.4E-05	0.0E+00	0.0E+00	1.5E+09	7.4E+09
Sr-89/90	3.7E+16	3.4E+16	1.0E+16	3.4E+16	2.5E+16	1.9E+11	1.4E+12	6.7E+14
Y-90	3.7E+16	3.4E+16	1.0E+16	3.4E+16	2.5E+16	1.9E+11	1.4E+12	6.7E+14
Zr-95	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Tc-99	0.0E+00	2.6E+10	3.7E+12	3.7E-03	0.0E+00	4.5E+11	3.7E+10	2.6E+11
Ru/Rh-106	0.0E+00	8.7E+07	1.5E+06	5.8E+08	0.0E+00	0.0E+00	1.5E+03	8.7E+03
Sb-125	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.1E+12	0.0E+00	0.0E+00	0.0E+00
I-129	0.0E+00	3.7E+07	7.4E+09	7.4E-06	0.0E+00	0.0E+00	7.4E+07	3.7E+08
Cs-134	0.0E+00	0.0E+00	0.0E+00	0.0E+00	8.0E+10	0.0E+00	0.0E+00	0.0E+00
Cs-137	2.5E+15	1.0E+14	1.4E+16	1.7E+01	3.9E+13	0.0E+00	1.4E+13	6.8E+13
Ce-144	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Pm-147	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Eu-154/155	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.5E+13	0.0E+00	0.0E+00	0.0E+00
U-Natural	0.0E+00	3.7E+10	1.5E+10	1.1E+11	0.0E+00	0.0E+00	1.9E+08	7.4E+08
Np-237	0.0E+00	8.9E+07	1.9E+10	1.9E+08	0.0E+00	0.0E+00	3.7E+07	2.2E+08
Pu-238	0.0E+00	7.2E+11	2.9E+10	3.6E+11	0.0E+00	0.0E+00	1.8E+07	2.9E+09
Pu-239/240	1.4E+12	8.9E+12	2.6E+12	1.9E+13	1.0E+13	6.5E+08	1.2E+06	4.4E+09
Pu-241	0.0E+00	1.2E+13	2.5E+12	2.7E+13	0.0E+00	0.0E+00	7.0E+04	2.5E+09
Am-241	0.0E+00	1.1E+13	1.5E+12	3.0E+13	0.0E+00	4.8E+08	7.4E+10	3.3E+11
Am-242m	0.0E+00	1.1E+10	7.3E+08	3.2E+10	0.0E+00	0.0E+00	1.1E+08	7.3E+08
Am-243	0.0E+00	3.7E+09	2.6E+08	1.1E+10	0.0E+00	0.0E+00	3.7E+07	3.0E+08
Cm-242	0.0E+00	3.7E+07	2.5E+06	8.3E+07	0.0E+00	0.0E+00	2.5E+05	1.3E+06
Cm-244	0.0E+00	9.5E+06	3.2E+08	9.5E-07	0.0E+00	0.0E+00	2.6E+08	1.3E+09
TOTAL (Bq)	7.7E+16	6.7E+16	3.4E+16	6.7E+16	5.0E+16	8.3E+11	1.7E+13	1.4E+15

Tank Farms Calculations

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Single Shell Tanks

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Tank Name	T-104	T-105	T-106	T-107	T-108	T-109	T-110	T-111
Month	11	9	4	8	3	1	1	3
Year	79	65	75	89	65	90	90	65
Time	13.83	28.00	18.42	4.08	28.50	3.67	3.67	28.50
C-14	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.7E+09	7.4E-02	0.0E+00
Co-60	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Se-79	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.9E+09	1.1E-01	0.0E+00
Sr-89/90	3.1E+14	0.0E+00	0.0E+00	1.9E+15	2.0E+11	2.4E+12	1.4E-14	0.0E+00
Y-90	3.1E+14	0.0E+00	0.0E+00	1.9E+15	2.0E+11	2.4E+12	1.4E+14	0.0E+00
Zr-95	0.0E+00	5.5E-31	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.5E-35
Tc-99	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	7.4E+10	3.7E+00	0.0E+00
Ru/Rh-106	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.2E+02	5.8E+01	3.7E+04
Sb-125	0.0E+00	0.0E+00	0.0E+00	6.3E+13	0.0E+00	0.0E+00	0.0E+00	0.0E+00
I-129	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.1E+08	3.0E-03	0.0E+00
Cs-134	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Cs-137	0.0E+00	0.0E+00	3.3E+16	1.6E+15	1.4E+13	1.7E+14	6.8E+03	6.7E+12
Ce-144	0.0E+00	0.0E+00	0.0E+00	4.3E+13	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Pm-147	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Eu-154/155	6.6E+13	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
U-Natural	4.6E+09	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.5E+09	7.4E+09	0.0E+00
No-237	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.6E+08	2.6E+06	0.0E+00
Pu-238	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	7.2E+07	1.5E+10	0.0E+00
Pu-239/240	2.2E+13	0.0E+00	1.5E+12	1.5E+10	0.0E+00	2.1E+10	8.1E+12	0.0E+00
Pu-241	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.8E+09	1.2E+12	0.0E+00
Am-241	0.0E+00	0.0E+00	0.0E+00	1.5E+10	0.0E+00	7.5E+08	3.0E+11	0.0E+00
Am-242m	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.1E+04	3.0E+05	0.0E+00
Am-243	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.3E+04	7.4E+05	0.0E+00
Cm-242	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.6E+01	8.8E+02	0.0E+00
Cm-244	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	6.4E+05	1.9E-05	0.0E+00
TOTAL (Bq)	7.0E+14	5.5E-31	3.3E-16	5.5E-15	1.5E+13	1.8E+14	2.8E+14	6.7E+12

Tank Farms Calculations
Single Shell Tanks

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Tank Name	T-112	T-201	T-202	T-203	T-204	TX-101	TX-102	TX-103
Month	10	1	1	1	12	1	2	9
Year	87	90	90	90	78	90	81	79
Time	5.92	3.67	3.67	3.67	14.75	3.67	12.58	14.00
C-14	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	7.4E+11	0.0E+00	0.0E+00
Co-60	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Se-79	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.1E+02	0.0E+00	0.0E+00
Sr-89/90	0.0E+00	0.0E+00	0.0E+00	0.0E+00	5.6E+10	2.7E+14	0.0E+00	8.4E+13
Y-90	0.0E+00	0.0E+00	0.0E+00	0.0E+00	5.6E+10	2.7E+14	0.0E+00	8.4E+13
Zr-95	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Tc-99	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.7E+03	0.0E+00	0.0E+00
Ru/Rh-106	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	8.7E+03	0.0E+00	0.0E+00
Sb-125	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
I-129	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.3E+00	0.0E+00	0.0E+00
Cs-134	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Cs-137	0.0E+00	0.0E+00	0.0E+00	0.0E+00	5.1E+09	2.4E+06	6.1E+15	8.7E+15
Ce-144	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Pm-147	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Eu-154/155	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
U-Natural	0.0E+00	0.0E+00	0.0E+00	0.0E+00	4.7E+05	3.0E+03	0.0E+00	0.0E+00
Np-237	0.0E+00	0.0E+00	1.5E+04	1.5E+05	0.0E+00	3.0E+02	0.0E+00	0.0E+00
Pu-238	0.0E+00	0.0E+00	7.2E+07	7.2E+08	0.0E+00	1.1E+07	0.0E+00	0.0E+00
Pu-239/240	6.8E+10	0.0E+00	1.3E+10	1.3E+11	4.5E+10	2.0E+07	0.0E+00	8.1E+11
Pu-241	0.0E+00	0.0E+00	9.0E+09	9.0E+10	0.0E+00	3.0E+06	0.0E+00	0.0E+00
Am-241	7.9E+10	0.0E+00	1.9E+09	1.9E+10	0.0E+00	3.7E+07	0.0E+00	0.0E+00
Am-242m	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.6E+04	0.0E+00	0.0E+00
Am-243	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.5E+04	0.0E+00	0.0E+00
Cm-242	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.1E+02	0.0E+00	0.0E+00
Cm-244	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	6.4E+00	0.0E+00	0.0E+00
TOTAL (Bq)	1.5E+11	0.0E+00	2.4E+10	2.4E+11	1.6E+11	5.5E+14	6.1E+15	8.9E+15

Tank Farms Calculations

Decay To:

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Single Shell Tanks

PAGE 15

Tank Name	TX-104	TX-105	TX-106	TX-107	TX-108	TX-109	TX-110	TX-111
Month	3	1	1	1	1	1	1	1
Year	65	90	90	90	90	90	90	90
Time	28.50	3.67	3.67	3.67	3.67	3.67	3.67	3.67
C-14	0.0E+00	1.1E+12	1.9E+11	3.7E+02	3.7E+11	1.1E+13	3.7E+12	3.7E+11
Co-60	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Se-79	0.0E+00	1.1E+11	1.1E+10	3.0E+02	3.7E+10	1.1E+12	3.3E+11	3.7E+10
Sr-89/90	0.0E+00	1.0E+14	1.7E+05	3.4E+07	1.7E+14	4.0E+15	3.4E+15	1.7E+15
Y-90	0.0E+00	1.0E+14	1.7E+05	3.4E+07	1.7E+14	4.0E+15	3.4E+15	1.7E+15
Zr-95	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Tc-99	0.0E+00	3.7E+12	3.3E+11	1.9E+04	1.5E+12	3.3E+13	1.1E+13	1.9E+12
Ru/Rh-106	0.0E+00	2.0E+05	5.8E+01	1.5E-03	8.7E+02	5.9E+05	1.7E+05	1.7E+04
Sb-125	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
I-129	0.0E+00	3.7E+09	3.7E+08	1.9E+01	2.2E+09	3.7E+10	1.9E+10	2.6E+09
Cs-134	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Cs-137	2.3E+16	6.8E+14	1.0E+15	3.4E+07	3.4E+15	3.0E+16	1.4E+16	3.0E+15
Ce-144	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Pm-147	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Eu-154/155	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
U-Natural	0.0E+00	3.7E-02	1.1E+04	7.4E+03	7.4E+09	3.7E+10	1.5E+10	7.4E+09
Np-237	0.0E+00	7.4E+09	1.5E+09	7.4E+01	3.0E+09	7.4E+10	3.0E+10	3.7E+09
Pu-238	0.0E+00	2.9E+07	3.6E+05	7.2E+03	3.6E+09	1.8E+11	7.5E+09	7.5E+08
Pu-239/240	0.0E+00	3.1E+07	2.6E+05	4.0E+04	2.6E+10	8.5E+12	4.4E+11	4.4E+10
Pu-241	0.0E+00	9.9E+07	1.6E+03	6.1E+04	3.0E+10	3.0E+12	2.7E+11	2.7E+10
Am-241	0.0E+00	1.1E+08	2.2E-06	2.5E+04	3.7E-10	4.8E+12	1.6E+12	1.9E+11
Am-242m	0.0E+00	1.9E+04	7.3E+03	3.6E-01	1.1E+06	7.3E+09	3.0E+09	3.0E+08
Am-243	0.0E+00	7.4E-03	1.1E-03	1.1E-01	2.2E-07	3.8E+09	1.9E+09	1.9E+08
Cm-242	0.0E+00	5.1E+01	1.3E-01	1.1E-03	2.5E+03	2.5E+07	8.8E+06	8.8E+05
Cm-244	0.0E+00	1.6E+09	6.4E-07	6.4E-00	1.6E-09	3.2E+10	1.3E+10	1.6E+09
TOTAL (Bq)	2.3E+16	8.9E+14	1.0E+15	1.0E+08	3.7E+15	3.8E+16	2.1E+16	6.5E+15

Tank Farms Calculations

Decay To:

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Single Shell Tanks

PAGE 16

Tank Name	TX-112	TX-113	TX-114	TX-115	TX-116	TX-117	TX-118	TY-101
Month	1	1	1	1	1	1	10	9
Year	90	90	90	90	90	90	81	85
Time	3.67	3.67	3.67	3.67	3.67	3.67	11.92	8.00
C-14	7.4E+10	3.8E+11	1.2E+11	2.6E+11	3.7E+10	3.7E+11	0.0E+00	2.4E+10
Co-60	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	9.5E+10
Se-79	2.6E+10	7.4E+09	2.2E+10	1.1E+10	7.4E+09	2.2E+09	0.0E+00	0.0E+00
Sr-89/90	2.7E+14	2.7E+14	2.7E+13	1.0E+15	1.4E+15	2.4E+15	1.5E+11	2.8E+14
Y-90	2.7E+14	2.7E+14	2.7E+13	1.0E+15	1.4E+15	2.4E+15	1.5E+11	2.8E+14
Zr-95	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Tc-99	7.4E+11	3.0E+11	7.4E+11	3.7E+11	2.2E+11	7.4E+10	0.0E+00	2.0E+11
Ru/Rh-106	1.2E+03	8.7E+02	8.7E+01	5.8E+03	1.7E+00	8.7E+00	0.0E+00	0.0E+00
Sb-125	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
I-129	1.5E+09	3.7E+08	1.1E+09	7.4E+08	3.0E+08	1.1E+08	0.0E+00	1.3E+09
Cs-134	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Cs-137	2.4E+15	6.8E+14	2.4E+15	1.4E+15	6.8E+14	2.0E+14	1.9E+14	6.4E+12
Ce-144	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Pm-147	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Eu-154/155	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
U-Natural	1.5E+09	3.7E+12	1.1E+11	7.4E+11	1.1E+11	7.4E+11	0.0E+00	4.5E+10
Np-237	3.0E+09	1.1E+09	3.0E+09	1.1E+09	7.4E+08	3.0E+08	0.0E+00	0.0E+00
Pu-238	2.9E+07	1.1E+10	3.6E+09	2.1E+09	1.7E+08	7.2E+08	0.0E+00	0.0E+00
Pu-239/240	2.5E+09	2.2E+12	2.2E+11	2.2E+10	2.8E+04	3.7E+05	0.0E+00	0.0E+00
Pu-241	6.1E+08	9.0E+11	9.0E+10	9.0E+09	3.4E+01	6.1E+02	0.0E+00	0.0E+00
Am-241	1.1E+10	2.2E+11	2.2E+10	2.6E+09	3.5E+08	7.5E+08	0.0E+00	3.5E+11
Am-242m	1.9E+07	7.3E+08	7.3E+07	7.3E+06	7.5E+04	7.3E+05	0.0E+00	0.0E+00
Am-243	1.1E+07	1.5E+07	1.1E+06	1.6E+05	2.7E+04	1.5E+05	0.0E+00	0.0E+00
Cm-242	5.1E+06	2.5E+06	2.5E+05	2.5E+04	1.3E+02	2.5E+03	0.0E+00	0.0E+00
Cm-244	9.5E+07	1.3E+06	6.4E+06	9.5E+07	1.3E+06	6.4E+05	0.0E+00	0.0E+00
TOTAL (Bq)	2.9E+15	1.2E+15	2.4E+15	3.4E+15	3.4E+15	4.9E+15	1.9E+14	5.6E+14

Tank Farms Calculations

Decay To:

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Single Shell Tanks

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Tank Name	TY-102	TY-103	TY-104	TY-105	TY-106	U-101	U-102	U-103
Month	9	8	1	9	7	1	4	1
Year	85	85	88	85	85	90	76	90
Time	8.00	8.08	5.67	8.00	8.17	3.67	17.42	3.67
C-14	1.5E+10	4.8E+10	2.5E+10	4.0E+10	5.3E+09	3.7E+11	0.0E+00	1.5E+08
Co-60	1.4E+10	5.2E+10	8.6E+10	2.6E+11	2.0E+10	0.0E+00	1.3E+13	0.0E+00
Se-79	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.9E+10	0.0E+00	7.4E+08
Sr-89/90	6.3E+13	3.6E+15	1.8E+15	9.8E+15	4.5E+14	3.4E+14	2.4E+15	6.7E+10
Y-90	6.3E+13	3.6E+15	1.8E+15	9.8E+15	4.5E+14	3.4E+14	2.4E+15	6.7E+10
Zr-95	1.6E-03	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Tc-99	1.3E+10	6.1E+11	2.8E+11	1.7E+12	7.9E+11	7.4E+11	0.0E+00	2.5E+08
Ru/Rh-106	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.6E+04	1.1E+09	2.4E+01
Sb-125	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
I-129	3.2E+08	1.9E+12	5.2E+11	1.8E+09	4.1E+11	1.1E+09	0.0E+00	3.7E+05
Cs-134	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Cs-137	7.3E+13	8.0E+14	8.8E+14	4.0E+14	6.3E+13	2.0E+15	6.2E+15	6.8E+11
Ce-144	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.3E+08	0.0E+00
Pm-147	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Eu-154/155	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	8.5E+13	0.0E+00
U-Natural	0.0E+00	0.0E+00	0.0E+00	1.9E+11	0.0E+00	7.4E+10	0.0E+00	1.9E+02
Np-237	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.0E+09	0.0E+00	1.1E+06
Pu-238	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	7.2E+09	0.0E+00	3.6E+08
Pu-239/240	0.0E+00	6.8E+12	1.5E+12	1.2E+12	7.2E+10	8.9E+10	3.2E+12	7.4E+06
Pu-241	0.0E+00	3.1E+08	0.0E+00	0.0E+00	0.0E+00	9.0E+10	0.0E+00	9.0E+03
Am-241	2.0E+11	1.1E+12	2.5E+11	1.6E+12	1.5E+11	3.3E+11	0.0E+00	3.7E+06
Am-242m	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.1E+06	0.0E+00	1.1E+04
Am-243	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.2E+08	0.0E+00	2.6E+03
Cm-242	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.7E+03	0.0E+00	2.5E+01
Cm-244	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.6E+08	0.0E+00	6.4E+04
TOTAL (Bq)	2.0E+14	8.0E+15	4.5E+15	2.0E+16	9.7E+14	2.7E+15	1.1E+16	8.2E+11

Tank Farms Calculations

Decay To:

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Single Shell Tanks

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Tank Name	U-104	U-105	U-106	U-107	U-108	U-109	U-110	U-111
Month	1	1	2	12	1	1	1	9
Year	90	90	74	74	90	90	90	80
Time	3.67	3.67	19.58	18.75	3.67	3.67	3.67	13.00
C-14	7.4E+01	2.6E+08	0.0E+00	0.0E+00	3.7E+08	1.1E+11	9.3E+09	0.0E+00
Co-60	0.0E+00	0.0E+00	0.0E+00	8.6E+07	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Se-79	1.1E+02	1.5E+07	0.0E+00	0.0E+00	1.9E+07	7.4E+09	3.3E+08	0.0E+00
Sr-89/90	1.4E+07	1.0E+11	2.2E+15	9.3E+13	1.7E+15	3.1E+13	1.0E+16	6.9E+12
Y-90	1.4E+07	1.0E+11	2.2E+15	9.3E+13	1.7E+15	3.1E+13	1.0E+16	6.9E+12
Zr-95	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Tc-99	3.7E+03	3.7E+08	0.0E+00	0.0E+00	7.4E+08	2.2E+11	1.1E+10	0.0E+00
Ru/Rh-106	2.6E-04	2.9E-01	0.0E+00	0.0E+00	2.9E+06	2.9E+02	1.7E+05	0.0E+00
Sb-125	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
I-129	7.4E+00	7.4E+05	0.0E+00	0.0E+00	1.1E+06	3.3E+08	1.9E+07	0.0E+00
Cs-134	0.0E+00	0.0E+00	0.0E+00	2.3E+05	0.0E+00	0.0E+00	0.0E+00	1.9E+11
Cs-137	1.4E+07	1.7E+12	7.0E+04	3.4E+13	2.4E+12	6.8E+14	3.4E+13	6.4E+13
Ce-144	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Pm-147	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Eu-154/155	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
U-Natural	3.0E+03	3.7E+08	0.0E+00	0.0E+00	3.3E+10	7.4E+08	1.1E+12	0.0E+00
Np-237	1.5E+01	1.5E+06	0.0E+00	0.0E+00	4.8E+06	3.7E+08	7.0E+07	0.0E+00
Pu-238	7.2E+02	3.2E+08	0.0E+00	0.0E+00	1.5E+10	1.5E+09	1.5E+12	0.0E+00
Pu-239/240	1.1E+03	3.7E+08	4.8E+08	1.0E+12	1.1E+11	3.7E+08	1.5E+12	5.9E+10
Pu-241	3.0E+03	2.1E+09	0.0E+00	0.0E+00	1.2E+12	2.1E+09	9.0E+12	0.0E+00
Am-241	4.1E+03	7.4E+09	0.0E+00	0.0E+00	3.3E+11	1.1E+10	3.7E+12	0.0E+00
Am-242m	1.5E-01	2.2E+05	0.0E+00	0.0E+00	3.6E+08	1.9E+06	2.6E+09	0.0E+00
Am-243	1.9E+00	2.2E+06	0.0E+00	0.0E+00	1.1E+08	7.4E+06	7.4E+08	0.0E+00
Cm-242	3.7E-04	6.4E+02	0.0E+00	0.0E+00	1.0E+06	5.1E+03	7.4E+06	0.0E+00
Cm-244	6.4E-01	2.9E+05	0.0E+00	0.0E+00	1.9E+05	6.4E+07	2.9E+06	0.0E+00
TOTAL (Bq)	4.1E+07	2.0E+12	4.4E+15	2.2E+14	3.5E+15	7.4E+14	2.0E+16	7.8E+13

Tank Farms Calculations

Decay To:

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Single Shell Tanks

PAGE 19

Tank Name	U-112	U-201	U-202	U-203	U-204
Month	1	1	1	12	12
Year	90	90	90	78	78
Time	3.67	3.67	3.67	14.75	14.75
C-14	7.4E+11	1.1E+11	1.1E+11	0.0E+00	0.0E+00
Co-60	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Se-79	3.3E+10	3.7E+09	3.7E+09	0.0E+00	0.0E+00
Sr-89/90	1.0E+14	6.7E+11	6.7E+11	6.6E+11	1.6E+10
Y-90	1.0E+14	6.7E+11	6.7E+11	6.6E+11	1.6E+10
Zr-95	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Tc-99	1.1E+12	1.9E+11	1.9E+11	0.0E+00	0.0E+00
Ru/Rh-106	8.7E+02	2.9E+00	2.6E+00	0.0E+00	0.0E+00
Sb-125	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
I-129	1.9E+09	3.0E+08	3.0E+08	0.0E+00	0.0E+00
Cs-134	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Cs-137	3.4E+15	6.8E+14	6.8E+14	3.2E+11	1.8E+13
Ce-144	0.0E+00	0.0E+00	0.0E+00	3.7E+04	0.0E+00
Pm-147	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Eu-154/155	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
U-Natural	2.6E+09	7.4E+01	1.1E+12	0.0E+00	3.6E+06
Np-237	3.7E+09	7.4E+08	7.4E+08	0.0E+00	0.0E+00
Pu-238	2.5E+09	7.2E+07	1.1E+08	0.0E+00	0.0E+00
Pu-239/240	1.3E+10	1.8E+05	2.2E+05	0.0E+00	5.5E+08
Pu-241	9.0E+09	4.9E+02	6.1E+02	0.0E+00	0.0E+00
Am-241	1.9E+10	4.4E+06	4.4E+06	0.0E+00	0.0E+00
Am-242m	1.9E+07	1.7E+04	4.3E+03	0.0E+00	0.0E+00
Am-243	3.7E+06	2.9E+03	3.0E+03	0.0E+00	0.0E+00
Cm-242	5.1E+04	4.4E+01	1.3E+01	0.0E+00	0.0E+00
Cm-244	1.3E+08	2.3E+07	2.9E+07	0.0E+00	0.0E+00
TOTAL (Bq)	3.6E+15	6.8E+14	6.8E+14	1.6E+12	1.8E+13

APPENDIX A-2.4
CALCULATIONS FOR DOUBLE-SHELL TANK FARMS

Tank Farms Calculations

Decay To:

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Double Shell Tanks PAGE 1

Tank Name	AN-101	AN-102	AN-103	AN-104	AN-105	AN-106	AN-107	AP-101
Month	7	8	2	1	11	3	2	NO
Year	88	91	90	85	84	91	85	DATA
Time	5.17	2.08	3.58	8.67	8.83	2.50	8.58	93.75
C-14	0.0E+00	2.7E+11	2.6E+11	0.0E+00	0.0E+00	9.1E+10	0.0E+00	0.0E+00
Co-60	0.0E+00	1.8E+12	3.1E+12	0.0E+00	0.0E+00	0.0E+00	4.2E+13	0.0E+00
Se-79	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Sr-89/90	1.4E+14	2.4E+16	1.6E+15	1.4E+14	2.8E+14	5.8E+14	1.8E+16	0.0E+00
Y-90	1.4E+14	2.4E+16	1.6E+15	1.4E+14	2.8E+14	5.8E+14	1.8E+16	0.0E+00
Zr-95	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Tc-99	0.0E+00	6.4E+13	2.2E+13	0.0E+00	0.0E+00	1.2E+13	0.0E+00	0.0E+00
Ru/Rh-106	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Sb-125	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
I-129	0.0E+00	0.0E+00	7.0E+10	0.0E+00	0.0E+00	2.8E+10	0.0E+00	0.0E+00
Cs-134	1.4E+13	0.0E+00	4.3E+12	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Cs-137	1.6E+16	5.8E+16	9.0E+16	6.7E+16	4.6E+16	3.6E+16	4.5E+16	0.0E+00
Ce-144	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Pm-147	1.6E+14	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Eu-154/155	0.0E+00	3.0E+14	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.8E+14	0.0E+00
U-Natural	0.0E+00	0.0E+00	8.9E+09	0.0E+00	0.0E+00	6.7E+08	0.0E+00	0.0E+00
Np-237	8.2E+09	0.0E+00	2.6E+09	0.0E+00	0.0E+00	2.2E+10	0.0E+00	0.0E+00
Pu-238	0.0E+00	0.0E+00	1.3E+09	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Pu-239/240	3.7E+10	3.1E+13	2.5E+09	1.3E+12	0.0E+00	6.2E+10	1.6E+13	0.0E+00
Pu-241	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	7.6E+13	0.0E+00
Am-241	1.3E+11	1.4E+14	3.0E+09	1.5E+15	0.0E+00	2.1E+11	1.2E+14	0.0E+00
Am-242m	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Am-243	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Cm-242	0.0E+00	2.8E+09	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Cm-244	0.0E+00	0.0E+00	4.8E+08	0.0E+00	0.0E+00	0.0E+00	5.6E+11	0.0E+00
TOTAL (Bq)	1.6E+16	1.1E+17	9.3E+16	6.9E+16	4.6E+16	3.7E+16	8.3E+16	0.0E+00

Tank Farms Calculations

Decay To:

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Double Shell Tanks PAGE 2

Tank Name	AP-102	AP-103	AP-104	AP-105	AP-106	AP-107	AP-108	AW-101
Month	5	4	6	no data	no data	no data	no data	6
Year	88	88	88	0	0	0	0	90
Time	5.33	5.42	5.25	0.00	0.00	0.00	0.00	3.25
C-14	0.0E+00	0.0E+00	3.5E+06	0.0E+00	0.0E+00	0.0E+00	0.0E+00	5.5E+10
Co-60	4.8E+11	0.0E+00	1.1E+10	0.0E+00	0.0E+00	0.0E+00	0.0E+00	5.9E+12
Se-79	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Sr-89/90	4.4E+09	8.6E+11	8.7E+07	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.5E+14
Y-90	4.4E+09	8.6E+11	8.7E+07	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.5E+14
Zr-95	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Tc-99	0.0E+00	0.0E+00	1.5E+08	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.2E+13
Ru/Rh-106	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Sb-125	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
I-129	0.0E+00	0.0E+00	1.0E+08	0.0E+00	0.0E+00	0.0E+00	0.0E+00	4.5E+10
Cs-134	0.0E+00	1.2E+08	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	7.5E+13
Cs-137	6.5E+10	4.9E+11	1.6E+09	0.0E+00	0.0E+00	0.0E+00	0.0E+00	7.3E+16
Ce-144	0.0E+00	5.2E+08	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Pm-147	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Eu-154/155	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
U-Natural	0.0E+00	0.0E+00	2.4E+06	0.0E+00	0.0E+00	0.0E+00	0.0E+00	5.7E+09
Np-237	0.0E+00	2.8E+09	1.2E+06	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.2E+11
Pu-238	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Pu-239/240	0.0E+00	2.6E+09	9.9E+06	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.0E+12
Pu-241	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Am-241	1.1E+09	2.1E+11	2.4E+06	0.0E+00	0.0E+00	0.0E+00	0.0E+00	5.1E+12
Am-242m	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Am-243	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	4.4E+13
Cm-242	3.6E+05	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Cm-244	4.5E+09	0.0E+00	3.3E+06	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
TOTAL (Bq)	5.6E+11	2.4E+12	1.3E+10	0.0E+00	0.0E+00	0.0E+00	0.0E+00	7.4E+16

Tank Farms Calculations

Decay To:

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Double Shell Tanks PAGE 3

Tank Name	AW-102	AW-103	AW-104	AW-105	AW-106	AY-101	AY-102	AZ-101
Month	6	8	11	7	8	7	6	4
Year	90	88	84	88	88	88	88	89
Time	3.25	5.08	8.83	5.17	5.08	5.17	5.25	4.42
C-14	0.0E+00	1.0E+11	0.0E+00	0.0E+00	0.0E+00	0.0E+00	6.3E+09	2.0E+11
Co-60	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	4.6E+12	1.1E+14
Se-79	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Sr-89/90	1.9E+13	0.0E+00	4.3E+15	0.0E+00	1.5E+15	1.1E+17	1.7E+17	1.5E+17
Y-90	1.9E+13	0.0E+00	4.3E+15	0.0E+00	1.5E+15	1.1E+17	1.7E+17	1.5E+17
Zr-95	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Tc-99	0.0E+00	9.8E+11	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.6E+11	5.5E+13
Ru/Rh-106	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Sb-125	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
I-129	0.0E+00	3.0E+09	0.0E+00	0.0E+00	0.0E+00	0.0E+00	7.5E+09	9.6E+10
Cs-134	3.8E+13	0.0E+00	4.8E+12	0.0E+00	2.8E+13	0.0E+00	1.0E+11	1.1E+15
Cs-137	8.1E+15	0.0E+00	1.1E+17	0.0E+00	1.4E+16	1.2E+16	1.9E+15	2.4E+17
Ce-144	9.5E+11	0.0E+00	0.0E+00	0.0E+00	1.4E+11	0.0E+00	0.0E+00	0.0E+00
Pm-147	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Eu-154/155	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.5E+14	1.2E+15
U-Natural	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.3E+11	0.0E+00
Np-237	2.4E+09	0.0E+00	0.0E+00	0.0E+00	1.8E+09	0.0E+00	0.0E+00	1.7E+11
Pu-238	0.0E+00	5.2E+12	0.0E+00	0.0E+00	0.0E+00	0.0E+00	6.9E+12	4.6E+12
Pu-239/240	2.9E+09	8.4E+13	0.0E+00	0.0E+00	2.2E+10	0.0E+00	2.3E+13	3.0E+13
Pu-241	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.1E+14
Am-241	5.4E+11	1.2E+13	0.0E+00	0.0E+00	5.0E+10	0.0E+00	1.1E+14	4.1E+14
Am-242m	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Am-243	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Cm-242	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.2E+09	9.5E+08
Cm-244	0.0E+00	4.7E+08	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.9E+12
TOTAL (Bq)	8.1E+15	1.0E+14	1.1E+17	0.0E+00	1.7E+16	2.2E+17	3.3E+17	5.5E+17

STACK ASSESSMENT FOR
40 CFR 61, SUBPART HAPPENDIX D
SOURCE ASSESSMENTFACILITY 222-S DISCHARGE POINT 296-S-21

FACILITY RADIOLOGICAL INVENTORY AT RISK

Radionuclide	Physical/ Chemical Form	Quantity (curies)	Release Factor	Potential Quantity Released (curies)	Projected Dose (mrem/yr)
1. Cs-137	Liquid	8.14E1	10 ⁻³	8.14E-2	1.16E-3
2. Sr-90	Liquid	3.668E2	10 ⁻³	3.668E-1	9.54E-3
3. Y-90	Liquid	3.668E2	10 ⁻³	3.668E-1	8.14E-5
4. Pu-239	Liquid	1.1E1	10 ⁻³	1.1E-2	5.67E-2
5. H-3	Liquid	1.4	10 ⁻³	1.4E-3	1.93E-8
6. C-14	Liquid	4.5E-3	10 ⁻³	4.5E-6	7.43E-9
7. I-129	Liquid	5.3E-1	10 ⁻³	5.3E-4	6.04E-5
8. Tc-99	Liquid	5.8E-2	10 ⁻³	5.8E-5	3.74E-8
9. Pm-147	Liquid	2.7	10 ⁻³	2.7E-3	1.82E-6
10. Pu-238	Liquid	4.1E-2	10 ⁻³	4.1E-5	1.95E-4
11. Am-241	Liquid	1.9E-1	10 ⁻³	1.9E-4	1.48E-3
12. U-233	Liquid	3.0E-8	10 ⁻³	3.0E-11	5.76E-11
13. U-235	Liquid	5.8E-4	10 ⁻³	5.8E-7	1.02E-6
14. U-238	Liquid	9.5E-3	10 ⁻³	9.6E-6	1.62E-5
15. _____	_____	_____	_____	_____	_____
16. _____	_____	_____	_____	_____	_____
Total Dose					6.924E-2

Method Used to Project Dose (CAP88) _____

COMMENTS • Quantity (curies) for Sr-90, Cs-137 & PU239 obtained from Memo, Loc V. Nguyen to E. K. Carter, "Project W-001, 222-S Laboratory Ventilation and Electrical System Upgrade - Dose Consequence Calculations", dated January 21, 1992.

- Remainder of 'Quantity (curies)' calculated using radionuclide distribution obtained from 219-S tanker shipment #93-03.
- Projected Dose calculated using CAP88 Unit Dose Factors from the Unit Dose Calculation Methods and Summary of Facility Effluent Monitoring Plan Determinations.

EVALUATOR P. J. FORTIN

MANAGER, ENVIRONMENTAL M. J. HALL

FACILITY MANAGER R. P. MARSHALL

DATE 11/9/93

DATE 11/9/93

DATE 11/8/93

Tank Farms Calculations

Decay To: 9

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Double Shell Tanks PAGE 4

Tank Name	AZ-102	SY-101	SY-102	SY-103
Month	10	5	6	6
Year	87	91	89	85
Time	5.92	2.33	4.25	8.25
C-14	0.0E+00	0.0E+00	3.2E+10	0.0E+00
Co-60	0.0E+00	0.0E+00	1.1E+12	0.0E+00
Se-79	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Sr-89/90	5.1E+15	4.2E+15	1.1E+15	2.3E+14
Y-90	5.1E+15	4.2E+15	1.1E+15	2.3E+14
Zr-95	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Tc-99	4.7E+15	0.0E+00	4.0E+12	0.0E+00
Ru/Rh-106	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Sb-125	0.0E+00	0.0E+00	0.0E+00	0.0E+00
I-129	0.0E+00	0.0E+00	4.3E+09	0.0E+00
Cs-134	0.0E+00	0.0E+00	2.7E+11	0.0E+00
Cs-137	9.6E+16	7.3E+16	3.1E+15	1.2E+17
Ce-144	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Pm-147	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Eu-154/155	0.0E+00	0.0E+00	2.2E+13	0.0E+00
U-Natural	6.3E+09	3.5E+09	0.0E+00	0.0E+00
Np-237	0.0E+00	0.0E+00	1.1E+10	0.0E+00
Pu-238	0.0E+00	0.0E+00	6.4E+11	0.0E+00
Pu-239/240	0.0E+00	1.8E+12	3.0E+12	3.6E+11
Pu-241	0.0E+00	0.0E+00	1.8E+13	0.0E+00
Am-241	7.2E+13	2.3E+13	1.7E+13	3.3E+11
Am-242m	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Am-243	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Cm-242	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Cm-244	0.0E+00	0.0E+00	6.5E+11	0.0E+00
TOTAL (Bq)	1.1E+17	8.1E+16	5.3E+15	1.2E+17

APPENDIX A-2.5
DECAY-CORRECTED RADIOISOTOPE
TOTALS BY TANK FARM

Single Shell Tanks

Decay Corrected Radioisotope Totals by Farm

Decay To:

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TANK/FARM	A			AX			B			BX		
Radioisotope	Bq	Ci	Bq	Ci	Bq	Ci	Bq	Ci	Bq	Ci		
C-14	4.23E+13	1.14E+03	3.34E+11	9.01E+00	8.55E+13	2.31E+03	5.90E+13	1.59E+03				
Co-60	8.88E+12	2.40E+02	8.36E+13	2.26E+03	0.00E+00	0.00E+00	1.39E+12	3.75E+01				
Se-79	3.05E+11	8.24E+00	1.50E+10	4.05E-01	3.86E+12	1.04E+02	4.04E+12	1.09E+02				
Sr-89/90	3.74E+17	1.01E+07	3.82E+17	1.03E+07	3.15E+16	8.51E+05	1.49E+16	4.01E+05				
Y-90	3.74E+17	1.01E+07	3.82E+17	1.03E+07	3.15E+16	8.51E+05	1.49E+16	4.01E+05				
Zr-95	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00				
Tc-99	1.04E+13	2.80E+02	3.70E+11	1.00E+01	1.30E+14	3.52E+03	1.33E+14	3.59E+03				
Ru/Rh-106	9.73E+09	2.63E-01	1.29E+11	3.49E+00	3.84E+09	1.04E-01	4.06E+09	1.10E-01				
Sb-125	2.00E+12	5.41E+01	1.25E+14	3.37E+03	2.75E+12	7.42E+01	0.00E+00	0.00E+00				
I-129	1.51E+10	4.07E-01	7.40E+08	2.00E-02	2.22E+11	6.01E+00	2.27E+11	6.15E+00				
Cs-134	4.36E+11	1.18E+01	7.20E+12	1.94E+02	0.00E+00	0.00E+00	1.14E+10	3.07E-01				
Cs-137	2.75E+16	7.45E+05	1.43E+17	3.86E+06	3.76E+16	1.02E+06	4.16E+16	1.12E+06				
Ce-144	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.30E+07	3.50E-04	0.00E+00	0.00E+00				
Pm-147	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00				
Eu-154/155	6.95E+13	1.88E+03	1.50E+15	4.06E+04	3.57E+13	9.66E+02	2.12E+12	5.72E+01				
U-Natural	2.98E+11	8.05E+00	3.70E+10	1.00E+00	9.27E+11	2.51E+01	3.72E+10	1.00E+00				
Np-237	1.31E+10	3.54E-01	7.42E+08	2.01E-02	3.98E+11	1.08E+01	4.03E+11	1.09E+01				
Pu-238	3.65E+12	9.87E+01	7.19E+11	1.94E+01	8.98E+11	2.43E+01	1.12E+11	3.03E+00				
Pu-239/240	1.02E+14	2.76E+03	4.40E+13	1.19E+03	5.39E+13	1.46E+03	1.07E+13	2.89E+02				
Pu-241	1.73E+14	4.67E+03	3.04E+13	8.22E+02	6.60E+13	1.79E+03	1.22E+13	3.30E+02				
Am-241	1.69E+14	4.57E+03	2.25E+12	6.07E+01	4.52E+13	1.22E+03	4.54E+13	1.23E+03				
Am-242m	2.56E+11	6.92E+00	1.08E+09	2.92E-02	1.52E+11	4.12E+00	3.67E+10	9.91E-01				
Am-243	1.09E+11	2.96E+00	3.70E+08	1.00E-02	8.06E+10	2.18E+00	2.21E+10	5.97E-01				
Cm-242	7.08E+08	1.91E-02	3.72E+06	1.00E-04	3.86E+08	1.04E-02	1.26E+08	3.40E-03				
Cm-244	2.94E+11	7.96E+00	1.90E+09	5.15E-02	3.80E+11	1.03E+01	1.59E+11	4.30E+00				
Total	7.76E+17	2.10E+07	9.09E+17	2.46E+07	1.01E+17	2.73E+06	7.15E+16	1.93E+06				

Single Shell Tanks

Decay Corrected Radioisotope Totals by Farm

Decay To:

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TANKFARM	BY		C		S		SX	
Radioisotope	Bq	Cl	Ba	Cl	Ba	Cl	Bq	Cl
C-14	2.41E+13	6.51E+02	1.04E+12	2.81E+01	4.44E+13	1.20E+03	3.01E+13	8.13E+02
Co-60	0.00E+00	0.00E+00	1.51E+14	4.09E+03	0.00E+00	0.00E+00	1.11E+16	3.00E+05
Se-79	1.52E+12	4.12E+01	4.07E+10	1.10E+00	2.97E+12	8.03E+01	3.31E+12	8.95E+01
Sr-89/90	4.95E+16	1.34E+06	2.40E+17	6.50E+06	1.15E+17	3.10E+06	3.22E+17	8.70E+06
Y-90	4.95E+16	1.34E+06	2.40E+17	6.50E+06	1.15E+17	3.10E+06	3.22E+17	8.70E+06
Zr-95	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tc-99	8.23E+13	2.22E+03	1.72E+14	4.66E+03	8.50E+13	2.30E+03	1.15E+14	3.10E+03
Ru/Rh-106	2.52E+06	6.81E-05	1.03E+07	2.79E-04	2.57E+09	6.95E-02	2.06E+09	5.58E-02
Sb-125	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.10E+12	8.37E+01
I-129	9.21E+10	2.49E+00	1.24E+10	3.35E-01	1.69E+11	4.57E+00	1.69E+11	4.58E+00
Cs-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.73E+11	7.37E+00	8.03E+10	2.17E+00
Cs-137	9.87E+16	2.67E+06	2.94E+16	7.95E+05	2.63E+17	7.10E+06	1.88E+18	5.08E+07
Ce-144	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.24E+11	1.42E+01
Pm-147	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Eu-154/155	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.51E+13	9.49E+02
U-Natural	2.66E+11	7.19E+00	1.10E+14	2.99E+03	1.65E+10	4.47E-01	3.97E+11	1.07E+01
Np-237	1.63E+11	4.42E+00	7.98E+09	2.16E-01	1.61E+11	4.35E+00	1.28E+11	3.45E+00
Pu-238	9.83E+11	2.66E+01	2.90E+11	7.84E+00	1.00E+11	2.71E+00	4.40E+12	1.19E+02
Pu-239/240	9.61E+12	2.60E+02	8.71E+14	2.36E+04	2.11E+14	5.71E+03	8.76E+13	2.37E+03
Pu-241	3.96E+12	1.07E+02	2.12E+13	5.74E+02	1.03E+12	2.79E+01	1.01E+14	2.72E+03
Am-241	2.18E+13	5.88E+02	3.00E+14	8.11E+03	3.77E+13	1.02E+03	2.59E+14	7.00E+03
Am-242m	3.10E+10	8.37E-01	3.22E+09	8.69E-02	7.37E+10	1.99E+00	3.99E+11	1.08E+01
Am-243	1.20E+13	3.25E+02	9.70E+08	2.62E-02	3.34E+10	9.01E-01	1.46E+11	3.95E+00
Cm-242	7.60E+07	2.06E-03	8.38E+06	2.27E-04	1.28E+08	3.45E-03	1.03E+09	2.78E-02
Cm-244	2.17E+11	5.87E+00	6.95E+08	1.88E-02	1.71E+11	4.62E+00	4.76E+11	1.29E+01
Total	1.98E+17	5.35E+06	5.12E+17	1.38E+07	4.93E+17	1.33E+07	2.54E+18	6.85E+07

Single Shell Tanks

Decay Corrected Radioisotope Totals by Farm

Decay To:

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TANKFARM	T		TX		TY		U	
Radioisotope	Bq	Cl	Bq	Cl	Bq	Cl	Bq	Cl
C-14	3.01E+11	8.12E+00	1.87E+13	5.05E+02	1.57E+11	4.25E+00	1.45E+12	3.92E+01
Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.30E+11	1.43E+01	1.33E+13	3.60E+02
Se-79	1.08E+10	2.92E-01	1.70E+12	4.60E+01	0.00E+00	0.00E+00	6.72E+10	1.82E+00
Sr-89/90	3.01E+15	8.15E+04	1.50E+16	4.06E+05	1.60E+16	4.31E+05	1.69E+16	4.56E+05
Y-90	3.01E+15	8.15E+04	1.50E+16	4.06E+05	1.60E+16	4.31E+05	1.69E+16	4.56E+05
Zr-95	5.47E-31	1.48E-41	0.00E+00	0.00E+00	1.64E-03	4.44E-14	0.00E+00	0.00E+00
Tc-99	8.21E+11	2.22E+01	5.39E+13	1.46E+03	3.59E+12	9.71E+01	2.45E+12	6.63E+01
Ru/Rh-106	4.74E+04	1.28E-06	1.00E+06	2.71E-05	0.00E+00	0.00E+00	1.15E+09	3.11E-02
Sb-125	6.31E+13	1.71E+03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-129	5.54E+08	1.50E-02	6.90E+10	1.86E+00	2.83E+12	7.66E+01	3.95E+09	1.07E-01
Cs-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.92E+11	5.19E+00
Cs-137	3.46E+16	9.35E+05	9.82E+16	2.65E+06	2.22E+15	5.99E+04	1.38E+16	3.74E+05
Ce-144	4.27E+13	1.15E+03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.28E+08	3.45E-03
Pm-147	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Eu-154/155	6.59E+13	1.78E+03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.47E+13	2.29E+03
U-Natural	1.44E+10	3.90E-01	5.47E+12	1.48E+02	2.35E+11	6.35E+00	2.31E+12	6.25E+01
Np-237	5.20E+08	1.40E-02	1.29E+11	3.48E+00	0.00E+00	0.00E+00	8.63E+09	2.33E-01
Pu-238	1.84E+10	4.96E-01	2.14E+11	5.77E+00	0.00E+00	0.00E+00	1.48E+12	4.01E+01
Pu-239/240	3.19E+13	8.62E+02	1.23E+13	3.31E+02	9.57E+12	2.59E+02	5.97E+12	1.61E+02
Pu-241	1.34E+12	3.61E+01	4.38E+12	1.18E+02	3.05E+08	8.26E-03	1.04E+13	2.81E+02
Am-241	8.16E+11	2.21E+01	6.84E+12	1.85E+02	3.60E+12	9.74E+01	4.37E+12	1.18E+02
Am-242m	8.36E+08	2.26E-02	1.14E+10	3.07E-01	0.00E+00	0.00E+00	2.94E+09	7.95E-02
Am-243	3.38E+08	9.13E-03	5.94E+09	1.60E-01	0.00E+00	0.00E+00	1.08E+09	2.93E-02
Cm-242	1.50E+06	4.06E-05	4.25E+07	1.15E-03	0.00E+00	0.00E+00	8.51E+06	2.30E-04
Cm-244	1.56E+09	4.21E-02	5.02E+10	1.36E+00	0.00E+00	0.00E+00	5.08E+08	1.37E-02
Total	4.08E+16	1.10E+06	1.28E+17	3.47E+06	3.42E+16	9.23E+05	4.77E+16	1.29E+06

Double Shell Tanks

Decay Corrected Radioisotope Totals by Farm

Decay To:

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TANKFARM	AN		AP		AW		AY	
Radioisotope	Bq	Ci	Bq	Ci	Bq	Ci	Bq	Ci
C-14	6.21E+11	1.68E+01	3.50E+06	9.45E-05	1.55E+11	4.19E+00	6.30E+09	1.70E-01
Co-60	4.72E+13	1.28E+03	4.89E+11	1.32E+01	5.88E+12	1.59E+02	4.58E+12	1.24E+02
Se-79	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sr-89/90	4.48E+16	1.21E+06	8.66E+11	2.34E+01	5.96E+15	1.61E+05	2.71E+17	7.33E+06
Y-90	4.48E+16	1.21E+06	8.66E+11	2.34E+01	5.96E+15	1.61E+05	2.71E+17	7.33E+06
Zr-95	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tc-99	9.80E+13	2.65E+03	1.50E+08	4.05E-03	2.30E+13	6.21E+02	1.60E+11	4.32E+00
Ru/Rh-106	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sb-125	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-129	9.80E+10	2.65E+00	1.00E+08	2.70E-03	4.80E+10	1.30E+00	7.50E+09	2.03E-01
Cs-134	1.87E+13	5.04E+02	1.15E+08	3.12E-03	1.46E+14	3.94E+03	1.01E+11	2.72E+00
Cs-137	3.58E+17	9.68E+06	5.61E+11	1.52E+01	2.02E+17	5.45E+06	1.35E+16	3.64E+05
Ce-144	0.00E+00	0.00E+00	5.23E+08	1.41E-02	1.09E+12	2.95E+01	0.00E+00	0.00E+00
Pm-147	1.59E+14	4.30E+03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Eu-154/155	5.84E+14	1.58E+04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.55E+14	6.89E+03
U-Natural	9.57E+09	2.59E-01	2.40E+06	6.49E-05	5.70E+09	1.54E-01	1.30E+11	3.51E+00
Np-237	3.28E+10	8.86E-01	2.80E+09	7.57E-02	3.24E+11	8.76E+00	0.00E+00	0.00E+00
Pu-238	1.26E+09	3.41E-02	0.00E+00	0.00E+00	5.18E+12	1.40E+02	6.90E+12	1.87E+02
Pu-239/240	4.84E+13	1.31E+03	2.61E+09	7.05E-02	8.60E+13	2.32E+03	2.30E+13	6.22E+02
Pu-241	7.59E+13	2.05E+03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Am-241	1.74E+15	4.70E+04	2.09E+11	5.66E+00	1.76E+13	4.75E+02	1.09E+14	2.95E+03
Am-242m	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Am-243	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.40E+13	1.19E+03	0.00E+00	0.00E+00
Cm-242	2.76E+09	7.46E-02	3.56E+05	9.63E-06	0.00E+00	0.00E+00	1.16E+09	3.13E-02
Cm-244	5.57E+11	1.50E+01	4.46E+09	1.21E-01	4.67E+08	1.26E-02	0.00E+00	0.00E+00
Total	4.51E+17	1.22E+07	3.00E+12	8.11E+01	2.14E+17	5.78E+06	5.56E+17	1.50E+07

Decay To: 9 93

Decay Corrected Radioisotope Totals by Farm

TANKFARM	AZ	Bq	Cl	SY	Bq	Cl
Radioisotope						
C-14		2.00E+11	5.40E+00	3.20E+10	8.64E-01	
Co-60		1.12E+14	3.03E+03	1.15E+12	3.10E+01	
Se-79		0.00E+00	0.00E+00	0.00E+00	0.00E+00	
Sr-89/90		1.57E+17	4.24E+06	5.55E+15	1.50E+05	
Y-90		1.57E+17	4.24E+06	5.55E+15	1.50E+05	
Zr-95		0.00E+00	0.00E+00	0.00E+00	0.00E+00	
Tc-99		4.75E+15	1.29E+05	4.00E+12	1.08E+02	
Ru/Rh-106		0.00E+00	0.00E+00	0.00E+00	0.00E+00	
Sb-125		0.00E+00	0.00E+00	0.00E+00	0.00E+00	
I-129		9.60E+10	2.59E+00	4.30E+09	1.16E-01	
Cs-134		1.12E+15	3.02E+04	2.71E+11	7.31E+00	
Cs-137		3.40E+17	9.18E+06	2.00E+17	5.41E+06	
Ce-144		0.00E+00	0.00E+00	0.00E+00	0.00E+00	
Pm-147		0.00E+00	0.00E+00	0.00E+00	0.00E+00	
Eu-154/155		1.16E+15	3.12E+04	2.25E+13	6.07E+02	
U-Natural		6.30E+09	1.70E-01	3.50E+09	9.46E-02	
Np-237		1.70E+11	4.59E+00	1.10E+10	2.97E-01	
Pu-238		4.63E+12	1.25E+02	6.38E+11	1.72E+01	
Pu-239/240		3.00E+13	8.11E+02	5.16E+12	1.39E+02	
Pu-241		2.05E+14	5.55E+03	1.75E+13	4.74E+02	
Am-241		4.79E+14	1.30E+04	4.01E+13	1.08E+03	
Am-242m		0.00E+00	0.00E+00	0.00E+00	0.00E+00	
Am-243		0.00E+00	0.00E+00	0.00E+00	0.00E+00	
Cm-242		9.50E+08	2.57E-02	0.00E+00	0.00E+00	
Cm-244		3.87E+12	1.04E+02	6.51E+11	1.76E+01	
Total		6.61E+17	1.79E+07	2.11E+17	5.71E+06	

APPENDIX B
NESHAP DATA SHEETS FOR INDIVIDUAL STACKS

STACK ASSESSMENT FOR 40 CFR 61, SUBPART H
APPENDIX D SOURCE ASSESSMENT

FACILITY 244-AR Vault DISCHARGE POINT Stack 296-A-12

FACILITY RADIOLOGICAL INVENTORY AT RISK

Radionuclide	Physical/ Chemical Form	Quantity (curies)	Release Factor	Potential Quantity Released (curies)	Projected Dose (mrem/yr)
1. C-14	Particulate	5.57E-04	1.00E-03	5.57E-07	1.46E-09
2. Co-60	Particulate	3.15E-01	1.00E-03	3.15E-04	9.14E-06
3. Se-79 (1)	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
4. Sr-89/90	Particulate	1.16E+03	1.00E-03	1.16E+00	5.08E-02
5. Y-90 (2)	Particulate	1.16E+03	1.00E-03	1.16E+00	4.37E-04
6. Tc-99	Particulate	1.29E+01	1.00E-03	1.29E-02	1.41E-05
7. Ru/Rh-106	Gas (3)	0.00E+00	1.00E+00	0.00E+00	0.00E+00
8. Sb-125	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
9. I-129	Gas	2.79E-04	1.00E+00	2.79E-04	8.12E-05
10. Cs-134	Particulate	3.02E+00	1.00E-03	3.02E-03	9.45E-05
11. Cs-137	Particulate	9.54E+02	1.00E-03	9.54E-01	2.28E-02
12. Ce-144	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
13. Pm-147	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
14. Eu-154 (1)	Particulate	3.81E+00	1.00E-03	3.81E-03	1.67E-04
15. Nat.U	Particulate	3.68E-04	1.00E-03	3.68E-07	1.05E-06
16. Np-237	Particulate	4.59E-04	1.00E-03	4.59E-07	5.46E-06
17. Pu-238	Particulate	3.12E-02	1.00E-03	3.12E-05	2.50E-04
18. Pu-239/240	Particulate	1.43E-01	1.00E-03	1.43E-04	1.24E-03
19. Pu-241	Particulate	5.55E-01	1.00E-03	5.55E-04	7.66E-05
20. Am-241	Particulate	1.60E+00	1.00E-03	1.60E-03	2.10E-02
21. Cm-242/244	Particulate	1.04E-02	1.00E-03	1.04E-05	7.22E-05

Total Dose: 9.70E-02

Method Used to Project Dose: CAP88

Operational Dose (4): 2.60E-03

COMMENTS

1. Sr-90 used as the beta emitter; dose factors were not included in the radionuclide library for this specific radionuclide.

2: Y-90 is assumed to be in secular equilibrium with Sr-90.

3: This is a conservative estimate.

4: Based on a 10 da/yr stack usage

STACK STATUS: DESIGNATED X NON-DESIGNATED

EVALUATOR [Signature] DATE 12/7/93

MANAGER, ENVIRONMENTAL [Signature] DATE 12-8-93

FACILITY MANAGER [Signature] DATE 12-8-93

QUALITY ASSURANCE [Signature] DATE 12/8/93

STACK ASSESSMENT FOR 40 CFR 61, SUBPART H
APPENDIX D SOURCE ASSESSMENT

FACILITY 244-AR Vault Canyon DISCHARGE POINT Stack 296-A-13

FACILITY RADIOLOGICAL INVENTORY AT RISK

Radionuclide	Physical/ Chemical Form	Quantity (curies)	Release Factor	Potential Quantity Released (curies)	Projected Dose (mrem/yr)
1. C-14	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
2. Co-60	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
3. Se-79 (1)	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
4. Sr-89/90	Particulate	1.05E-02	1.00E-03	1.05E-05	4.60E-07
5. Y-90 (2)	Particulate	1.05E-02	1.00E-03	1.05E-05	3.96E-09
6. Tc-99	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
7. Ru/Rh-106	Gas (3)	0.00E+00	1.00E+00	0.00E+00	0.00E+00
8. Sb-125	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
9. I-129	Gas	0.00E+00	1.00E+00	0.00E+00	0.00E+00
10. Cs-134	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
11. Cs-137	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
12. Ce-144	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
13. Pm-147	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
14. Eu-154 (1)	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
15. Nat.U	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
16. Np-237	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
17. Pu-238	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
18. Pu-239/240	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
19. Pu-241	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
20. Am-241	Particulate	2.10E-02	1.00E-03	2.10E-05	2.75E-04
21. Cm-242/244	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00

Total Dose: 2.76E-04

Method Used to Project Dose: CAP88

COMMENTS

1. Sr-90 used as the beta emitter; dose factors were not included in the radionuclide library for this specific radionuclide.

2. Y-90 is assumed to be in secular equilibrium with Sr-90.

3. This is a conservative estimate.

STACK STATUS: DESIGNATED X NON-DESIGNATED

EVALUATOR [Signature] DATE 12/7/93

MANAGER, ENVIRONMENTAL [Signature] DATE 12-8-93

FACILITY MANAGER [Signature] DATE 12-8-93

QUALITY ASSURANCE [Signature] DATE 12/8/93

STACK ASSESSMENT FOR 40 CFR 61, SUBPART H
APPENDIX D SOURCE ASSESSMENT

FACILITY 241-AZ/Primary DISCHARGE POINT Stack 296-A-17

FACILITY RADIOLOGICAL INVENTORY AT RISK

Radionuclide	Physical/ Chemical Form	Quantity (curies) (4)	Release Factor (4)	Potential Quantity Released (curies)	Projected Dose (mrem/yr)
1. C-14	Particulate	4.97E+00	1.00E-03	4.97E-03	1.30E-05
2. Co-60	Particulate	1.74E+03	1.00E-03	1.74E+00	5.05E-02
3. Se-79 (1)	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
4. Sr-89/90	Particulate	3.95E+04	1.00E-03	3.95E+01	1.73E+00
5. Y-90 (2)	Particulate	3.95E+04	1.00E-03	3.95E+01	1.49E-02
6. Tc-99	Particulate	1.29E+05	1.00E-03	1.29E+02	1.41E-01
7. Ru/Rh-106	Gas (3)	0.00E+00	1.00E+00	0.00E+00	0.00E+00
8. Sb-125	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
9. I-129	Gas	2.48E+00	1.00E+00	2.48E+00	7.22E-01
10. Cs-134	Particulate	2.89E+00	1.00E-03	2.89E-03	9.05E-05
11. Cs-137	Particulate	9.24E+06	1.00E-03	9.24E+03	2.21E+02
12. Ce-144	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
13. Pm-147	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
14. Eu-154 (1)	Particulate	1.88E+04	1.00E-03	1.88E+01	8.23E-01
15. Nat.U	Particulate	1.88E+00	1.00E-03	1.88E-03	5.34E-03
16. Np-237	Particulate	2.44E-01	1.00E-03	2.44E-04	2.90E-03
17. Pu-238	Particulate	2.63E-01	1.00E-03	2.63E-04	2.11E-03
18. Pu-239/240	Particulate	2.50E+00	1.00E-03	2.50E-03	2.17E-02
19. Pu-241	Particulate	1.18E+01	1.00E-03	1.18E-02	1.63E-03
20. Am-241	Particulate	1.46E+02	1.00E-03	1.46E-01	1.91E+00
21. Cm-242/244	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00

Total Dose: 2.26E+02

Method Used to Project Dose: CAP88

COMMENTS

1. Sr-90 used as the beta emitter; dose factors were not included in the radionuclide library for this specific radionuclide.

2: Y-90 is assumed to be in secular equilibrium with Sr-90.

3: This is a conservative estimate.

4: Supernatant data used; sludge/slurry contribution is less than 1% of the supernatant contribution to the total dose.

STACK STATUS: X DESIGNATED NON-DESIGNATED

EVALUATOR [Signature] DATE 12/7/93

MANAGER, ENVIRONMENTAL [Signature] DATE 12-8-93

FACILITY MANAGER [Signature] DATE 12-8-93

QUALITY ASSURANCE [Signature] DATE 12/8/93

STACK ASSESSMENT FOR 40 CFR 61, SUBPART H
APPENDIX D SOURCE ASSESSMENT

FACILITY 241-AY-101 Annulus DISCHARGE POINT Stack 296-A-18

FACILITY RADIOLOGICAL INVENTORY AT RISK

Radionuclide	Physical/ Chemical Form	Quantity (curies)	Release Factor	Potential Quantity Released (curies)	Projected Dose (mrem/yr)
1. C-14	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
2. Co-60	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
3. Se-79 (1)	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
4. Sr-89/90	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
5. Y-90 (2)	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
6. Tc-99	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
7. Ru/Rh-106	Gas (3)	0.00E+00	1.00E+00	0.00E+00	0.00E+00
8. Sb-125	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
9. I-129	Gas	0.00E+00	1.00E+00	0.00E+00	0.00E+00
10. Cs-134	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
11. Cs-137	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
12. Ce-144	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
13. Pm-147	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
14. Eu-154 (1)	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
15. Nat.U	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
16. Np-237	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
17. Pu-238	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
18. Pu-239/240	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
19. Pu-241	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
20. Am-241	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
21. Cm-242/244	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00

Total Dose: 0.00E+00

Method Used to Project Dose: CAP88

COMMENTS

1. Sr-90 used as the beta emitter; dose factors were not included in the radionuclide library for this specific radionuclide.

2: Y-90 is assumed to be in secular equilibrium with Sr-90.

3: This is a conservative estimate.

STACK STATUS: DESIGNATED X NON-DESIGNATEDEVALUATOR [Signature] DATE 12/7/93MANAGER, ENVIRONMENTAL [Signature] DATE 12-8-93FACILITY MANAGER [Signature] DATE 12-8-93QUALITY ASSURANCE [Signature] DATE 12/8/93

STACK ASSESSMENT FOR 40 CFR 61, SUBPART H
APPENDIX D SOURCE ASSESSMENT

FACILITY 241-AY-102 Annulus DISCHARGE POINT Stack 296-A-19

FACILITY RADIOLOGICAL INVENTORY AT RISK

Radionuclide	Physical/ Chemical Form	Quantity (curies)	Release Factor	Potential Quantity Released (curies)	Projected Dose (mrem/yr)
1. C-14	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
2. Co-60	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
3. Se-79 (1)	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
4. Sr-89/90	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
5. Y-90 (2)	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
6. Tc-99	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
7. Ru/Rh-106	Gas (3)	0.00E+00	1.00E+00	0.00E+00	0.00E+00
8. Sb-125	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
9. I-129	Gas	0.00E+00	1.00E+00	0.00E+00	0.00E+00
10. Cs-134	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
11. Cs-137	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
12. Ce-144	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
13. Pm-147	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
14. Eu-154 (1)	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
15. Nat.U	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
16. Np-237	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
17. Pu-238	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
18. Pu-239/240	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
19. Pu-241	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
20. Am-241	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
21. Cm-242/244	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00

Total Dose: 0.00E+00

Method Used to Project Dose: CAP88

COMMENTS

1. Sr-90 used as the beta emitter; dose factors were not included in the radionuclide library for this specific radionuclide.

2: Y-90 is assumed to be in secular equilibrium with Sr-90.

3: This is a conservative estimate.

STACK STATUS: DESIGNATED X NON-DESIGNATEDEVALUATOR [Signature] DATE 12/7/93MANAGER, ENVIRONMENTAL [Signature] DATE 12-8-93FACILITY MANAGER [Signature] DATE 12-8-93QUALITY ASSURANCE [Signature] DATE 12/8/93

STACK ASSESSMENT FOR 40 CFR 61, SUBPART H
APPENDIX D SOURCE ASSESSMENT

FACILITY 241-AZ Tank Annulus DISCHARGE POINT Stack 296-A-20

FACILITY RADIOLOGICAL INVENTORY AT RISK

Radionuclide	Physical/ Chemical Form	Quantity (curies)	Release Factor	Potential Quantity Released (curies)	Projected Dose (mrem/yr)
1. C-14	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
2. Co-60	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
3. Se-79 (1)	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
4. Sr-89/90	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
5. Y-90 (2)	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
6. Tc-99	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
7. Ru/Rh-106	Gas (3)	0.00E+00	1.00E+00	0.00E+00	0.00E+00
8. Sb-125	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
9. I-129	Gas	0.00E+00	1.00E+00	0.00E+00	0.00E+00
10. Cs-134	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
11. Cs-137	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
12. Ce-144	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
13. Pm-147	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
14. Eu-154 (1)	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
15. Nat.U	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
16. Np-237	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
17. Pu-238	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
18. Pu-239/240	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
19. Pu-241	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
20. Am-241	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
21. Cm-242/244	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00

Total Dose: 0.00E+00

Method Used to Project Dose: CAP88

COMMENTS

1. Sr-90 used as the beta emitter; dose factors were not included in the radionuclide library for this specific radionuclide.

2: Y-90 is assumed to be in secular equilibrium with Sr-90.

3: This is a conservative estimate.

STACK STATUS: DESIGNATED X NON-DESIGNATEDEVALUATOR [Signature] DATE 12/7/93MANAGER, ENVIRONMENTAL [Signature] DATE 12-8-93FACILITY MANAGER [Signature] DATE 12-8-93QUALITY ASSURANCE [Signature] DATE 12/8/93

STACK ASSESSMENT FOR 40 CFR 61, SUBPART H
APPENDIX D SOURCE ASSESSMENT

FACILITY 242-A Evaporator Building DISCHARGE POINT Stack 296-A-21

FACILITY RADIOLOGICAL INVENTORY AT RISK

Radionuclide	Physical/ Chemical Form	Quantity (curies)	Release Factor	Potential Quantity Released (curies)	Projected Dose (mrem/yr)
1. C-14	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
2. Co-60	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
3. Se-79 (1)	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
4. Sr-89/90	Particulate	9.50E-03	1.00E-03	9.50E-06	4.16E-07
5. Y-90 (2)	Particulate	9.50E-03	1.00E-03	9.50E-06	3.58E-09
6. Tc-99	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
7. Ru/Rh-106	Gas (3)	0.00E+00	1.00E+00	0.00E+00	0.00E+00
8. Sb-125	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
9. I-129	Gas	0.00E+00	1.00E+00	0.00E+00	0.00E+00
10. Cs-134	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
11. Cs-137	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
12. Ce-144	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
13. Pm-147	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
14. Eu-154 (1)	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
15. Nat.U	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
16. Np-237	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
17. Pu-238	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
18. Pu-239/240	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
19. Pu-241	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
20. Am-241	Particulate	1.89E-04	1.00E-03	1.89E-07	2.48E-06
21. Cm-242/244	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00

Total Dose: 2.90E-06

Method Used to Project Dose: CAPS8

COMMENTS

1. Sr-90 used as the beta emitter; dose factors were not included in the radionuclide library for this specific radionuclide.

2: Y-90 is assumed to be in secular equilibrium with Sr-90.

3: This is a conservative estimate.

STACK STATUS: DESIGNATED X NON-DESIGNATED

EVALUATOR [Signature] DATE 12/7/93

MANAGER, ENVIRONMENTAL [Signature] DATE 12-8-93

FACILITY MANAGER [Signature] DATE 12-8-93

QUALITY ASSURANCE [Signature] DATE 12/8/93

STACK ASSESSMENT FOR 40 CFR 61, SUBPART H
APPENDIX D SOURCE ASSESSMENT

FACILITY 242-A Evaporator Vessel DISCHARGE POINT Stack 296-A-22

FACILITY RADIOLOGICAL INVENTORY AT RISK

Radionuclide	Physical/ Chemical Form	Quantity (curies)	Release Factor	Potential Quantity Released (curies)	Projected Dose (mrem/yr)
1. C-14	Particulate	3.50E+01	1.00E-03	3.50E-02	9.17E-05
2. Co-60	Particulate	1.27E+02	1.00E-03	1.27E-01	3.69E-03
3. Se-79 (1)	Particulate	1.05E+01	1.00E-03	1.05E-02	4.60E-04
4. Sr-89/90	Particulate	2.83E+04	1.00E-03	2.83E+01	1.24E+00
5. Y-90 (2)	Particulate	2.83E+04	1.00E-03	2.83E+01	1.07E-02
6. Tc-99	Particulate	2.70E+02	1.00E-03	2.70E-01	2.94E-04
7. Ru/Rh-106	Gas (3)	2.01E+03	1.00E+00	2.01E+03	4.19E+01
8. Sb-125	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
9. I-129	Gas	3.50E-01	1.00E+00	3.50E-01	1.02E-01
10. Cs-134	Particulate	1.10E+03	1.00E-03	1.10E+00	3.46E-02
11. Cs-137	Particulate	1.94E+05	1.00E-03	1.94E+02	4.63E+00
12. Ce-144	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
13. Pm-147	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
14. Eu-154 (1)	Particulate	1.09E+03	1.00E-03	1.09E+00	4.77E-02
15. Nat.U	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
16. Np-237	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
17. Pu-238	Particulate	1.80E-01	1.00E-03	1.80E-04	1.44E-03
18. Pu-239/240	Particulate	2.16E+01	1.00E-03	2.16E-02	1.87E-01
19. Pu-241	Particulate	1.83E+03	1.00E-03	1.83E+00	2.53E-01
20. Am-241	Particulate	1.34E+02	1.00E-03	1.34E-01	1.76E+00
21. Cm-242/244	Particulate	1.63E+00	1.00E-03	1.63E-03	1.13E-02

Total Dose: 5.02E+01

Method Used to Project Dose: CAP88

COMMENTS

1. Sr-90 used as the beta emitter; dose factors were not included in the radionuclide library for this specific radionuclide.

2: Y-90 is assumed to be in secular equilibrium with Sr-90.

3: This is a conservative estimate.

STACK STATUS: X DESIGNATED NON-DESIGNATED

EVALUATOR [Signature] DATE 12/7/93

MANAGER, ENVIRONMENTAL [Signature] DATE 12-8-93

FACILITY MANAGER [Signature] DATE 12-8-93

QUALITY ASSURANCE [Signature] DATE 12/8/93

**STACK ASSESSMENT FOR 40 CFR 61, SUBPART H
APPENDIX D SOURCE ASSESSMENT**

FACILITY 244-A DCRT DISCHARGE POINT Stack 296-A-25

FACILITY RADIOLOGICAL INVENTORY AT RISK

Radionuclide	Physical/ Chemical Form	Quantity (curies)	Release Factor	Potential Quantity Released (curies)	Projected Dose (mrem/yr)
1. C-14	Particulate	3.98E-02	1.00E-03	3.98E-05	1.04E-07
2. Co-60	Particulate	9.84E+01	1.00E-03	9.84E-02	2.85E-03
3. Se-79 (1)	Particulate	7.97E-11	1.00E-03	7.97E-14	3.49E-15
4. Sr-89/90	Particulate	1.08E-06	1.00E-03	1.08E-09	4.73E-11
5. Y-90 (2)	Particulate	1.08E-06	1.00E-03	1.08E-09	4.07E-13
6. Tc-99	Particulate	7.97E-09	1.00E-03	7.97E-12	8.69E-15
7. Ru/Rh-106	Gas (3)	2.58E-01	1.00E+00	2.58E-01	5.39E-03
8. Sb-125	Particulate	2.21E+01	1.00E-03	2.21E-02	9.17E-05
9. I-129	Gas	3.98E-12	1.00E+00	3.98E-12	1.16E-12
10. Cs-134	Particulate	4.87E+00	1.00E-03	4.87E-03	1.52E-04
11. Cs-137	Particulate	1.66E+05	1.00E-03	1.66E+02	3.97E+00
12. Ce-144	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
13. Pm-147	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
14. Eu-154 (1)	Particulate	7.74E+02	1.00E-03	7.74E-01	3.39E-02
15. Nat.U	Particulate	3.98E-01	1.00E-03	3.98E-04	1.13E-03
16. Np-237	Particulate	2.05E-05	1.00E-03	2.05E-08	2.44E-07
17. Pu-238	Particulate	7.75E+00	1.00E-03	7.75E-03	6.22E-02
18. Pu-239/240	Particulate	1.51E+02	1.00E-03	1.51E-01	1.31E+00
19. Pu-241	Particulate	3.23E+02	1.00E-03	3.23E-01	4.46E-02
20. Am-241	Particulate	1.18E+01	1.00E-03	1.18E-02	1.55E-01
21. Cm-242/244	Particulate	1.72E-10	1.00E-03	1.72E-13	1.19E-12

Method Used to Project Dose: CAP88

Total Dose: 5.58E+00
Operational Dose (4): 1.06E-01

COMMENTS

1. Sr-90 used as the beta emitter; dose factors were not included in the radionuclide library for this specific radionuclide.
2. Y-90 is assumed to be in secular equilibrium with Sr-90.
3. This is a conservative estimate.
4. Incorporates volumetric and time factors based on projected usage.
5. This system is not currently transferring waste that would require a designated status for the stack.

STACK STATUS: DESIGNATED NON-DESIGNATED (5)

EVALUATOR [Signature] DATE 12/7/93

MANAGER, ENVIRONMENTAL [Signature] DATE 12-8-93

FACILITY MANAGER [Signature] DATE 12-8-93

QUALITY ASSURANCE [Signature] DATE 12/8/93

STACK ASSESSMENT FOR 40 CFR 61, SUBPART H
APPENDIX D SOURCE ASSESSMENT

FACILITY 204-AR Unloading Facility DISCHARGE POINT Stack 296-A-26

FACILITY RADIOLOGICAL INVENTORY AT RISK

Radionuclide	Physical/ Chemical Form	Quantity (curies)	Release Factor	Potential Quantity Released (curies)	Projected Dose (mrem/yr)
1. C-14	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
2. Co-60	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
3. Se-79 (1)	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
4. Sr-89/90	Particulate	5.00E-03	1.00E-03	5.00E-06	2.19E-07
5. Y-90 (2)	Particulate	5.00E-03	1.00E-03	5.00E-06	1.89E-09
6. Tc-99	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
7. Ru/Rh-106	Gas (3)	0.00E+00	1.00E+00	0.00E+00	0.00E+00
8. Sb-125	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
9. I-129	Gas	0.00E+00	1.00E+00	0.00E+00	0.00E+00
10. Cs-134	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
11. Cs-137	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
12. Ce-144	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
13. Pm-147	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
14. Eu-154 (1)	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
15. Nat.U	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
16. Np-237	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
17. Pu-238	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
18. Pu-239/240	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
19. Pu-241	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
20. Am-241	Particulate	1.00E-04	1.00E-03	1.00E-07	1.31E-06
21. Cm-242/244	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00

Total Dose: 1.53E-06

Method Used to Project Dose: CAP88

COMMENTS

1. Sr-90 used as the beta emitter; dose factors were not included in the radionuclide library for this specific radionuclide.

2: Y-90 is assumed to be in secular equilibrium with Sr-90.

3: This is a conservative estimate.

STACK STATUS: DESIGNATED X NON-DESIGNATEDEVALUATOR [Signature] DATE 12/7/93MANAGER, ENVIRONMENTAL [Signature] DATE 12-8-93FACILITY MANAGER [Signature] DATE 12-8-93QUALITY ASSURANCE [Signature] DATE 12/8/93

STACK ASSESSMENT FOR 40 CFR 61, SUBPART H
APPENDIX D SOURCE ASSESSMENT

FACILITY AW Tank Farm DISCHARGE POINT Stack 296-A-27

FACILITY RADIOLOGICAL INVENTORY AT RISK

Radionuclide	Physical/ Chemical Form	Quantity (curies) (4)	Release Factor (4)	Potential Quantity Released (curies)	Projected Dose (mrem/yr)
1. C-14	Particulate	1.60E+00	1.00E-03	1.60E-03	4.19E-06
2. Co-60	Particulate	1.60E+02	1.00E-03	1.60E-01	4.64E-03
3. Se-79 (1)	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
4. Sr-89/90	Particulate	1.61E+05	1.00E-03	1.61E+02	7.05E+00
5. Y-90 (2)	Particulate	1.61E+05	1.00E-03	1.61E+02	6.07E-02
6. Tc-99	Particulate	6.11E+02	1.00E-03	6.11E-01	6.66E-04
7. Ru/Rh-106	Gas (3)	0.00E+00	1.00E+00	0.00E+00	0.00E+00
8. Sb-125	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
9. I-129	Gas	1.22E+00	1.00E+00	1.22E+00	3.55E-01
10. Cs-134	Particulate	3.04E+03	1.00E-03	3.04E+00	9.52E-02
11. Cs-137	Particulate	5.19E+06	1.00E-03	5.19E+03	1.24E+02
12. Ce-144	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
13. Pm-147	Particulate	2.56E+02	1.00E-03	2.56E-01	2.92E-04
14. Eu-154 (1)	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
15. Nat.U	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
16. Np-237	Particulate	1.55E+01	1.00E-03	1.55E-02	1.84E-01
17. Pu-238	Particulate	1.18E-04	1.00E-03	1.18E-07	9.46E-07
18. Pu-239/240	Particulate	3.88E+01	1.00E-03	3.88E-02	3.36E-01
19. Pu-241	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
20. Am-241	Particulate	1.21E+03	1.00E-03	1.21E+00	1.59E+01
21. Cm-242/244	Particulate	1.33E-02	1.00E-03	1.33E-05	9.23E-05

Total Dose: 1.48E+02

Method Used to Project Dose: CAP88

COMMENTS

1. Sr-90 used as the beta emitter; dose factors were not included in the radionuclide library for this specific radionuclide.

2. Y-90 is assumed to be in secular equilibrium with Sr-90.

3. This is a conservative estimate.

4. Supernatant data used; sludge/slurry contribution is less than 1% of the supernatant contribution to the total dose.

STACK STATUS: X DESIGNATED NON-DESIGNATEDEVALUATOR [Signature] DATE 12/7/93MANAGER, ENVIRONMENTAL [Signature] DATE 12-8-93FACILITY MANAGER [Signature] DATE 12-8-93QUALITY ASSURANCE [Signature] DATE 12/8/93

STACK ASSESSMENT FOR 40 CFR 61, SUBPART H
APPENDIX D SOURCE ASSESSMENT

FACILITY 241-AW Tank Annulus DISCHARGE POINT Stack 296-A-28

FACILITY RADIOLOGICAL INVENTORY AT RISK

Radionuclide	Physical/ Chemical Form	Quantity (curies)	Release Factor	Potential Quantity Released (curies)	Projected Dose (mrem/yr)
1. C-14	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
2. Co-60	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
3. Se-79 (1)	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
4. Sr-89/90	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
5. Y-90 (2)	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
6. Tc-99	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
7. Ru/Rh-106	Gas (3)	0.00E+00	1.00E+00	0.00E+00	0.00E+00
8. Sb-125	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
9. I-129	Gas	0.00E+00	1.00E+00	0.00E+00	0.00E+00
10. Cs-134	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
11. Cs-137	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
12. Ce-144	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
13. Pm-147	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
14. Eu-154 (1)	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
15. Nat.U	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
16. Np-237	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
17. Pu-238	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
18. Pu-239/240	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
19. Pu-241	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
20. Am-241	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
21. Cm-242/244	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00

Total Dose: 0.00E+00

Method Used to Project Dose: CAP88

COMMENTS

1. Sr-90 used as the beta emitter; dose factors were not included in the radionuclide library for this specific radionuclide.

2: Y-90 is assumed to be in secular equilibrium with Sr-90.

3: This is a conservative estimate.

STACK STATUS: DESIGNATED X NON-DESIGNATEDEVALUATOR [Signature] DATE 12/7/93MANAGER, ENVIRONMENTAL [Signature] DATE 12-8-93FACILITY MANAGER [Signature] DATE 12-8-93QUALITY ASSURANCE [Signature] DATE 12/8/93

STACK ASSESSMENT FOR 40 CFR 61, SUBPART H
APPENDIX D SOURCE ASSESSMENT

FACILITY AN Tank Farm Primary DISCHARGE POINT Stack 296-A-29

FACILITY RADIOLOGICAL INVENTORY AT RISK

Radionuclide	Physical/ Chemical Form	Quantity (curies) (4)	Release Factor (4)	Potential Quantity Released (curies)	Projected Dose (mrem/yr)
1. C-14	Particulate	1.54E+01	1.00E-03	1.54E-02	4.03E-05
2. Co-60	Particulate	1.28E+03	1.00E-03	1.28E+00	3.71E-02
3. Se-79 (1)	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
4. Sr-89/90	Particulate	9.81E+05	1.00E-03	9.81E+02	4.30E+01
5. Y-90 (2)	Particulate	9.81E+05	1.00E-03	9.81E+02	3.70E-01
6. Tc-99	Particulate	2.09E+03	1.00E-03	2.09E+00	2.28E-03
7. Ru/Rh-106	Gas (3)	0.00E+00	1.00E+00	0.00E+00	0.00E+00
8. Sb-125	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
9. I-129	Gas	2.65E+00	1.00E+00	2.65E+00	7.71E-01
10. Cs-134	Particulate	5.04E+02	1.00E-03	5.04E-01	1.58E-02
11. Cs-137	Particulate	9.41E+06	1.00E-03	9.41E+03	2.25E+02
12. Ce-144	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
13. Fm-147	Particulate	4.30E+03	1.00E-03	4.30E+00	4.90E-03
14. Eu-154 (1)	Particulate	1.31E+04	1.00E-03	1.31E+01	5.74E-01
15. Nat.U	Particulate	2.59E-01	1.00E-03	2.59E-04	7.36E-04
16. Np-237	Particulate	8.86E-01	1.00E-03	8.86E-04	1.05E-02
17. Pu-238	Particulate	3.41E-02	1.00E-03	3.41E-05	2.73E-04
18. Pu-239/240	Particulate	7.42E+02	1.00E-03	7.42E-01	6.43E+00
19. Pu-241	Particulate	2.05E+03	1.00E-03	2.05E+00	2.83E-01
20. Am-241	Particulate	4.35E+04	1.00E-03	4.35E+01	5.70E+02
21. Cm-242/244	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00

Total Dose: 8.46E+02

Method Used to Project Dose CAP93

COMMENTS

1. Sr-90 used as the beta emitter; dose factors were not included in the radionuclide library for this specific radionuclide.
2. Y-90 is assumed to be in secular equilibrium with Sr-90.
3. This is a conservative estimate.
4. Supernatant data used; sludge/slurry contribution is less than 1% of the supernatant contribution to the total dose.

STACK STATUS: X DESIGNATED NON-DESIGNATEDEVALUATOR [Signature] DATE 12/12/93MANAGER, ENVIRONMENTAL [Signature] DATE 12-5-93FACILITY MANAGER [Signature] DATE 12-8-93QUALITY ASSURANCE [Signature] DATE 12/18/93

STACK ASSESSMENT FOR 40 CFR 61, SUBPART H
APPENDIX D SOURCE ASSESSMENT

FACILITY 241-AN Tank Annulus DISCHARGE POINT Stack 296-A-30

FACILITY RADIOLOGICAL INVENTORY AT RISK

Radionuclide	Physical/ Chemical Form	Quantity (curies)	Release Factor	Potential Quantity Released (curies)	Projected Dose (mrem/yr)
1. C-14	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
2. Co-60	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
3. Se-79 (1)	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
4. Sr-89/90	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
5. Y-90 (2)	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
6. Tc-99	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
7. Ru/Rh-106	Gas (3)	0.00E+00	1.00E+00	0.00E+00	0.00E+00
8. Sb-125	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
9. I-129	Gas	0.00E+00	1.00E+00	0.00E+00	0.00E+00
10. Cs-134	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
11. Cs-137	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
12. Ce-144	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
13. Pm-147	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
14. Eu-154 (1)	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
15. Nat.U	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
16. Np-237	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
17. Pu-238	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
18. Pu-239/240	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
19. Pu-241	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
20. Am-241	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
21. Cm-242/244	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00

Total Dose: 0.00E+00

Method Used to Project Dose: CAP88

COMMENTS

1. Sr-90 used as the beta emitter; dose factors were not included in the radionuclide library for this specific radionuclide.

2: Y-90 is assumed to be in secular equilibrium with Sr-90.

3: This is a conservative estimate.

STACK STATUS: DESIGNATED X NON-DESIGNATEDEVALUATOR [Signature] DATE 12/7/93MANAGER, ENVIRONMENTAL [Signature] DATE 12-8-93FACILITY MANAGER [Signature] DATE 12-8-93QUALITY ASSURANCE [Signature] DATE 12/8/93

STACK ASSESSMENT FOR 40 CFR 61, SUBPART H
APPENDIX D SOURCE ASSESSMENT

FACILITY AP Tank Farm Primary DISCHARGE POINT Stack 296-A-40

FACILITY RADIOLOGICAL INVENTORY AT RISK

Radionuclide	Physical/ Chemical Form	Quantity (curies)	Release Factor	Potential Quantity Released (curies)	Projected Dose (mrem/yr)
1. C-14	Particulate	9.45E-05	1.00E-03	9.45E-08	2.48E-10
2. Co-60	Particulate	1.32E+01	1.00E-03	1.32E-02	3.83E-04
3. Se-79 (1)	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
4. Sr-89/90	Particulate	2.34E+01	1.00E-03	2.34E-02	1.02E-03
5. Y-90 (2)	Particulate	2.34E+01	1.00E-03	2.34E-02	8.82E-06
6. Tc-99	Particulate	4.05E-03	1.00E-03	4.05E-06	4.41E-09
7. Ru/Rh-106	Gas (3)	0.00E+00	1.00E+00	0.00E+00	0.00E+00
8. Sb-125	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
9. I-129	Gas	2.70E-03	1.00E+00	2.70E-03	7.86E-04
10. Cs-134	Particulate	3.12E-03	1.00E-03	3.12E-06	9.77E-08
11. Cs-137	Particulate	1.52E+01	1.00E-03	1.52E-02	3.63E-04
12. Ce-144	Particulate	1.41E-02	1.00E-03	1.41E-05	1.93E-07
13. Pm-147	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
14. Eu-154 (1)	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
15. Nat.U	Particulate	6.49E-05	1.00E-03	6.49E-08	1.84E-07
16. Np-237	Particulate	7.57E-02	1.00E-03	7.57E-05	9.01E-04
17. Pu-238	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
18. Pu-239/240	Particulate	7.05E-02	1.00E-03	7.05E-05	6.11E-04
19. Pu-241	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
20. Am-241	Particulate	5.66E+00	1.00E-03	5.66E-03	7.41E-02
21. Cm-242/244	Particulate	1.21E-01	1.00E-03	1.21E-04	8.40E-04
Total Dose:					7.91E-02
Operational Dose:					0.21 (4)

Method Used to Project Dose CAPSS

COMMENTS

1. Sr-90 used as the beta emitter; dose factors were not included in the radionuclide library for this specific radionuclide.
2. Y-90 is assumed to be in secular equilibrium with Sr-90.
3. This is a conservative estimate.
4. Radiological inventory data were available for only 3 of 8 tanks; therefore, the calculated potential offsite dose based on 3 tanks must be adjusted by a factor of 8/3.

STACK STATUS: Y DESIGNATED NON-DESIGNATED

EVALUATOR [Signature] DATE 12/17/93

MANAGER, ENVIRONMENTAL [Signature] DATE 12-8-93

FACILITY MANAGER [Signature] DATE 12-8-93

QUALITY ASSURANCE [Signature] DATE 12/8/93

STACK ASSESSMENT FOR 40 CFR 61, SUBPART H
APPENDIX D SOURCE ASSESSMENT

FACILITY 241-AP Tank Annulus DISCHARGE POINT Stack 296-A-41

FACILITY RADIOLOGICAL INVENTORY AT RISK

Radionuclide	Physical/ Chemical Form	Quantity (curies)	Release Factor	Potential Quantity Released (curies)	Projected Dose (mrem/yr)
1. C-14	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
2. Co-60	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
3. Se-79 (1)	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
4. Sr-89/90	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
5. Y-90 (2)	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
6. Tc-99	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
7. Ru/Rh-106	Gas (3)	0.00E+00	1.00E+00	0.00E+00	0.00E+00
8. Sb-125	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
9. I-129	Gas	0.00E+00	1.00E+00	0.00E+00	0.00E+00
10. Cs-134	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
11. Cs-137	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
12. Ce-144	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
13. Pm-147	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
14. Eu-154 (1)	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
15. Nat.U	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
16. Np-237	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
17. Pu-238	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
18. Pu-239/240	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
19. Pu-241	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
20. Am-241	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
21. Cm-242/244	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00

Total Dose: 0.00E+00

Method Used to Project Dose: CAP88

COMMENTS

1. Sr-90 used as the beta emitter; dose factors were not included in the radionuclide library for this specific radionuclide.

2: Y-90 is assumed to be in secular equilibrium with Sr-90.

3: This is a conservative estimate.

STACK STATUS: DESIGNATED X NON-DESIGNATEDEVALUATOR [Signature] DATE 12/7/93MANAGER, ENVIRONMENTAL [Signature] DATE 12-8-93FACILITY MANAGER [Signature] DATE 12-1-93QUALITY ASSURANCE [Signature] DATE 12/8/93

WHC-SD-EN-RPT-007

STACK ASSESSMENT FOR 40 CFR 61, SUBPART H
APPENDIX D SOURCE ASSESSMENT

FACILITY 244-BX DCRT DISCHARGE POINT Stack 296-B-28

FACILITY RADIOLOGICAL INVENTORY AT RISK

Radionuclide	Physical/ Chemical Form	Quantity (curies)	Release Factor	Potential Quantity Released (curies)	Projected Dose (mrem/yr)
1. C-14	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
2. Co-60	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
3. Se-79 (1)	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
4. Sr-89/90	Particulate	3.09E+01	1.00E-03	3.09E-02	1.35E-03
5. Y-90 (2)	Particulate	3.09E+01	1.00E-03	3.09E-02	1.16E-03
6. Tc-99	Particulate	2.76E+01	1.00E-03	2.76E-02	3.01E-03
7. Ru/Rh-106	Gas (3)	0.00E+00	1.00E+00	0.00E+00	0.00E+00
8. Sb-125	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
9. I-129	Gas	0.00E+00	1.00E+00	0.00E+00	0.00E+00
10. Cs-134	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
11. Cs-137	Particulate	2.04E+04	1.00E-03	2.04E+01	4.88E-01
12. Ce-144	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
13. Pm-147	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
14. Eu-154 (1)	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
15. Nat.U	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
16. Np-237	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
17. Pu-238	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
18. Pu-239/240	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
19. Pu-241	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
20. Am-241	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
21. Cm-242/244	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00

Method Used to Project Dose: CAP88

Total Dose: 4.89E-00

Operational Dose (4): 1.60E-01

COMMENTS

1. Sr-90 used as the beta emitter; dose factors were not included in the radionuclide library for this specific radionuclide.

2: Y-90 is assumed to be in secular equilibrium with Sr-90.

3: This is a conservative estimate.

4: Incorporates volumetric and time factors based on projected usage.

5: This system is not currently transferring waste that would require a designated status for the stack.

STACK STATUS: DESIGNATED X NON-DESIGNATED (5)EVALUATOR [Signature] DATE 12/2/92MANAGER, ENVIRONMENTAL [Signature] DATE 12-8-93FACILITY MANAGER [Signature] DATE 12-8-93QUALITY ASSURANCE [Signature] DATE 12/8/93

**STACK ASSESSMENT FOR 40 CFR 61, SUBPART H
APPENDIX D SOURCE ASSESSMENT**

FACILITY 244-CR Vault DISCHARGE POINT Stack 296-C-05

FACILITY RADIOLOGICAL INVENTORY AT RISK

Radionuclide	Physical/ Chemical Form	Quantity (curies)	Release Factor	Potential Quantity Released (curies)	Projected Dose (mrem/yr)
1. C-14	Particulate	4.86E-01	1.00E-03	4.86E-04	1.27E-06
2. Co-60	Particulate	2.97E+03	1.00E-03	2.97E+00	8.61E-02
3. Se-79 (1)	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
4. Sr-89/90	Particulate	3.51E+06	1.00E-03	3.51E+03	1.54E+02
5. Y-90 (2)	Particulate	3.51E+06	1.00E-03	3.51E+03	1.32E+00
6. Tc-99	Particulate	4.59E+02	1.00E-03	4.59E-01	5.00E-04
7. Ru/Rh-106	Gas (3)	0.00E+00	1.00E+00	0.00E+00	0.00E+00
8. Sb-125	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
9. I-129	Gas	5.68E-02	1.00E+00	5.68E-02	1.65E-02
10. Cs-134	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
11. Cs-137	Particulate	1.22E+05	1.00E-03	1.22E+02	2.92E+00
12. Ce-144	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
13. Pm-147	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
14. Eu-154 (1)	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
15. Nat.U	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
16. Np-237	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
17. Pu-238	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
18. Pu-239/240	Particulate	1.03E+03	1.00E-03	1.03E+00	8.93E+00
19. Pu-241	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
20. Am-241	Particulate	1.51E+03	1.00E-03	1.51E+00	1.98E+01
21. Cm-242/244	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00

Total Dose: 1.87E+02

Method Used to Project Dose: CAP88

COMMENTS

1. Sr-90 used as the beta emitter; dose factors were not included in the radionuclide library for this specific radionuclide.

2: Y-90 is assumed to be in secular equilibrium with Sr-90.

3: This is a conservative estimate.

4: This system is not currently transferring waste that would require a designated status for the stack.

STACK STATUS: DESIGNATED X NON-DESIGNATED (4)

EVALUATOR [Signature] DATE 12/7/93

MANAGER, ENVIRONMENTAL [Signature] DATE 12-8-93

FACILITY MANAGER [Signature] DATE 12-8-93

QUALITY ASSURANCE [Signature] DATE 12/8/93

STACK ASSESSMENT FOR 40 CFR 61, SUBPART E
APPENDIX D SOURCE ASSESSMENT

FACILITY 241-C-104/105/106 Portable DISCHARGE POINT Stack 296-P-16

FACILITY RADIOLOGICAL INVENTORY AT RISK

Radionuclide	Physical/ Chemical Form	Quantity (curies) (4)	Release Factor (4)	Potential Quantity Released (curies)	Projected Dose (mrem/yr)
1. C-14	Particulate	2.69E-01	1.00E-03	2.69E-04	7.05E-07
2. Co-60	Particulate	1.92E+01	1.00E-03	1.92E-02	5.57E-04
3. Se-79 (1)	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
4. Sr-89/90	Particulate	3.70E+02	1.00E-03	3.70E-01	1.62E-02
5. Y-90 (2)	Particulate	3.70E+02	1.00E-03	3.70E-01	1.39E-04
6. Tc-99	Particulate	2.20E+01	1.00E-03	2.20E-02	2.40E-05
7. Ru/Rh-106	Gas (3)	0.00E+00	1.00E+00	0.00E+00	0.00E+00
8. Sb-125	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
9. I-129	Gas	1.21E-02	1.00E+00	1.21E-02	3.52E-03
10. Cs-134	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
11. Cs-137	Particulate	2.71E+04	1.00E-03	2.71E+01	6.48E-01
12. Cs-144	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
13. Pm-147	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
14. Eu-154 (1)	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
15. Nat. U	Particulate	2.84E-02	1.00E-03	2.84E-05	8.07E-05
16. Np-237	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
17. Pu-238	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
18. Pu-239/240	Particulate	6.02E+01	1.00E-03	6.02E-02	5.22E-01
19. Pu-241	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
20. Am-241	Particulate	1.14E+00	1.00E-03	1.14E-03	1.49E-02
21. Cm-242/244	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00

Supernatant Dose: 1.21E+00
Sludge/Slurry Dose: 0.47E+00
Total Dose: 1.68E+00

Method Used to Project Dose: CAP88

COMMENTS

1. Sr-90 used as the beta emitter; dose factors were not included in the radionuclide library for this specific radionuclide.

2: Y-90 is assumed to be in secular equilibrium with Sr-90.

3: This is a conservative estimate.

4: Supernatant data is listed; sludge/slurry contribution is approximately 39% of the supernatant contribution to the total dose.

STACK STATUS: X DESIGNATED NON-DESIGNATED

EVALUATOR [Signature] DATE 12/8/93
MANAGER, ENVIRONMENTAL [Signature] DATE 12-8-93
FACILITY MANAGER [Signature] DATE 12-8-93
QUALITY ASSURANCE [Signature] DATE 12/8/93

STACK ASSESSMENT FOR 40 CFR 61, SUBPART H
APPENDIX D SOURCE ASSESSMENT

FACILITY 241-A-104/105/106 DISCHARGE POINT Stack 296-P-17

FACILITY RADIOLOGICAL INVENTORY AT RISK

Radionuclide	Physical/ Chemical Form	Quantity (curies)	Release Factor	Potential Quantity Released (curies)	Projected Dose (mrem/yr)
1. C-14	Particulate	7.08E+02	1.00E-03	7.08E-01	1.85E-03
2. Co-60	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
3. Se-79 (1)	Particulate	2.97E-01	1.00E-03	2.97E-04	1.30E-05
4. Sr-89/90	Particulate	3.78E+06	1.00E-03	3.78E+03	1.66E+02
5. Y-90 (2)	Particulate	3.78E+06	1.00E-03	3.78E+03	1.43E+00
6. Tc-99	Particulate	1.00E+01	1.00E-03	1.00E-02	1.09E-05
7. Ru/Rh-106	Gas (3)	8.16E-02	1.00E+00	8.16E-02	1.71E-03
8. Sb-125	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
9. I-129	Gas	1.00E-02	1.00E+00	1.00E-02	2.91E-03
10. Cs-134	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
11. Cs-137	Particulate	3.78E+04	1.00E-03	3.78E+01	9.03E-01
12. Ce-144	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
13. Pm-147	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
14. Eu-154 (1)	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
15. Nat.U	Particulate	6.05E+00	1.00E-03	6.05E-03	1.72E-02
16. Np-237	Particulate	4.64E-02	1.00E-03	4.64E-05	5.52E-04
17. Pu-238	Particulate	6.81E+01	1.00E-03	6.81E-02	5.46E-01
18. Pu-239/240	Particulate	2.00E+03	1.00E-03	2.00E+00	1.73E+01
19. Pu-241	Particulate	3.24E+03	1.00E-03	3.24E+00	4.47E-01
20. Am-241	Particulate	1.19E+03	1.00E-03	1.19E+00	1.56E+01
21. Cm-242/244	Particulate	6.57E-03	1.00E-03	6.57E-06	4.56E-05

Total Dose: 2.02E+02

Method Used to Project Dose: CAP88

COMMENTS

1. Sr-90 used as the beta emitter; dose factors were not included in the radionuclide library for this specific radionuclide.
2. Y-90 is assumed to be in secular equilibrium with Sr-90.
3. This is a conservative estimate.
4. This system is currently not in operation. If the exhausters would be routinely operated again, the system would become designated.

STACK STATUS: DESIGNATED X NON-DESIGNATED (4)EVALUATOR [Signature] DATE 12/7/93MANAGER, ENVIRONMENTAL [Signature] DATE 12-8-93FACILITY MANAGER [Signature] DATE 12-8-93QUALITY ASSURANCE [Signature] DATE 12/8/93

STACK ASSESSMENT FOR 40 CFR 61, SUBPART H
APPENDIX D SOURCE ASSESSMENT

FACILITY 241-SY Tank Annulus DISCHARGE POINT Stack 296-P-22

FACILITY RADIOLOGICAL INVENTORY AT RISK

Radionuclide	Physical/ Chemical Form	Quantity (curies)	Release Factor	Potential Quantity Released (curies)	Projected Dose (mrem/yr)
1. C-14	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
2. Co-60	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
3. Se-79 (1)	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
4. Sr-89/90	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
5. Y-90 (2)	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
6. Tc-99	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
7. Ru/Rh-106	Gas (3)	0.00E+00	1.00E+00	0.00E+00	0.00E+00
8. Sb-125	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
9. I-129	Gas	0.00E+00	1.00E+00	0.00E+00	0.00E+00
10. Cs-134	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
11. Cs-137	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
12. Ce-144	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
13. Pm-147	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
14. Eu-154 (1)	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
15. Nat.U	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
16. Np-237	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
17. Pu-238	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
18. Pu-239/240	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
19. Pu-241	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
20. Am-241	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
21. Cm-242/244	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00

Total Dose: 0.00E+00

Method Used to Project Dose: CAP88

COMMENTS

1. Sr-90 used as the beta emitter; dose factors were not included in the radionuclide library for this specific radionuclide.

2: Y-90 is assumed to be in secular equilibrium with Sr-90.

3: This is a conservative estimate.

STACK STATUS: DESIGNATED X NON-DESIGNATED

EVALUATOR [Signature] DATE 12/7/93

MANAGER, ENVIRONMENTAL [Signature] DATE 12-8-93

FACILITY MANAGER [Signature] DATE 12-8-93

QUALITY ASSURANCE [Signature] DATE 12/8/93

STACK ASSESSMENT FOR 40 CFR 61, SUBPART H
APPENDIX D SOURCE ASSESSMENT

FACILITY SY Tank Farm Primary DISCHARGE POINT Stack 296-P-23

FACILITY RADIOLOGICAL INVENTORY AT RISK

Radionuclide	Physical/ Chemical Form	Quantity (curies) (4)	Release Factor (4)	Potential Quantity Released (curies)	Projected Dose (mrem/yr)
1. C-14	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
2. Co-60	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
3. Se-79 (1)	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
4. Sr-89/90	Particulate	5.21E+03	1.00E-03	5.21E+00	1.35E-01
5. Y-90 (2)	Particulate	5.21E+03	1.00E-03	5.21E+00	1.16E-03
6. Tc-99	Particulate	1.04E+01	1.00E-03	1.04E-02	6.71E-06
7. Ru/Rh-106	Gas (3)	0.00E+00	1.00E+00	0.00E+00	0.00E+00
8. Sb-125	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
9. I-129	Gas	0.00E+00	1.00E+00	0.00E+00	0.00E+00
10. Cs-134	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
11. Cs-137	Particulate	7.29E+05	1.00E-03	7.29E+02	1.04E+01
12. Ce-144	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
13. Pm-147	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
14. Eu-154 (1)	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
15. Nat.U	Particulate	5.81E-04	1.00E-03	5.81E-07	9.82E-07
16. Np-237	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
17. Pu-238	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
18. Pu-239/240	Particulate	6.75E-01	1.00E-03	6.75E-04	3.48E-03
19. Pu-241	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
20. Am-241	Particulate	2.27E+00	1.00E-03	2.27E-03	1.77E-02
21. Cm-242/244	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00

Total Dose: 1.05E+01

Method Used to Project Dose: CAP88

COMMENTS

1. Sr-90 used as the beta emitter; dose factors were not included in the radionuclide library for this specific radionuclide.

2: Y-90 is assumed to be in secular equilibrium with Sr-90.

3: This is a conservative estimate.

4: Supernatant data used; sludge/slurry contribution is less than 1% of the supernatant contribution to the total dose.

STACK STATUS: X DESIGNATED NON-DESIGNATED

EVALUATOR [Signature] DATE 12/7/93

MANAGER, ENVIRONMENTAL [Signature] DATE 12-8-93

FACILITY MANAGER [Signature] DATE 12-8-93

QUALITY ASSURANCE [Signature] DATE 12/8/93

WHC-SD-EN-RPT-007

STACK ASSESSMENT FOR 40 CFR 61, SUBPART H
APPENDIX D SOURCE ASSESSMENT

FACILITY 241-AY/AZ Backup DISCHARGE POINT Stack 296-P-26

FACILITY RADIOLOGICAL INVENTORY AT RISK

Radionuclide	Physical/ Chemical Form	Quantity (curies) (4)	Release Factor (4)	Potential Quantity Released (curies)	Projected Dose (mrem/yr)
1. C-14	Particulate	4.97E+00	1.00E-03	4.97E-03	1.30E-05
2. Co-60	Particulate	1.74E+03	1.00E-03	1.74E+00	5.05E-02
3. Se-79 (1)	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
4. Sr-89/90	Particulate	3.95E+04	1.00E-03	3.95E+01	1.73E+00
5. Y-90 (2)	Particulate	3.95E+04	1.00E-03	3.95E+01	1.49E-02
6. Tc-99	Particulate	1.29E+05	1.00E-03	1.29E+02	1.41E-01
7. Ru/Rh-106	Gas (3)	0.00E+00	1.00E+00	0.00E+00	0.00E+00
8. Sb-125	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
9. I-129	Gas	2.48E+00	1.00E+00	2.48E+00	7.22E-01
10. Cs-134	Particulate	2.89E+00	1.00E-03	2.89E-03	9.05E-05
11. Cs-137	Particulate	9.24E+06	1.00E-03	9.24E+03	2.21E+02
12. Ce-144	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
13. Pm-147	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
14. Eu-154 (1)	Particulate	1.88E+04	1.00E-03	1.88E+01	8.23E-01
15. Nat.U	Particulate	1.88E+00	1.00E-03	1.88E-03	5.34E-03
16. Np-237	Particulate	2.44E-01	1.00E-03	2.44E-04	2.90E-03
17. Pu-238	Particulate	2.63E-01	1.00E-03	2.63E-04	2.11E-03
18. Pu-239/240	Particulate	2.50E+00	1.00E-03	2.50E-03	2.17E-02
19. Pu-241	Particulate	1.18E+01	1.00E-03	1.18E-02	1.63E-03
20. Am-241	Particulate	1.46E+02	1.00E-03	1.46E-01	1.91E+00
21. Cm-242/244	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
Total Dose:					2.26E+02

Method Used to Project Dose: CAP88

COMMENTS

1. Sr-90 used as the beta emitter; dose factors were not included in the radionuclide library for this specific radionuclide.
2. Y-90 is assumed to be in secular equilibrium with Sr-90.
3. This is a conservative estimate.
4. Supernatant data used; sludge/slurry contribution is less than 1% of the supernatant contribution to the total dose.
5. This stack is not currently registered. Operational time requires that this stack be designated.

STACK STATUS: X DESIGNATED (5) NON-DESIGNATEDEVALUATOR [Signature] DATE 12/7/93MANAGER, ENVIRONMENTAL [Signature] DATE 12-8-93FACILITY MANAGER [Signature] DATE 12-8-93QUALITY ASSURANCE [Signature] DATE 12/8/93

STACK ASSESSMENT FOR 40 CFR 61, SUBPART H
APPENDIX D SOURCE ASSESSMENT

FACILITY SY Tank Farm Backup DISCHARGE POINT Stack 296-P-28

FACILITY RADIOLOGICAL INVENTORY AT RISK

Radionuclide	Physical/ Chemical Form	Quantity (curies) (4)	Release Factor (4)	Potential Quantity Released (curies)	Projected Dose (mrem/yr)
1. C-14	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
2. Co-60	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
3. Se-79 (1)	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
4. Sr-89/90	Particulate	5.21E+03	1.00E-03	5.21E+00	1.35E-01
5. Y-90 (2)	Particulate	5.21E+03	1.00E-03	5.21E+00	1.16E-03
6. Tc-99	Particulate	1.04E+01	1.00E-03	1.04E-02	6.71E-06
7. Ru/Rh-106	Gas (3)	0.00E+00	1.00E+00	0.00E+00	0.00E+00
8. Sb-125	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
9. I-129	Gas	0.00E+00	1.00E+00	0.00E+00	0.00E+00
10. Cs-134	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
11. Cs-137	Particulate	7.29E+05	1.00E-03	7.29E+02	1.04E+01
12. Ce-144	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
13. Pm-147	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
14. Eu-154 (1)	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
15. Nat. U	Particulate	5.81E-04	1.00E-03	5.81E-07	9.82E-07
16. Np-237	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
17. Pu-238	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
18. Pu-239/240	Particulate	6.75E-01	1.00E-03	6.75E-04	3.48E-03
19. Pu-241	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
20. Am-241	Particulate	2.27E+00	1.00E-03	2.27E-03	1.77E-02
21. Cm-242/244	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
Total Dose:					1.05E+01

Method Used to Project Dose: CAP88

COMMENTS

1. Sr-90 used as the beta emitter; dose factors were not included in the radionuclide library for this specific radionuclide.

2: Y-90 is assumed to be in secular equilibrium with Sr-90.

3: This is a conservative estimate.

4: Supernatant data used; sludge/slurry contribution is less than 1% of the supernatant contribution to the total dose.

5: This stack is not currently registered. Operational time does not require this stack to be designated.

STACK STATUS: DESIGNATED X NON-DESIGNATED (5)

EVALUATOR [Signature] DATE 12/7/93

MANAGER, ENVIRONMENTAL [Signature] DATE 12-8-93

FACILITY MANAGER [Signature] DATE 12-8-93

QUALITY ASSURANCE [Signature] DATE 12/8/93

STACK ASSESSMENT FOR 40 CFR 61, SUBPART H
APPENDIX D SOURCE ASSESSMENT

FACILITY Building 209-E DISCHARGE POINT Stack 296-P-31

FACILITY RADIOLOGICAL INVENTORY AT RISK

Radionuclide	Physical/ Chemical Form	Quantity (curies)	Release Factor	Potential Quantity Released (curies)	Projected Dose (mrem/yr)
1. C-14	Particulate	0.00E+00	1.00E-06	0.00E+00	0.00E+00
2. Co-60	Particulate	8.37E-04	1.00E-06	8.37E-10	2.43E-11
3. Se-79 (1)	Particulate	0.00E+00	1.00E-06	0.00E+00	0.00E+00
4. Sr-89/90	Particulate	1.99E+01	1.00E-06	1.99E-05	8.72E-07
5. Y-90 (2)	Particulate	1.99E+01	1.00E-06	1.99E-05	7.50E-09
6. Tc-99	Particulate	0.00E+00	1.00E-06	0.00E+00	0.00E+00
7. Ru/Rh-106	Gas (3)	0.00E+00	1.00E+00	0.00E+00	0.00E+00
8. Sb-125	Particulate	0.00E+00	1.00E-06	0.00E+00	0.00E+00
9. I-129	Gas	0.00E+00	1.00E+00	0.00E+00	0.00E+00
10. Cs-134	Particulate	0.00E+00	1.00E-06	0.00E+00	0.00E+00
11. Cs-137	Particulate	4.59E-02	1.00E-06	4.59E-08	1.10E-09
12. Ce-144	Particulate	0.00E+00	1.00E-06	0.00E+00	0.00E+00
13. Pm-147	Particulate	0.00E+00	1.00E-06	0.00E+00	0.00E+00
14. Eu-154 (1)	Particulate	1.73E-02	1.00E-06	1.73E-08	7.58E-10
15. Nat. U	Particulate	5.04E-06	1.00E-06	5.04E-12	1.43E-11
16. Np-237	Particulate	0.00E+00	1.00E-06	0.00E+00	0.00E+00
17. Pu-238	Particulate	2.35E-04	1.00E-06	2.35E-10	1.88E-09
18. Pu-239/240	Particulate	9.58E+01	1.00E-06	9.58E-05	8.31E-04
19. Pu-241	Particulate	4.55E-02	1.00E-06	4.55E-08	6.28E-09
20. Am-241	Particulate	1.16E-03	1.00E-06	1.16E-09	1.52E-08
21. Cm-242/244	Particulate	0.00E+00	1.00E-06	0.00E+00	0.00E+00

Total Dose: 8.31E-04

Method Used to Project Dose: CAP88

COMMENTS

1. Sr-90 used as the beta emitter; dose factors were not included in the radionuclide library for this specific radionuclide.
2. Y-90 is assumed to be in secular equilibrium with Sr-90.
3. This is a conservative estimate.

STACK STATUS: DESIGNATED X NON-DESIGNATED

EVALUATOR [Signature] DATE 12/7/93

MANAGER, ENVIRONMENTAL [Signature] DATE 12-8-93

FACILITY MANAGER. [Signature] DATE 12-8-93

QUALITY ASSURANCE [Signature] DATE 12/8/93

STACK ASSESSMENT FOR 40 CFR 61, SUBPART H
APPENDIX D SOURCE ASSESSMENT

FACILITY 241-SX Tank Farm DISCHARGE POINT Stack 296-S-15

FACILITY RADIOLOGICAL INVENTORY AT RISK

Radionuclide	Physical/ Chemical Form	Quantity (curies) (4)	Release Factor (4)	Potential Quantity Released (curies)	Projected Dose (mrem/yr)
1. C-14	Particulate	8.13E+02	1.00E-03	8.13E-01	1.34E-03
2. Co-60	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
3. Se-79 (1)	Particulate	8.95E+01	1.00E-03	8.95E-02	2.33E-03
4. Sr-89/90	Particulate	6.66E+06	1.00E-03	6.66E+03	1.73E+02
5. Y-90 (2)	Particulate	6.66E+06	1.00E-03	6.66E+03	1.48E+00
6. Tc-99	Particulate	3.10E+03	1.00E-03	3.10E+00	2.00E-03
7. Ru/Rh-106	Gas (3)	5.58E-02	1.00E+00	5.58E-02	6.70E-04
8. Sb-125	Particulate	8.37E+01	1.00E-03	8.37E-02	2.07E-04
9. I-129	Gas	4.58E+00	1.00E+00	4.58E+00	5.22E-01
10. Cs-134	Particulate	2.17E+00	1.00E-03	2.17E-03	4.04E-05
11. Cs-137	Particulate	1.90E+06	1.00E-03	1.90E+03	2.70E+01
12. Ce-144	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
13. Pm-147	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
14. Eu-154 (1)	Particulate	9.49E+02	1.00E-03	9.49E-01	2.47E-02
15. Nat.U	Particulate	1.07E+01	1.00E-03	1.07E-02	1.81E-02
16. Np-237	Particulate	3.45E+00	1.00E-03	3.45E-03	2.43E-02
17. Pu-238	Particulate	1.19E+02	1.00E-03	1.19E-01	5.66E-01
18. Pu-239/240	Particulate	2.33E+03	1.00E-03	2.33E+00	1.20E+01
19. Pu-241	Particulate	2.72E+03	1.00E-03	2.72E+00	2.22E-01
20. Am-241	Particulate	7.01E+03	1.00E-03	7.01E+00	5.46E+01
21. Cm-242/244	Particulate	1.29E-01	1.00E-03	1.29E-02	5.31E-02

Total Dose: 2.70E+02

Method Used to Project Dose: CAP88

COMMENTS

1. Sr-90 used as the beta emitter; dose factors were not included in the radionuclide library for this specific radionuclide.

2: Y-90 is assumed to be in secular equilibrium with Sr-90.

3: This is a conservative estimate.

4: Supernatant data used; sludge/slurry contribution is less than 1% of the supernatant contribution to the total dose.

STACK STATUS: X DESIGNATED NON-DESIGNATEDEVALUATOR [Signature] DATE 12/7/93MANAGER, ENVIRONMENTAL [Signature] DATE 12-8-93FACILITY MANAGER [Signature] DATE 12-8-93QUALITY ASSURANCE [Signature] DATE 12/8/93 STACK

ASSESSMENT FOR 40 CFR 61, SUBPART H
APPENDIX D SOURCE ASSESSMENT

FACILITY 242-S Evaporator Building DISCHARGE POINT Stack 296-S-18

FACILITY RADIOLOGICAL INVENTORY AT RISK

Radionuclide	Physical/ Chemical Form	Quantity (curies)	Release Factor	Potential Quantity Released (curies)	Projected Dose (mrem/yr)
1. C-14	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
2. Co-60	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
3. Se-79 (1)	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
4. Sr-89/90	Particulate	9.50E-03	1.00E-03	9.50E-06	2.47E-07
5. Y-90 (2)	Particulate	9.50E-03	1.00E-03	9.50E-06	2.11E-09
6. Tc-99	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
7. Ru/Rh-106	Gas (3)	0.00E+00	1.00E+00	0.00E+00	0.00E+00
8. Sb-125	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
9. I-129	Gas	0.00E+00	1.00E+00	0.00E+00	0.00E+00
10. Cs-134	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
11. Cs-137	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
12. Ce-144	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
13. Pm-147	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
14. Eu-154 (1)	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
15. Nat.U	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
16. Np-237	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
17. Pu-238	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
18. Pu-239/240	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
19. Pu-241	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
20. Am-241	Particulate	1.89E-04	1.00E-03	1.89E-07	1.47E-06
21. Cm-242/244	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00

Total Dose: 1.72E-06

Method Used to Project Dose: CAP88

COMMENTS

1. Sr-90 used as the beta emitter; dose factors were not included in the radionuclide library for this specific radionuclide.

2: Y-90 is assumed to be in secular equilibrium with Sr-90.

3: This is a conservative estimate.

STACK STATUS: DESIGNATED X NON-DESIGNATED

EVALUATOR [Signature] DATE 12/7/93

MANAGER, ENVIRONMENTAL [Signature] DATE 12-8-93

FACILITY MANAGER [Signature] DATE 12-8-93

QUALITY ASSURANCE [Signature] DATE 12/8/93

WHC-SD-EN-RPT-007

STACK ASSESSMENT FOR 40 CFR 61, SUBPART H
APPENDIX D SOURCE ASSESSMENT

FACILITY 244-S DCRT DISCHARGE POINT Stack 296-S-22

FACILITY RADIOLOGICAL INVENTORY AT RISK

Radionuclide	Physical/ Chemical Form	Quantity (curies)	Release Factor	Potential Quantity Released (curies)	Projected Dose (mrem/yr)
1. C-14	Particulate	6.46E-07	1.00E-03	6.46E-10	1.07E-12
2. Co-60	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
3. Se-79 (1)	Particulate	3.19E-09	1.00E-03	3.19E-12	8.29E-14
4. Sr-89/90	Particulate	2.73E+05	1.00E-03	2.73E+02	7.10E+00
5. Y-90 (2)	Particulate	2.73E+05	1.00E-03	2.73E+02	6.06E-02
6. Tc-99	Particulate	1.29E-07	1.00E-03	1.29E-10	8.32E-14
7. Ru/Rh-106	Gas (3)	1.22E-02	1.00E+00	1.22E-02	1.46E-04
8. Sb-125	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
9. I-129	Gas	2.24E-10	1.00E+00	2.24E-10	2.55E-11
10. Cs-134	Particulate	1.27E+00	1.00E-03	1.27E-03	2.36E-05
11. Cs-137	Particulate	2.82E+05	1.00E-03	2.82E+02	4.00E+00
12. Ce-144	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
13. Pm-147	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
14. Eu-154 (1)	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
15. Nat.U	Particulate	9.46E-03	1.00E-03	9.46E-06	1.60E-05
16. Np-237	Particulate	2.24E-06	1.00E-03	2.24E-09	1.58E-08
17. Pu-238	Particulate	6.19E-02	1.00E-03	6.19E-05	2.95E-04
18. Pu-239/240	Particulate	6.85E+02	1.00E-03	6.85E-01	3.53E+00
19. Pu-241	Particulate	7.76E-01	1.00E-03	7.76E-04	6.34E-05
20. Am-241	Particulate	3.19E-01	1.00E-03	3.19E-04	2.49E-03
21. Cm-242/244	Particulate	1.35E-05	1.00E-03	1.35E-08	5.56E-08

Method Used to Project Dose: CAP88

Total Dose: 1.47E+01

Operational Dose (4): 3.40E-01

COMMENTS

1. Sr-90 used as the beta emitter; dose factors were not included in the radionuclide library for this specific radionuclide.

2: Y-90 is assumed to be in secular equilibrium with Sr-90.

3: This is a conservative estimate.

4: Incorporates volumetric and time factors based on projected usage.

5: This system is not currently transferring waste that would require a designated status for the stack.

STACK STATUS: DESIGNATED X NON-DESIGNATED (5)EVALUATOR [Signature] DATE 12/2/93MANAGER, ENVIRONMENTAL [Signature] DATE 12-8-93FACILITY MANAGER [Signature] DATE 12-8-93QUALITY ASSURANCE [Signature] DATE 12/5/93

STACK ASSESSMENT FOR 40 CFR 61, SUBPART H
APPENDIX D SOURCE ASSESSMENT

FACILITY 242-T Evaporator Building DISCHARGE POINT Stack 296-T-17

FACILITY RADIOLOGICAL INVENTORY AT RISK

Radionuclide	Physical/ Chemical Form	Quantity (curies)	Release Factor	Potential Quantity Released (curies)	Projected Dose (μ rem/yr)
1. C-14	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
2. Co-60	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
3. Se-79 (1)	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
4. Sr-89/90	Particulate	5.10E-03	1.00E-03	5.10E-06	1.33E-07
5. Y-90 (2)	Particulate	5.10E-03	1.00E-03	5.10E-06	1.13E-09
6. Tc-99	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
7. Ru/Rh-106	Gas (3)	0.00E+00	1.00E+00	0.00E+00	0.00E+00
8. Sb-125	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
9. I-129	Gas	0.00E+00	1.00E+00	0.00E+00	0.00E+00
10. Cs-134	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
11. Cs-137	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
12. Ce-144	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
13. Pm-147	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
14. Eu-154 (1)	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
15. Nat.U	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
16. Np-237	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
17. Pu-238	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
18. Pu-239/240	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
19. Pu-241	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
20. Am-241	Particulate	1.00E-04	1.00E-03	1.00E-07	7.79E-07
21. Cm-242/244	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00

Total Dose: 9.13E-07

Method Used to Project Dose: CAP88

COMMENTS

1. Sr-90 used as the beta emitter; dose factors were not included in the radionuclide library for this specific radionuclide.

2: Y-90 is assumed to be in secular equilibrium with Sr-90.

3: This is a conservative estimate.

STACK STATUS: DESIGNATED X NON-DESIGNATED

EVALUATOR [Signature] DATE 12/7/93

MANAGER, ENVIRONMENTAL [Signature] DATE 12-8-93

FACILITY MANAGER [Signature] DATE 12-8-93

QUALITY ASSURANCE [Signature] DATE 12/8/93

STACK ASSESSMENT FOR 40 CFR 61, SUBPART H
APPENDIX D SOURCE ASSESSMENT

FACILITY 244-TX DCRT DISCHARGE POINT Stack 296-T-18

FACILITY RADIOLOGICAL INVENTORY AT RISK

Radionuclide	Physical/ Chemical Form	Quantity (curies)	Release Factor	Potential Quantity Released (curies)	Projected Dose (mrem/yr)
1. C-14	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
2. Co-60	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
3. Se-79 (1)	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
4. Sr-89/90	Particulate	4.56E+03	1.00E-03	4.56E+00	1.19E-01
5. Y-90 (2)	Particulate	4.56E+03	1.00E-03	4.56E+00	1.01E-03
6. Tc-99	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
7. Ru/Rh-106	Gas (3)	0.00E+00	1.00E+00	0.00E+00	0.00E+00
8. Sb-125	Particulate	1.51E+02	1.00E-03	1.51E-01	3.73E-04
9. I-129	Gas	0.00E+00	1.00E+00	0.00E+00	0.00E+00
10. Cs-134	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
11. Cs-137	Particulate	3.84E+03	1.00E-03	3.84E+00	5.45E-02
12. Ce-144	Particulate	1.03E+02	1.00E-03	1.03E-01	8.38E-04
13. Pm-147	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
14. Eu-154 (1)	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
15. Nat.U	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
16. Np-237	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
17. Pu-238	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
18. Pu-239/240	Particulate	3.60E-02	1.00E-03	3.60E-05	1.85E-04
19. Pu-241	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
20. Am-241	Particulate	3.60E-02	1.00E-03	3.60E-05	2.80E-04
21. Cm-242/244	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00

Method Used to Project Dose: CAP88

Total Dose: 1.76E-01

Operational Dose (4): 1.76E-01

COMMENTS

1. Sr-90 used as the beta emitter; dose factors were not included in the radionuclide library for this specific radionuclide.

2: Y-90 is assumed to be in secular equilibrium with Sr-90.

3: This is a conservative estimate.

4: Incorporates volumetric and time factors based on projected usage.

5: This system is not currently transferring waste that would require a designated status for the stack.

STACK STATUS: DESIGNATED X NON-DESIGNATED (5)

EVALUATOR [Signature] DATE 12/7/93

MANAGER, ENVIRONMENTAL [Signature] DATE 12-8-93

FACILITY MANAGER [Signature] DATE 12-8-93

QUALITY ASSURANCE [Signature] DATE 12/8/93

WHC-SD-EN-RPT-007

STACK ASSESSMENT FOR 40 CFR 61, SUBPART H
APPENDIX D SOURCE ASSESSMENT

FACILITY 244-U DCRT DISCHARGE POINT Stack 296-U-11

FACILITY RADIOLOGICAL INVENTORY AT RISK

Radionuclide	Physical/ Chemical Form	Quantity (curies)	Release Factor	Potential Quantity Released (curies)	Projected Dose (mrem/yr)
1. C-14	Particulate	1.24E-02	1.00E-03	1.24E-05	2.05E-08
2. Co-60	Particulate	1.15E+02	1.00E-03	1.15E-01	1.98E-03
3. Se-79 (1)	Particulate	4.39E-04	1.00E-03	4.39E-07	1.14E-08
4. Sr-89/90	Particulate	3.45E+04	1.00E-03	3.45E+01	8.97E-01
5. Y-90 (2)	Particulate	3.45E+04	1.00E-03	3.45E+01	7.66E-03
6. Tc-99	Particulate	1.46E-02	1.00E-03	1.46E-05	9.42E-09
7. Ru/Rh-106	Gas (3)	9.70E-03	1.00E+00	9.70E-03	1.16E-04
8. Sb-125	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
9. I-129	Gas	2.53E-05	1.00E+00	2.53E-05	2.88E-06
10. Cs-134	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
11. Cs-137	Particulate	5.47E+04	1.00E-03	5.47E+01	7.77E-01
12. Ce-144	Particulate	1.15E-03	1.00E-03	1.15E-06	9.36E-09
13. Pm-147	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
14. Eu-154 (1)	Particulate	7.49E+02	1.00E-03	7.49E-01	1.95E-02
15. Nat.U	Particulate	1.46E+00	1.00E-03	1.46E-03	2.47E-03
16. Np-237	Particulate	9.30E-05	1.00E-03	9.30E-08	6.56E-07
17. Pu-238	Particulate	1.99E+00	1.00E-03	1.99E-03	9.47E-03
18. Pu-239/240	Particulate	3.02E+01	1.00E-03	3.02E-02	1.56E-01
19. Pu-241	Particulate	1.20E+01	1.00E-03	1.20E-02	9.80E-04
20. Am-241	Particulate	9.84E-04	1.00E-03	9.84E-07	7.67E-06
21. Cm-242/244	Particulate	1.37E-05	1.00E-03	1.37E-08	5.64E-08

Total Dose: 1.87E+00

Method Used to Project Dose: CAP88

Operational Dose (4): 3.70E-01

COMMENTS

1. Sr-90 used as the beta emitter; dose factors were not included in the radionuclide library for this specific radionuclide.

2: Y-90 is assumed to be in secular equilibrium with Sr-90.

3: This is a conservative estimate.

4: Incorporates volumetric and time factors based on projected usage.

5: This stack is not currently registered and is inactive. JLK 12/8/93

STACK STATUS: DESIGNATED X NON-DESIGNATED (5)EVALUATOR [Signature] DATE 12/7/93MANAGER, ENVIRONMENTAL [Signature] DATE 12-8-93FACILITY MANAGER [Signature] DATE 12-8-93QUALITY ASSURANCE [Signature] DATE 12/8/93

A5.0 GROUT

Grout has one registered stack, 296-G-1, which is not a designated stack.

STACK ASSESSMENT FOR
40 CFR 61, SUBPART H

NONDESTRUCTIVE ASSESSMENT [NDA]
(In Situ Gamma Spectroscopy)

FACILITY Grout DISCHARGE POINT 296-6-1
NUMBER OF HEPA FILTER BANKS (n) 2

Emission and Effective Dose Equivalent (CAP88) values reported in the Radionuclide Air Emissions Report for the Hanford Site, CY 1992.

Radionuclide	Unabated Potential (Curies)	EDE (mrem Ci ⁻¹ y ⁻¹)	Projected Dose (mrem y ⁻¹)
1. <u>Cs-137</u>	<u>3.48 · 10⁻⁷</u>	<u>0.0239</u>	<u>8.3 · 10⁻⁷</u>
2. <u>Co-60</u>	<u>8.60 · 10⁻⁷</u>	<u>0.0239</u>	<u>2.5 · 10⁻⁸</u>
3. <u>Mn-54</u>	<u>1.76 · 10⁻⁷</u>	<u>5.51 · 10⁻³</u>	<u>9.7 · 10⁻¹⁰</u>
4. _____	_____	_____	_____
5. _____	_____	_____	_____
6. _____	_____	_____	_____

Total Dose 3.4 · 10⁻⁸

COMMENTS

No alpha or beta reported.

EVALUATOR [Signature]
MANAGER, ENVIRONMENTAL [Signature]
~~FACILITY~~ MANAGER [Signature]

DATE 27 Nov 1993
DATE 11-29-93
DATE 11-30-93

A6.0 222-S LABORATORY

The 222-S Laboratory has two registered stacks: 296-S-16 and 296-S-21.
Neither of the stacks are designated.

STACK ASSESSMENT FOR
40 CFR 61, SUBPART HNONDESTRUCTIVE ASSESSMENT [NDA]
(In Situ Gamma Spectroscopy)

FACILITY 222 S Laboratory DISCHARGE POINT 296-S-16
 NUMBER OF HEPA FILTER BANKS (n) 1

Emission and Effective Dose Equivalent (CAP88) values reported in the
 Radionuclide Air Emissions Report for the Hanford Site, CY 1992.

Radionuclide	Unabated Potential (Curies)	EDE (mrem Ci ⁻¹ y ⁻¹)	Projected Dose (mrem y ⁻¹)
1. <u>Cs-137</u>	<u>$9.74 \cdot 10^{-6}$</u>	<u>0.0142</u>	<u>$1.38 \cdot 10^{-2}$</u>
2. <u>total (Sr-90)</u>	<u>$9.79 \cdot 10^{-6}$</u>	<u>0.026</u>	<u>$2.55 \cdot 10^{-2}$</u>
3. <u>total (Pu-239)</u>	<u>$3.14 \cdot 10^{-7}$</u>	<u>5.15</u>	<u>$1.62 \cdot 10^{-6}$</u>
4. _____	_____	_____	_____
5. _____	_____	_____	_____
6. _____	_____	_____	_____

Total Dose $2.02 \cdot 10^{-6}$

COMMENTS

EVALUATOR *Scott H. Smith*

DATE 23 Nov '93

MANAGER, ENVIRONMENTAL *J. Smith*

DATE 11-29-93

FACILITY MANAGER *D. A. Marshall*

DATE 12/2/93

A7.0 T PLANT

T Plant has two registered stacks: 291-T-1 and 296-T-13. Neither of the two stacks are designated. The 291-T-1 stack was originally a designated stack. However, a nondestructive assessment of the high-efficiency particulate air filters found that the stack was not a designated stack (formerly released as WHC-SD-WM-ER-292, Rev. 0). Data covering the nondestructive assessment of the stack follow.

STACK ASSESSMENT FOR
40 CFR 61, SUBPART H

NONDESTRUCTIVE ASSESSMENT [NDA]
(In Situ Gamma Spectroscopy)

FACILITY T Plant DISCHARGE POINT 291-T-1
NUMBER OF HEPA FILTER BANKS (n) 2

Emission and Effective Dose Equivalent (CAP88) values reported in the Radionuclide Air Emissions Report for the Hanford Site, CY 1992.

Radionuclide	Unabated Potential (Curies)	EDE (mrem Ci ⁻¹ y ⁻¹)	Projected Dose (mrem y ⁻¹)
1. <u>Cs-137</u>	<u>1.69 · 10⁻³</u>	<u>4.28 · 10⁻³</u>	<u>7.23 · 10⁻⁶</u>
2. <u>Sr-90</u>	<u>1.56 · 10⁻³</u>	<u>7.92 · 10⁻³</u>	<u>1.22 · 10⁻⁵</u>
3. <u>Pu-239/240</u>	<u>2.02 · 10⁻³</u>	<u>1.55</u>	<u>3.22 · 10⁻³</u>
4. <u>Am-241</u>	<u>1.8 · 10⁻⁴</u>	<u>2.35</u>	<u>4.47 · 10⁻⁴</u>
5. _____	_____	_____	_____
6. _____	_____	_____	_____

Total Dose 3.69 · 10⁻³

COMMENTS

~~This value is 3.25 times less than the value reported in our 22 May 1993, Rev 0. It is less because the report reflects the low EDE values rather than the current 89 stack height EDE values and above. EDE values obtained from our 50 0499. A correction to our 50 0499-192 will be made to reflect the lower value. This stack remains below the 0.1 mrem y⁻¹ EDE threshold value for regular monitoring.~~

WHR
6 Dec. '93

EVALUATOR J. A. Bennett

DATE 2 Dec. '93

MANAGER, ENVIRONMENTAL [Signature]

DATE 12-2-93

FACILITY MANAGER [Signature]

DATE 12/2/93

STACK ASSESSMENT FOR
40 CFR 61, SUBPART H

NONDESTRUCTIVE ASSESSMENT [NDA]
(In Situ Gamma Spectroscopy)

FACILITY T Plant DISCHARGE POINT 296-T-13
NUMBER OF HEPA FILTER BANKS (n) 2

Emission and Effective Dose Equivalent (CAP88) values reported in the Radionuclide Air Emissions Report for the Hanford Site, CY 1992.

Radionuclide	Unabated Potential (Curies)	EDE (mrem $\text{Ci}^{-1} \text{y}^{-1}$)	Projected Dose (mrem y^{-1})
1. <u>Cs-137</u>	<u>$1.35 \cdot 10^{-4}$</u>	<u>$4.29 \cdot 10^{-3}$</u>	<u>$5.79 \cdot 10^{-7}$</u>
2. <u>Sr-90</u>	<u>$1.25 \cdot 10^{-4}$</u>	<u>$7.92 \cdot 10^{-3}$</u>	<u>$9.79 \cdot 10^{-7}$</u>
3. <u>Pu-239/240</u>	<u>$1.66 \cdot 10^{-4}$</u>	<u>1.55</u>	<u>$2.57 \cdot 10^{-4}$</u>
4. <u>Am-241</u>	<u>$1.5 \cdot 10^{-5}$</u>	<u>2.35</u>	<u>$3.53 \cdot 10^{-5}$</u>
5. _____	_____	_____	_____
6. _____	_____	_____	_____

Total Dose $2.94 \cdot 10^{-4}$

COMMENTS

Dose assessment based on 89% of the 291-T-1 NDA
unabated potential as reported in WHC-SD-WM-ER-292,
Rev. 0. EDE values are for an 89 m height as per
WHC-EP-0498 pages 1 and A3-14.

EVALUATOR [Signature]
MANAGER, ENVIRONMENTAL [Signature]
FACILITY MANAGER [Signature]

DATE 2 Dec. '93

DATE 12-2-93

DATE 12/2/93

EXECUTIVE SUMMARY

This report presents the results of the nondestructive assessment study conducted on the 291-T-1 Exhaust Stack, as required by Westinghouse Hanford Company Compliance Plan, 93010990B, submitted April 9, 1993.¹ In particular, the spent high-efficiency particulate air filters from the 291-T-1 Exhaust Stack, bank #3 were assessed using portable gamma spectroscopy. The results indicate that the 291-T-1 Exhaust Stack does not require continuous monitoring according to the "National Emission Standards for Hazardous Air Pollutants," Title 40, *Code of Federal Regulations*, Part 61, Subpart H.²

T Plant is petitioning to redesignate the 291-T-1 Exhaust Stack from an emission source requiring continuous monitoring to an emission source requiring only periodic confirmatory monitoring, in accordance with 40 CFR 61.93(4)(i). The implications of this redesignation are as follow:

- The nondestructive assessment study on the backup exhaust system, (296-T-13 Exhaust Stack), scheduled for November 1993, is not required.

¹Diediker, L. P., 1993, *Compliance Plan Prepared in Response to Compliance Order and Information Request EPA Docket Number: 1093-01-23-113/114*, (internal letter No. 9301990B R1 to J. D. Bauer, RL, April 9), Westinghouse Hanford Company, Richland, Washington.

²40 CFR 61, "National Emission Standards for Hazardous Air Pollutants," *Code of Federal Regulations*, Subpart H, National Emission Standards for Emissions of Radionuclides Other than Radon from Department of Energy Facilities, as amended.

- Compliance with National Emission Standards for Hazardous Air Pollutants and American National Standards Institute standards for sample probe location and design is not required for the 291-T-1 Exhaust Stack. Therefore, the proposed resolutions of *The 291-T-1 NESHAPS Compliance Plan Report*³ no longer apply. It is recommended that *The 291-T-1 NESHAPS Compliance Plan Report* be nullified.

³WHC, 1993, *The 291-T-1 NESHAPS Compliance Plan Report*, WHC-SD-WM-ER-218, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

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LIST OF TERMS

CAM	continuous air monitor
EDE	effective dose equivalent
EPA	U.S. Environmental Protection Agency
HEPA	high-efficiency particulate air
MDA	minimum detectable activity
MEI	maximally exposed individual
NDA	nondestructive assessment
NIST	National Institute of Standards and Technology
ROI	region of interest
WHC	Westinghouse Hanford Company

THE 291-T-1 EXHAUST STACK PETITION FOR REDESIGNATION OF STATUS

1.0 INTRODUCTION

The T Plant canyon exhaust system draws air under negative pressure from the 221-T "canyon" building through high-efficiency particulate air (HEPA) filters before releasing it to the atmosphere. The filtered air is released to the atmosphere either through the main stack, 291-T-1, or the backup stack, 296-T-13 (Figure 1). In both cases the effluent is monitored by a fixed continuous monitoring system that draws a representative sample from the gas stream in the stack through a sampling probe. The monitoring system at the 291-T-1 Stack consists of an alpha continuous air monitor (CAM), a beta-gamma CAM, and a record sampler; the monitoring system at the 296-T-13 Stack consists of a beta-gamma CAM and a record sampler.

The 291-T-1 Exhaust Stack is the primary exhaust system for the 221-T canyon building. The backup system, 296-T-13 Stack, is operated during those times when the maintenance is required on the 291-T-1 Stack. Operating records for the past year show that the 291-T-1 Stack operated 92% of the time, while the 296-T-13 Stack operated 8% of the time.

In the main exhaust system, the air is drawn through cells (Figure 2) located in the canyon floor into the main canyon duct running the length of the facility. This vent duct exits at the north end of the facility. Headers from the main duct route the air to four individual HEPA filter banks. Each filter bank consists of a prefilter and two series 3 by 3 arrays of nine 2- by 2-ft HEPA filters. Air exiting the filter banks is collected in a common plenum and exhausted through the 291-T-1 Stack. Two fans, in a series configuration located downstream of the plenum, provide the ventilation for the main exhaust system.

In the backup exhaust system the air is drawn through a duct located in the canyon roof (see Figure 2) and passes through a filter building before being discharged to the atmosphere through the 296-T-13 Stack. The filter building contains three arrays of filters in series. The first array consists of 2- by 2-ft by 2-in. dust top prefilters. The next two arrays consist of 2- by 2-ft by 11.5-in. HEPA filters. Each of the arrays contains 57 filters (3 rows of 19 filters). A fan located downstream of the HEPA filter bank provides the ventilation for the backup exhaust system.

Estimates of prefiltered emissions were calculated on both the 291-T-1 and 296-T-13 Stacks using a factor of 3,000 times the 1989 annual emissions (WHC 1992). The 3,000 factor, based on the rated filter efficiency, represents the decontamination factor for the HEPA filters. The results indicated that the 291-T-1 Stack had the potential to emit greater than 0.1 mrem y^{-1} and was classified as a designated emissions source, subject to the continuous monitoring requirements of 40 CFR 61, Subpart H. However, the 296-T-13 Stack was classified as an emissions source not subject to the continuous monitoring requirements. The Westinghouse Hanford Company (WHC) Compliance Plan (Diediker 1993) proposed that nondestructive assessment (NDA)

Figure 1. Schematic of 221-T Emissions System.

Figure 2. 221-T Canyon Ventilation Flow Diagram.

29310037.2

be performed on both of the exhaust stacks to verify their source designations. Additional proposed actions for the 291-T-1 Stack included conducting a line loss study and submitting a study report to determine actions required to achieve compliance with the 40 CFR 61 standards. EPA has subsequently determined that line loss studies are not required. However, the line loss study is still scheduled to start in spring 1993. The 291-T-1 *NESHAPS Compliance Plan Report* (WHC 1993b) was submitted on September 30, 1993.

In September 1992, the U.S. Environmental Protection Agency (EPA), Region 10, initiated a proposal for a test method to measure radioactive particulate emissions (particularly gamma emitters) from HEPA filters in stack exhaust systems across the Hanford Site. NDA was developed using portable low-resolution gamma spectroscopy instrumentation as an in situ method to evaluate gamma emissions from HEPA filters. Guidance for the developed method comes from 40 CFR 61, Subpart H, and 40 CFR 61, Appendix B, Method 114, Test Methods for Measuring Radionuclide Emissions from Stationary Sources.

In May 1993, the NDA method was tested at the B Plant 296-B-13 Stack HEPA filters. The results indicated the NDA method would work, and the method was formally presented to the EPA, Region 10, on June 10, 1993. After receiving EPA verbal approval at the June 10, 1993 meeting, NDA implementation began at the Hanford Site as an alternative method to the source term and back calculation methodologies.

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2.0 DESCRIPTION OF NONDESTRUCTIVE ASSESSMENT TESTING

On September 17, 1993 the HEPA filters from T Plant 291-T-1 filter bank #3 were replaced. This work was conducted under Work Plan, WP-T-025, *291-T Filter Change-out* (Belcher 1993). As the old filters were removed, they were double-bagged and placed in cardboard packing boxes from the new filters. T Plant Health Physics personnel measured the dose rate of the boxed filters using a μ R meter. The filters were then tested in accordance with WHC-SD-ER-TP-011, Rev. 0 (WHC 1993a). Data were collected and spectra were saved using the Microspec-1,¹ a portable gamma spectrometer. The detector was fitted with a lead shield and collimator. The instrument was calibrated, under controlled conditions, to the in-field HEPA filter geometry. A background spectrum was collected at the test site. All 18 HEPA filters from bank #3 of the 291-T-1 Stack were measured for gamma radiation during the changeout. Conducting the NDA on the individual HEPA filters resulted in a simpler geometry and more accurate measurements.

2.1 INSTRUMENT CALIBRATION

Two peaks are required to complete an energy calibration for the Microspec-1. Sodium-22 is preferred for an energy calibration because it has both a low-energy (511-keV) and a high-energy (1,275-keV) gamma emission. Using a standard 2- by 2-ft by 11.5-in. HEPA filter, a National Institute of Standards and Technology (NIST) traceable ^{22}Na check source was placed in its center. The detector head, with collimated shield, was then placed up against the bagged and boxed HEPA filter at the center of a 2-ft by 11.5-in. side. The ^{22}Na spectrum was collected over a 5-minute interval.

The instrument was then calibrated according to the manufacturer's specifications. Because ^{137}Cs was expected to be the only gamma emitter from the HEPA filters, a NIST traceable ^{137}Cs check source was placed in the center of the HEPA filter, and the region of interest (ROI) for ^{137}Cs was established. The efficiency for the ^{137}Cs ROI was also determined for this geometry.

2.2 DATA COLLECTION

Sampling of the spent HEPA filters took place about 30 m north of the 291-T-1 banks. Before any filters were brought to the location, a background spectrum was collected and saved. This background measurement was used to determine the minimum detectable activity (MDA).

The sampling point for the HEPA filters was the same as for the calibration geometry. That is, the detector head, with collimated shield, was placed flush against the boxed HEPA filter of interest at the center of a 2-ft by 11.5-in. side. Spectra were collected from three of the four available sides (no variability in the measurements were noticed by doing

¹Microspec-1 is a trademark of Bubble Technology Industries, Inc., Chalk River, Ontario, Canada.

this). For each spectrum collected, data included: the sample filename, sample collection time, ROI, gross and net counts in ROI, energy (in keV) of the ROI, and percent dead time. Spectra were saved to a disk for future reference. For spent filters that had no measurable activity above background, typically only one spectrum was collected and saved.

Measurements of gross gamma activity were made at the marked locations on the filter housing of the third bank before removing the HEPA filters. Additionally, measurements were made at the marked locations of the filter housing of the other three banks and the prefilters. The location and designation for each of these measurements is shown in Figure 3. These measurements were used to determine the appropriate ratios for calculating the total stack activity.

Figure 3. Exhaust System and Measurement Locations.

Where:

R_i = gross counts in region of interest for the bank

r_i = gross counts in region of interest for the prefilters

Both R_i and r_i are corrected for dead time

A-261

29310037.12

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3.0 RESULTS OF NONDESTRUCTIVE ASSESSMENT TESTING

3.1 INSTRUMENT EFFICIENCY

The ROI for ^{137}Cs , with gamma emission of 662 keV, was determined to be between channels 62 and 72. The ROI-calibrated peak energy was 660.8 keV. The intrinsic efficiency of measurement was determined to be about 11% ($\pm 28\%$). The absolute efficiency is determined by equation (1); it differs from the intrinsic efficiency by a constant (Knoll 1989).

$$\eta = \frac{\text{cpm}}{\text{dpm}} \times 100 = \frac{\left[\frac{\text{counts}}{t(1-DT)} \right]_{\text{source}} - \left[\frac{\text{counts}}{t(1-DT)} \right]_{\text{background}}}{A_0 e^{-\lambda \Delta t}} \times 100 = \% \quad (1)$$

where:

- η = absolute efficiency in percent
- cpm = counts per minute
- dpm = disintegrations per minute
- counts = gross counts in region of interest
- t = count time of source, background, or sample (min)
- DT = instrument dead time (decimal)
- A_0 = initial check source activity (dpm)
- λ = decay constant of check source (y^{-1})
- Δt = time elapsed from check source birth to time of use (y).

3.2 MINIMUM DETECTABLE ACTIVITY

The background counts in the ROI were on the order of 200 counts per minute. Using equation (2) the MDA was calculated to be about 100 nCi at the 99% confidence interval (Altshuler and Pasternack 1963).

$$\text{MDA} = \frac{4.66 \sqrt{\left[\frac{\text{counts}}{t^2(1-DT)} \right]_{\text{background}}}}{2.22\eta} = \text{pCi} \quad (2)$$

where:

- 4.66 = the value used to determine the instrument reading with a difference from background that is large enough to be statistically significant at the 99% confidence level
- 2.22 = the conversion from counts per minute to picocuries.

3.3 CALCULATION OF CESIUM-137 ACTIVITY (BANK #3 HEPA FILTERS)

The activity $A_{i\text{HEPA}}$ for each of the 18 HEPA filters from bank #3 was calculated by using equation (3).

$$A_{i\text{HEPA}} = \frac{\left[\frac{\text{counts}}{t(1-DT)} \right]_{i\text{HEPA}} - \left[\frac{\text{counts}}{t(1-DT)} \right]_{\text{background}}}{2.22\eta e^{-\lambda t_{i\text{HEPA}}}} = \text{pCi} \quad (3)$$

where:

$A_{i\text{HEPA}}$ = activity of i th HEPA filter (pCi)
 $t_{i\text{HEPA}}$ = time elapsed from HEPA filter installation to measurement date (y).

The composite activity for bank #3 was determined by summing the activities of the individual HEPA filters according to equation (4). Where the activity of an individual HEPA filter was below the MDA, the MDA value was used to calculate the composite activity.

$$A_{\text{Bank3}} = \sum_{i=1}^{18} A_{i\text{HEPA}} = \text{pCi} \quad (4)$$

where:

A_{Bank3} = composite activity for the two stages of HEPA filters in filter bank #3.

The annualized activity for each of the filters was calculated by dividing the total activity by the length of service for the HEPA filters. Filter banks 1, 2, and 4 have been fully operational since their installation (length of service = 2.55 y). Filter bank #3 was removed from service on June 30, 1993 because of an aerosol challenge failure, and remained offline until the filter changeout (length of service = 2.33 y). The 291-T-1 Stack normally operates 92% of the time. Therefore, the actual service time for filter bank #3 was 2.14 y (2.33 x 0.92). The annualized activity for each of the 18 HEPA filters ($A_{i\text{HEPA}(a)}$) is equal to the filter activity divided by 2.14 y. A summary of the raw data and calculated and annualized activities for each of the individual HEPA filters is presented in Table 1.

The measured ^{137}Cs activity from the 18 spent HEPA filters in bank #3 is calculated to be $3.56 \pm 28\% \mu\text{Ci}$. The annualized activity for HEPA filter bank #3 is $1.66 \pm 28\% \mu\text{Ci y}^{-1}$. This annualized activity is then used as a basis to determine the total 291-T-1 Stack activity, which includes all four HEPA filter banks and their respective prefilters.

Table 1. Summary of Results from Nondestructive Assessment for Filter Bank #3 High-Efficiency Particulate Air Filters. (3 sheets)

HEPA Filter	Run	Dead time (%)	ROI Gross counts	Total activity (pCi)	Annualized activity (pCi y ⁻¹)
1-1	1	4.6	831	298,995	139,717
	2	6.0	999	521,164	243,534
	3	7.0	1006	543,131	253,799
	Avg	N/A	N/A	454,430	212,350
1-2	1	7.5	865	373,244	174,413
	2	6.5	983	507,918	237,345
	3	4.9	848	322,897	150,887
	Avg	N/A	N/A	401,353	187,548
1-3	1	4.2	648	733,91	34,295
	2	4.7	739	188,171	87,930
	3	4.3	646	71,788	33,546
	Avg	N/A	N/A	111,116	51,923
1-4	1	4.2	965	456,889	213,499
	2	4.6	1115	644,010	300,939
	3	4.1	915	152,335	71,185
	Avg	N/A	N/A	417,745	195,207
1-5	1	5.3	714	163,269	76,294
	2	4.4	852	322,341	150,627
	3	4.9	795	258,307	120,704
	Avg	N/A	N/A	247,972	115,875

Table 1. Summary of Results from Nondestructive Assessment for Filter Bank #3 High-Efficiency Particulate Air Filters. (3 sheets)

HEPA Filter	Run	Dead time (%)	ROI Gross counts	Total activity (pCi)	Annualized activity (pCi y ⁻¹)
1-6	1	4.2	850	317,765	148,488
	2	4.1	811	269,561	125,963
	3	4.5	667	98,912	46,220
	Avg	N/A	N/A	228,746	106,891
1-7	1	4.1	848	314,276	146,858
	2	3.3	970	452,016	211,222
	3	1.8	924	379,968	177,555
	Avg	N/A	N/A	382,087	178,545
1-8	1	4.8	690	129,463	60,497
	2	5.8	844	327,849	153,200
	3	4.2	763	212,515	99,306
	Avg	N/A	N/A	223,276	104,334
1-9	1	5.6	809	282,679	132,093
	2	1.2	771	193,871	90,594
	3	6.6	698	155,578	72,700
	Avg	N/A	N/A	210,709	98,462
2-1	1	7.2	461	<97,657	45,634
	2	2.7	487	<97,657	45,634
	3	3.4	486	<97,657	45,634
	Avg	N/A	N/A	<97,657	45,634

Table 1. Summary of Results from Nondestructive Assessment for Filter Bank #3 High-Efficiency Particulate Air Filters. (3 sheets)

HEPA Filter	Run	Dead time (%)	ROI Gross counts	Total activity (pCi)	Annualized activity (pCi y ⁻¹)
2-2	1	7.2	490	<97,657	45,634
2-3	1	5.2	467	<97,657	45,634
2-4	1	1.8	524	<97,657	45,634
	2	2.0	475	<97,657	45,634
	Avg	N/A	N/A	<97,657	45,634
2-5	1	1.8	519	<97,657	45,634
2-6	1	6.1	475	<97,657	45,634
2-7	1	5.0	482	<97,657	45,634
2-8	1	4.5	489	<97,657	45,634
2-9	1	2.3	486	<97,657	45,634
All filters	Sum	N/A	N/A	3,556,347	1,661,841

N/A = not applicable.

3.4 CALCULATION OF CESIUM-137 ACTIVITY (ALL FOUR HEPA FILTER BANKS)

To account for the ¹³⁷Cs activity on the other HEPA filter banks, the gross activity measurements (R_i) collected at the marked locations at each of the filter bank housings were used (see Figure 3). The gross counts were converted to corrected counts to account for the dead time using equation (5). Because the measurement locations at banks #2 and #3 were so close together, the contribution from each filter could not be separated. To determine the

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$$R_{i(c)} = \frac{R_{i(g)}}{1 - DT} \quad (5)$$

where:

$R_{i(c)}$ = corrected counts
 $R_{i(g)}$ = gross counts.

separate contribution of each of the HEPA filter banks, the corrected counts were divided by two.

To determine the annualized activity of each of the HEPA filter banks the corrected counts were ratioed to that of bank #3 and multiplied by the annualized activity for bank #3 as shown in equation (6).

(6)

$$A_{Bank i(a)} = \frac{R_{i(c)}}{R_{3(c)}} A_{Bank 3(a)} = pCi \ y^{-1}$$

where:

$A_{Bank i(a)}$ = annualized activity for the i th filter bank

i = filter banks #1, #2, and #4.

A summary of the raw data, corrected counts, and the calculated annualized activities for each of the individual prefilters is presented in Table 2. The annualized ^{137}Cs activity for all the HEPA filters in all four banks is equal to $7.3 \pm 29\% \ \mu\text{Ci} \ y^{-1}$.

3.5 CALCULATION OF CESIUM-137 ACTIVITY (PREFILTERS)

To account for the ^{137}Cs activity on the prefilter banks, the gross activity measurements collected at the marked locations at each of the HEPA filter banks (R_i) and prefilter (r_i) housings were used (see Figure 3). Corrected counts were calculated as for the HEPA filters. To determine the annualized activity of each of the prefilter banks the corrected counts were ratioed to that of the respective HEPA filter bank and multiplied by the annualized activity of filter bank #3 as shown in equation (7).

$$A_{PF(i)} = \frac{r_{i(c)}}{R_{i(c)}} A_{Bank(i)} = pCi \ y^{-1} \quad (7)$$

where:

$A_{PF(i)}$ = annualized activity for the i th prefilter
 i = prefilters #1, #2, #3, and #4.

Table 2. Summary of Results for Cesium-137 Activity on High-Efficiency Particulate Air Filter Banks.

Bank number	$R_{i(g)}$ Gross counts	Dead time (%)	$R_{i(c)}$ Corrected counts	$R_{i(c)}/R_{3(c)}$	Annualized activity ($\mu\text{Ci y}^{-1}$)
1	6,482	14.1	7,546	1.2	1.99
2	12,251	17.7	7,443	1.2	1.99
3	11,191	10.4	6,245	1.0	1.66
4	5,661	11.9	6,426	1.0	1.66
Sum	N/A	N/A	N/A	N/A	7.30

N/A = not applicable.

A summary of the raw data, corrected counts, and the calculated annualized activities for each of the individual prefilters is presented in Table 3. The annualized ^{137}Cs activity for the prefilters in all four banks is equal to $1.17 \pm 31\% \text{ mCi y}^{-1}$.

Table 3. Summary of Results of Cesium-137 Activity on Prefilters.

Prefilter number	$r_{i(g)}$ Gross counts	Dead time (%)	$r_{i(c)}$ Corrected counts	$r_{i(c)}/r_{3(c)}$	Annualized activity ($\mu\text{Ci y}^{-1}$)
1	80,156	91.7	965,730	128	255
2	82,911	94.3	1,454,600	195	388
3	74,442	92.7	1,033,500	165	274
4	83,296	91.3	957,430	149	247
All	N/A	N/A	N/A	N/A	1,164

N/A = not applicable.

3.6 CALCULATION OF CESIUM-137 ACTIVITY (HEPA AND PREFILTERS)

The ^{137}Cs annualized activity, $A_{\text{Cs-137 NDA}}$, as measured by this NDA method, for the 291-T-1 Stack is the sum of the activities for the HEPA filters and the prefilters in each of the four filter banks [equation (8)]. This value is equal to $1.18 \pm 31\% \text{ mCi y}^{-1}$ ($0.0073 + 1.17$).

$$A_{\text{Cs-137 NDA}} = \sum A_{\text{Bank}(i)} + \sum A_{\text{PF}(i)} = \text{mCi y}^{-1} \quad (8)$$

where:

$A_{\text{Cs-137 NDA}}$ = ^{137}Cs activity for all four filter banks (HEPA and prefilters).

3.7 CALCULATION OF POTENTIAL UNABATED RELEASE FOR 291-T-1 STACK

The NDA spectra showed no indication of ^{241}Am or beta contamination. However, the Radionuclide Air Emissions Reports for Calendar Years 1991 and 1992 (DOE/RL 1992; DOE/RL 1993) show both beta and alpha emissions. The 1991 report presented values for ^{241}Am , $^{239,240}\text{Pu}$, and total beta. The 1992 report presented values for ^{241}Am , $^{239,240}\text{Pu}$, ^{137}Cs , and ^{90}Sr . Therefore, an estimate of the amounts of these isotopes captured on the HEPA and prefilters is included in the calculation of the potential unabated release from the 291-T-1 Stack.

The contribution of these additional isotopes (^{90}Sr , ^{241}Am , $^{239,240}\text{Pu}$) is calculated using the ratios of the emitted value of the isotopes to the emitted value of ^{137}Cs . To obtain the estimated values of ^{90}Sr , ^{241}Am , and $^{239,240}\text{Pu}$ captured by the canyon filtration system, these ratios are multiplied by the ^{137}Cs activity calculated in this NDA study. This is expressed in equation (9).

$$A_{i\text{NDA}} = \frac{A_{i\text{emitted}}}{A_{\text{Cs-137 emitted}}} A_{\text{Cs-137 NDA}} = \text{mCi y}^{-1} \quad (9)$$

where:

$A_{i\text{NDA}}$ = isotope contribution estimated from NDA study
 $A_{i\text{emitted}}$ = reported value from DOE/RL 1992; DOE/RL 1993
 i = ^{90}Sr , ^{241}Am , $^{239,240}\text{Pu}$.

The potential unabated release for each of the four isotopes is equal to the sum of the activities calculated using the NDA method and the reported emissions. This is expressed in equation (10) below.

$$A_i = A_{i\text{NDA}} + A_{i\text{emitted}} = \text{mCi y}^{-1} \quad (10)$$

The total unabated potential emitted activity may now be expressed as the sum of the activities of the four isotopes, equation (11).

$$A_{291-T-1} = A_{Cs-137} + A_{Sr-90} + A_{Pu-239/240} + A_{Am-241} = mCi \ y^{-1} \quad (11)$$

A summary of the results from the calculation of the radioisotope emissions from the 291-T-1 Stack is presented in Table 4. The reported emissions for 1991 and 1992 are presented. Because the total reported emissions from 1991 is 16 times greater than 1992, an average value was used to determine the emitted isotope ratios. This is consistent with the annualized approach in the previous calculations, and represents the measured emissions during the operation of the filter banks. The emitted values for ^{241}Am and $^{239,240}Pu$ represent the averages from 1991 and 1992. Because ^{90}Sr was not measured in 1991, the emitted value for ^{90}Sr is the average for the 1992 ^{90}Sr value and the 1991 total beta value. Because ^{137}Cs was not measured in 1991, the 1991 value is estimated from the 1991 total beta value and the 1992 ratio of ^{137}Cs to ^{90}Sr . Because the 1992 report presents the only completed data set, the isotopic ratios are calculated from the 1992 data. Based upon this approach, the total unabated potential annual curies released from the 291-T-1 Exhaust Stack is estimated to be $5.52 \pm 31\%$ mCi y^{-1} .

Table 4. Summary of Results for Radioisotopes from the 291-T-1 Exhaust Stack.

Isotope	Emitted (mCi y^{-1})			Ratio to emitted Cs-137 ^c	Estimated filter activity (mCi y^{-1})	Total potential activity (mCi y^{-1})
	1991	1992	Avg			
Cs-137	1.0 ^a	0.013	0.51	1	1.18	1.69
Sr-90	0.93 ^b	0.012	0.471	0.923	1.09	1.56
Pu-239/240	0.13	0.022	0.076	1.69	2.0	2.08
Am-241	0.013	0.002	0.0075	0.154	0.182	0.19
Sum	2.07	0.049	1.07	N/A	4.45	5.52

N/A = not applicable

^aEstimated from the 1991 total beta value and the 1992 ratio of ^{137}Cs to ^{90}Sr

^b1991 total beta value

^cDerived from the 1992 isotopic ratios.

3.8 CALCULATION OF OFFSITE EFFECTIVE DOSE EQUIVALENTS

The Hanford Site employs the CAP-88 dose model (Beres 1990; WHC 1991) to demonstrate compliance with 40 CFR 61.92. This model calculates a unit dose factor for each radionuclide discharged from the Hanford Site to predict an effective dose equivalent (EDE) for the maximally exposed individual (MEI) offsite. This theoretical MEI is located at a residence in Ringold, Washington. The EDE is multiplied by the activity of each isotope to produce the theoretical dose to the MEI (equation 12).

$$\dot{H}_{total} = \sum (EDE_{(i)} \times A_{(i)}) = \text{mrem y}^{-1} \quad (12)$$

where:

$\dot{H}$ = potential unabated dose to the MEI
 $EDE_{(i)}$ = effective dose equivalent for each radionuclide

To determine the annualized EDE for the potential unabated emissions from the 291-T-1 Stack the EDEs from the 200 West Area (WHC 1991) were multiplied by the isotope activities calculated in the previous section. Table 5 presents a summary of these calculations. Based upon this approach, the total annual unabated potential emissions and annualized EDE released to the MEI from the 291-T-1 Exhaust Stack is estimated to be $1.2 \times 10^{-2} \pm 31\% \text{ mrem y}^{-1}$.

Table 5. Summary of Results for Effective Dose Rate for the 291-T-1 Exhaust Stack.

Isotope	EDE (mrem Ci ⁻¹ y ⁻¹)	Activity, A _i (Ci)	$\dot{H}$ (mrem y ⁻¹)
Cs-137	1.42×10^{-2}	1.69×10^{-3}	2.4×10^{-5}
Sr-90	2.6×10^{-2}	1.56×10^{-3}	4.1×10^{-5}
Pu-239/240	5.15	2.08×10^{-3}	1.1×10^{-2}
Am-241	7.79	1.9×10^{-4}	1.5×10^{-3}
Sum	N/A	5.52×10^{-3}	1.2×10^{-2}

EDE = effective dose equivalent

$\dot{H}$ = potential unabated dose to the maximally exposed individual

N/A = not applicable.

4.0 DISCUSSION

The NDA methodology uses the Microspec-1, a portable gamma spectrometer, to obtain direct gamma radiation readings from HEPA filters. Microspec-1 can also detect the presence of beta emitters and specific isotope peaks, such as ^{241}Am . The concentration of alpha- and beta-emitting radioisotopes are estimated from the ratios of isotopes detected in stack emissions. At T Plant 18 HEPA filters were measured as they were removed from filter bank #3. By coordinating the NDA testing with this scheduled filter changeout, direct readings were obtained from the filters, resulting in a simplified measurement geometry and more accurate measurements were obtained.

In calculating the annualized potential unabated dose to the MEI, assumptions were made throughout. The assumptions used and the effect on the calculations are discussed below.

1. All HEPA filters in the second stage of filter bank #3 had gamma activities less than the MDA. In estimating the ^{137}Cs activity, these nine filters were assigned a value equal to the MDA ($= 0.45 \mu\text{Ci y}^{-1}$). The sum of these activities represent 25% of the total activity of filter bank #3.
2. The calculated ^{137}Cs activity for HEPA filters in bank #3 is the basis for all subsequent calculations. Thus, from assumption 1 above, all subsequent calculations contain as much as a 25% built-in level of conservatism.
3. The measured gamma activity for filter bank #3 HEPAs is decay corrected to the HEPA filter installation date. This assumes that all of the detected activity was placed on the filters at the time of installation, rather than being deposited over time. At a half-life of 30 y for ^{137}Cs , this results in a slight overestimation of the total filter activity.
4. The prefilter contribution is derived from empirical data, rather than using the rated decontamination factors. Using the manufacturers' rated prefilter efficiency results in multiplying the total bank activities by 20. Field measurements indicate that the prefilters are more efficient than predicted by the manufacturers' specifications, with decontamination factors of 128 to 195. The use of measured decontamination factors provides a more realistic estimate of operating conditions, and results in a higher multiplication factor. It is less, however, than using a single-stage HEPA filtration decontamination factor of 3,000. It should be noted that if this ultra conservative factor of 3,000 is used, the the total offsite dose to the MEI is still less than the EPA threshold.
5. No alpha or beta radiation was detected on the individual HEPA filters. However, estimates were calculated for alpha and beta activity on the HEPA and prefilters based on known values of ^{137}Cs activity. From these estimates 69% of the activity of the HEPA filters was attributed to alpha and beta emitters. A more realistic

representation of the potential emissions would be to use only the ¹³⁷Cs values calculated from the NDA study, and the reported stack emissions to calculate the potential unabated dose.

The operations in the T Plant canyon during the past 3 y consisted of management and cleanup of legacy waste, and transfer of liquid wastes to railcar for storage in the Hanford Site Tank Farms. Most of the wastes in the canyon are low level and are free of alpha activity. Current data from routine canyon workplace air sampling show no ^{239/240}Pu alpha activity. Samples are collected on filters using a high-volume, grab sampler (minimum volume = 100 ft³) during canyon occupancy. To account for the presence of radon/thoron daughters, the samples are allowed to decay for 36 hours before measurement. The filters are then analyzed using a 5-minute counting interval for alpha and beta/gamma radiation. Alpha radiation is measured using a Ludlum,¹ Model 1000 mini-scaler; beta-gamma radiation is measured using a Ludlum, Model 2000 mini-scaler. The results indicate no detectable alpha radiation and an average of 50 to 100 cpm beta/gamma radiation.

It is likely that the small quantities of reported alpha and beta emissions from the 291-T-1 Stack are due to the release of residual contamination (⁹⁰Sr, ^{239/240}Pu, ²⁴¹Am) in the stack and ducting downstream of the filter banks. This contamination was deposited in the exhaust system when T Plant operated as a chemical processing plant (1945 to 1956), and actively functioned as a high-level decontamination facility (1957 to 1990).

The designation of the 291-T-1 Stack as an emissions source subject to the continuous monitoring requirements, based on the back calculation method, is inappropriate because it does not distinguish between the current emissions and residual contamination downstream of the filtering system. The results of both the NDA and routine canyon monitoring indicate little or no activity in the prefiltered exhaust from these contaminants. The estimation of alpha and beta activity on the HEPA filters and the prefilters, based on the NDA results, also assumes the presence of these contaminants in the T Plant prefiltered exhaust. Still, the conservative inclusion of HEPA and prefilter alpha and beta activity in the calculation of the offsite dose to the MEI results in a value of $1.2 \times 10^{-2} \pm 31\%$ mrem y⁻¹. If only the measured activity from the NDA study and the reported emissions are used, the offsite dose to the MEI is reduced to $1.5 \times 10^{-6} \pm 31\%$ mrem y⁻¹, which is approximately 670 times less than the EPA threshold.

¹Ludlum Models 1000 and 2000 are trademarks of Ludlum Measurement, Inc., Sweetwater, Texas.

5.0 CONCLUSIONS AND RECOMMENDATIONS

The data collected from the measurement of the 18 HEPA filters from the third bank of the 291-T-1 Stack indicate that only a small amount of ^{137}Cs exists on these filters. There was no indication of beta contamination on the filters that would result in a beta smear on the spectra collected. Additionally, no alpha (specifically ^{241}Am) contamination was seen in the spectra collected. However, as a means of conservatism, beta and alpha components were added to the total potential unabated emissions in determining the offsite dose to the MEI. Even with this conservative assumption, the MEI dose of $1.2 \times 10^{-2} \pm 31\% \text{ mrem y}^{-1}$ is below the EPA threshold of 0.1 mrem y^{-1} [40 CFR 61.93(4)(i)].

Based on the results of the NDA study of the HEPA filters the following items are recommended with regard to 40 CFR 61 compliance at T Plant.

- The 291-T-1 Exhaust Stack should be reclassified as a stack not subject to the continuous monitoring requirements per 40 CFR 61.93(4)(i).
- Based on the results of the 291-T-1 Stack NDA study, the 296-T-13 should also be classified as a stack not subject to the continuous monitoring requirements. The 296-T-13 Stack exhausts the same air as the 291-T-1 Stack and operates only 8% of the time.
- The proposed resolutions of *The 291-T-1 NESHAPS Compliance Plan Report* (WHC 1993b) no longer apply. It is recommended that *The 291-T-1 NESHAPS Compliance Plan Report* be nullified.
- The line loss study is no longer a compliance requirement (Poeten 1993) However, T Plant plans to proceed with this study to further characterize stack emissions and confirm particle size distributions.
- Continue the existing sampling programs at 291-T-1 and 296-T-13 Stacks.

It is T Plant's intention to remain proactive in complying with all 40 CFR 61 requirements, and to control its potential unabated emissions below the 0.1 mrem y^{-1} threshold. Movement of equipment into or out of the canyon, and cleanup and decontamination activities with a potential to significantly increase air emissions will be evaluated and controlled as necessary. A major upgrade is being planned to increase the canyon ventilation system from 40,000 to 100,000 ft^3 by the year 1999. This upgrade will include the installation of a backup fan system in the 291-T-1 Exhaust Stack, and the installation of a new sampling probe and flow monitoring system. At that time the 296-T-13 Exhaust Stack will be taken out of service. If future NDA evaluations indicate that the potential offsite dose to the MEI exceeds the 0.1 mrem y^{-1} threshold, T Plant will reopen discussions with EPA regarding needed compliance upgrades.

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A8.0 UO₃ PLANT

UO₃ Plant has three registered stacks: 296-U-2, 296-U-4, and 296-U-13.
None of these stacks are designated stacks.

WHC-SD-EN-RPT-007

STACK ASSESSMENT FOR
40 CFR 61, SUBPART H

BACK CALCULATION (3000ⁿ) SOURCE ASSESSMENT

FACILITY UO₂ DISCHARGE POINT Stack 296-U-2

NUMBER OF HEPA FILTER BANKS (n) 1 and Prefilters(80% efficient)
BACK CALCULATION FACTOR 5(3000) (3000ⁿ)

Annual Air Emissions Report (year) 1992

Radionuclide	Quantity Released (Curies)	Back Calculation Factor	Potential Quantity Released (curies)	Projected Dose (mrem/yr)
1. <u>Total Beta</u>	<u>1.3 E-07</u>	<u>1.5 E+04</u>	<u>2.0 E-03</u>	<u>1.6 E-05</u>
2. <u>Total Alpha</u>	<u>1.2 E-07</u>	<u>1.5 E+04</u>	<u>1.8 E-03</u>	<u>1.0 E-03</u>
Total Dose				<u>1.0 E-03</u>

Method Used to Project Dose (CAP88) WHC-EP-0498, 200 West Area 89-m Stack

COMMENTS

Assuming Total Beta = ⁹⁰Sr and Total Alpha = ²³⁴U.

EVALUATOR
MANAGER, ENVIRONMENTAL
FACILITY MANAGER

[Signature]
[Signature]
C. D. Wollan

DATE 11-17-93
DATE 11-17-93
DATE 11/17/93

STACK ASSESSMENT FOR
40 CFR 61, SUBPART H

BACK CALCULATION (3000ⁿ) SOURCE ASSESSMENT

FACILITY UO₃ DISCHARGE POINT Stack 296-U-4
 NUMBER OF HEPA FILTER BANKS (n) 0 BACK CALCULATION FACTOR (3000)⁰
 (3000ⁿ)
 Annual Air Emissions Report (year) 1992

Radionuclide	Quantity Released (Curies)	Back Calculation Factor	Potential Quantity Released (curies)	Projected Dose (mrem/yr)
1. <u>⁹⁰Sr</u>	<u>5.4 E-08</u>	<u>1.0</u>	<u>5.4 E-08</u>	<u>4.2 E-10</u>
2. <u>¹³⁷Cs</u>	<u>3.8 E-07</u>	<u>1.0</u>	<u>3.8 E-07</u>	<u>1.6 E-09</u>
3. <u>U. total</u>	<u>9.4 E-07</u>	<u>1.0</u>	<u>9.4 E-07</u>	<u>5.4 E-07</u>
4. <u>^{239,240}Pu</u>	<u>4.0 E-08</u>	<u>1.0</u>	<u>4.0 E-08</u>	<u>6.2 E-08</u>
5. <u>²⁴¹Am</u>	<u>ND</u>	<u>1.0</u>	<u>0.0 E+00</u>	<u>0.0 E+00</u>
Total Dose				<u>6.0 E-07</u>

Method Used to Project Dose (CAP88) WHC-EP-0498, 200 West Area 89-m Stack

COMMENTS

The releases of Uranium (U.total) was available only as a composite, i.e., combined ²³⁴U, ²³⁵U, ²³⁸U, etc. releases. It has been assumed that Uranium exists solely as ²³⁴U. This is a conservative assumption and results in a slightly higher calculated EDF.

ND= none detected

EVALUATOR
 MANAGER, ENVIRONMENTAL
 FACILITY MANAGER

[Signature]
REJ
C.D. Williams

DATE 11-17-93
 DATE 11-17-93
 DATE 11/17/93

STACK ASSESSMENT FOR
40 CFR 61, SUBPART H

BACK CALCULATION (3000ⁿ) SOURCE ASSESSMENT

FACILITY UO₂ DISCHARGE POINT Stack 296-U-13
 NUMBER OF HEPA FILTER BANKS (n) 1 and Prefilters(80% efficient)
 BACK CALCULATION FACTOR 5(3000) (3000ⁿ)
 Annual Air Emissions Report (year) 1992

Radionuclide	Quantity Released (Curies)	Back Calculation Factor	Potential Quantity Released (curies)	Projected Dose (mrem/yr)
1. <u>Total Beta</u>	<u><1.7 E-07</u>	<u>1.5 E+04</u>	<u><2.6 E-03</u>	<u><6.8 E-05</u>
2. <u>Total Alpha</u>	<u><2.1 E-08</u>	<u>1.5 E+04</u>	<u><3.2 E-04</u>	<u><6.0 E-04</u>
			Total Dose	<u><6.7 E-04</u>

Method Used to Project Dose (CAP88) WHC-EP-0498, 200 West Area 10-m Stack

COMMENTS

Assuming Total Beta = ⁹⁰Sr and Total Alpha = ²³⁴U.

EVALUATOR *[Signature]*
 MANAGER, ENVIRONMENTAL *[Signature]*
 FACILITY MANAGER *C.D. Williams*

DATE 11-17-93
 DATE 11-17-93
 DATE 11/17/93

A9.0 PFP

The Plutonium Finishing Plant (PFP) has five registered stacks: 291-Z-1, 296-Z-3, 296-Z-5, 296-Z-6, and 296-Z-14. Two of the stacks are major: 291-Z-1 and 296-Z-3. Stack 296-Z-5 was analyzed using a release fraction based on a powder spill in a static atmosphere. A description of the assessment by this method follows.

STACK ASSESSMENT FOR
40 CFR 61, SUBPART HBACK CALCULATION (3000ⁿ) SOURCE ASSESSMENT

FACILITY: Plutonium Finishing Plant DISCHARGE POINT: 291-Z-1

NUMBER OF HEPA FILTER BANKS (n) 3BACK CALCULATION FACTOR : 2.7E+10
(3000ⁿ)

Annual Air Emissions Report (year) 1992

Radionuclide	Quantity Released (Curies)	Back Calculation Factor	Potential Quantity Released (curies)	Projected Dose (mrem/yr)
1. Pu ²³⁹ , Pu ²³⁹	4.2 E-04	2.7 E+10	1.13 E+7	1.76 E+07
2. Pu ²⁴¹	2.9 E-03	2.7 E+10	7.83 E+7	1.93 E+06
3. Am ²⁴¹	7.2 E-05	2.7 E+10	1.94 E+7	4.57 E+06
4. Total Beta	3.4 E-04	2.7 E+10	9.18 E+7	4.18 E+03
			Total Dose	2.41 E+07

Method Used to Project Dose (CAP88) CAP88

COMMENTS

EVALUATOR [Signature]
MANAGER, ENVIRONMENTAL [Signature]
FACILITY MANAGER [Signature]EEM [Signature]DATE 12-12-93
DATE 12-13-93
DATE 12/14/93
12-14-93

STACK ASSESSMENT FOR
40 CFR 61, SUBPART HBACK CALCULATION (3000ⁿ) SOURCE ASSESSMENT

FACILITY: Plutonium Finishing Plant DISCHARGE POINT: 296-Z-3

NUMBER OF HEPA FILTER BANKS (n) 2 BACK CALCULATION FACTOR : 9.0E+6
(3000ⁿ)
Annual Air Emissions Report (year) 1992

Radionuclide	Quantity Released (Curies)	Back Calculation Factor	Potential Quantity Released (curies)	Projected Dose (mrem/yr)
1. Pu ²³⁹ , Pu ²³⁹	1.0 E-06	9.0 E+06	9.0	4.64 E+01
2. Am ²⁴¹	8.8 E-07	9.0 E+06	7.92	6.17 E+01
3. Total Beta	2.8 E-07	9.0 E+06	2.52	6.55 E-02
			Total Dose	1.08 E+02

Method Used to Project Dose (CAP88) CAP88

COMMENTS

EVALUATOR
MANAGER, ENVIRONMENTAL
FACILITY MANAGER

EEM

DATE 12-12-93
DATE 12-13-93
DATE 12/14/93
12-14-93

STACK ASSESSMENT FOR
40 CFR 61, SUBPART H

MODIFIED SOURCE ASSESSMENT

FACILITY 2736-ZB DISCHARGE POINT 296-7-5

FACILITY RADIOLOGICAL INVENTORY AT RISK

Radionuclide	Physical/ Chemical Form	Quantity (curies)	Release Factor	Potential Quantity Released (curies)	Projected Dose (mrem/yr)
1. <u>Pu-238</u>	<u>Particle</u>	<u>10.97</u>	<u>4.0E⁻⁵</u>	<u>4.39E-4</u>	<u>2.09E-4</u>
2. <u>Pu-239</u>	<u>Particle</u>	<u>42.91</u>	<u>4.0E⁻⁵</u>	<u>1.72E-3</u>	<u>8.84E-3</u>
3. <u>Pu-240</u>	<u>Particle</u>	<u>19.53</u>	<u>4.0E⁻⁵</u>	<u>7.81E-4</u>	<u>4.02E-3</u>
4. <u>Pu-241</u>	<u>Particle</u>	<u>1065.03</u>	<u>4.0E⁻⁵</u>	<u>4.26E-2</u>	<u>3.48E-3</u>
5. <u>Am-241</u>	<u>Particle</u>	<u>36.88</u>	<u>4.0E⁻⁵</u>	<u>1.48E-3</u>	<u>1.15E-2</u>

Total Dose 2.99E-2

Method Used to Project Dose (CAP88) _____

COMMENTS

The source term for this facility is based upon a two year average of materials which were repackaged to support safe long term storage. The partition factor of 4.0E-5 is derived from studies performed by Sutter, Johnston, and Mishima in 1981 (NUREG/CR2139). This study spilled Depleted Uranium Oxide (DUO) powders in a quiescent test chamber to determine the release fraction for very dense materials such as plutonium. The highest fraction of respirable particles (less than or equal to 10 um) was measured at 0.004% or a factor of 4.0E-5. The study examined 1-kilogram spills of DUO powder from a height of 1 meter. The results of this study are widely recognized and employed. The Mishima study closely approximates the work of repackaging plutonium oxides in the 2736-ZB repackaging glovebox in that fine powders are poured from a slightly elevated container. Where the study spilled from 1 meter the glovebox working height is only 3-6 inches. Once the transfer of material is complete the new canister is mechanically sealed for safe storage and the glovebox is cleaned. Hence only the spill fraction is subject to release as only nuisance contamination levels persist in the glovebox afterward.

EVALUATOR D. Alison/ [Signature]

DATE 11-16-93

MANAGER, ENVIRONMENTAL D.J. McBride/ [Signature]

DATE 11-17-93

FACILITY MANAGER E. C. Vogt/ [Signature]

DATE 11/17/93

WHC-SD-EN-RPT-007

STACK ASSESSMENT FOR
40 CFR 61, SUBPART HAPPENDIX D
SOURCE ASSESSMENTFACILITY 2736-Z, 2736-ZA DISCHARGE POINT 296-Z-6

FACILITY RADIOLOGICAL INVENTORY AT RISK

Radionuclide	Physical/ Chemical Form	Quantity (curies)	Release Factor	Potential Quantity Released (curies)	Projected Dose (mrem/yr)
1. <u>Pu-238</u>	<u>Solid</u>	<u>1259</u>	<u>10^{-6}</u>	<u>$1.26E-3$</u>	<u>$5.99E-3$</u>
2. <u>Pu-239</u>	<u>Solid</u>	<u>1688</u>	<u>10^{-6}</u>	<u>$1.688E-3$</u>	<u>$8.69E-3$</u>
3. <u>Pu-240</u>	<u>Solid</u>	<u>1414</u>	<u>10^{-6}</u>	<u>$1.414E-3$</u>	<u>$7.27E-3$</u>
4. <u>Pu-241</u>	<u>Solid</u>	<u>90156</u>	<u>10^{-6}</u>	<u>$9.016E-2$</u>	<u>$7.37E-3$</u>
5. <u>Am-241</u>	<u>Solid</u>	<u>3201</u>	<u>10^{-6}</u>	<u>$3.201E-3$</u>	<u>$2.49E-2$</u>
Total Dose					<u>$5.43E-2$</u>

Method Used to Project Dose (CAP88)

COMMENTS

The source term for this vent is based solely on canisters containing various mixtures of plutonium locked in a polymer matrix, commonly referred to as polycubes. These canisters require a vent to allow for evolved gases to vent. The remainder of materials stored in the 2736-Z vaults are exempt from the assessment as they are contained within multiple, mechanically sealed containers for long-term, safe storage.

EVALUATOR D. Alison/ *D. Alison*DATE 11-15-93MANAGER, ENVIRONMENTAL D.J. McBride/ *D. McBride*DATE 11-15-93FACILITY MANAGER E. C. Vogt/ *E. C. Vogt*DATE 11/17/93

STACK ASSESSMENT FOR
40 CFR 61, SUBPART HAPPENDIX D
SOURCE ASSESSMENTFACILITY 232-Z DISCHARGE POINT 296-Z-14

FACILITY RADIOLOGICAL INVENTORY AT RISK

Radionuclide	Physical/ Chemical Form	Quantity (curies)	Release Factor	Potential Quantity Released (curies)	Projected Dose (mrem/yr)
1. <u>Pu-238</u>	<u>Solid</u>	<u>6.31</u>	<u>10^{-6}</u>	<u>$6.31E-6$</u>	<u>$3.0E-5$</u>
2. <u>Pu-239</u>	<u>Solid</u>	<u>24.67</u>	<u>10^{-6}</u>	<u>$24.7E-5$</u>	<u>$1.27E-4$</u>
3. <u>Pu-240</u>	<u>Solid</u>	<u>11.23</u>	<u>10^{-6}</u>	<u>$1.12E-5$</u>	<u>$5.8E-5$</u>
4. <u>Pu-241</u>	<u>Solid</u>	<u>612.26</u>	<u>10^{-6}</u>	<u>$6.12E-4$</u>	<u>$5.0E-5$</u>
5. <u>Am-241</u>	<u>Solid</u>	<u>21.20</u>	<u>10^{-6}</u>	<u>$2.12E-5$</u>	<u>$1.65E-4$</u>
Total Dose					<u>$4.30E-4$</u>

Method Used to Project Dose (CAP88) _____

COMMENTS

The source term for this vent is based upon contamination which is contained within various ducts and glovebox/hood arrangements within the 232-Z building. This facility has been in layup since the early 1960's. The material in the ductwork is assumed to be highly agglomerated and adherent to the walls of the host structure. This assumption is supported by prior work performed on similar ductwork/piping at the Plutonium Finishing Plant. Plutonium materials removed from existing ducts/piping for (or to support) remediation work has demonstrated that the material is not readily available as it is a solid material.

EVALUATOR D. Alison/ *[Signature]*DATE 11-16-93MANAGER, ENVIRONMENTAL D.J. McBride/ *[Signature]*DATE 11-17-93FACILITY MANAGER E. C. Voigt/ *[Signature]*DATE 11/17/93

A10.0 LAUNDRY (SHUTDOWN)

The 200 West Laundry has only one registered stack, 296-W-1, and it was shut down in 1993.

STACK ASSESSMENT FOR
40 CFR 61, SUBPART HAPPENDIX D
SOURCE ASSESSMENTFACILITY 200 West Laundry DISCHARGE POINT 296-W-1

FACILITY RADIOLOGICAL INVENTORY AT RISK

Radionuclide	Physical/ Chemical Form	Quantity (curies)	Release Factor	Potential Quantity Released (curies)	Projected Dose (mrem/yr)
1. _____	_____	_____	_____	_____	_____
2. _____	_____	_____	_____	_____	_____
3. _____	_____	_____	_____	_____	_____
4. _____	_____	_____	_____	_____	_____
5. _____	_____	_____	_____	_____	_____
6. _____	_____	_____	_____	_____	_____
7. _____	_____	_____	_____	_____	_____
8. _____	_____	_____	_____	_____	_____
9. _____	_____	_____	_____	_____	_____
10. _____	_____	_____	_____	_____	_____
11. _____	_____	_____	_____	_____	_____
12. _____	_____	_____	_____	_____	_____
13. _____	_____	_____	_____	_____	_____
14. _____	_____	_____	_____	_____	_____
15. _____	_____	_____	_____	_____	_____
16. _____	_____	_____	_____	_____	_____
Total Dose					0

Method Used to Project Dose (CAP88) N/A

COMMENTS

Stack is inactive, there are no emissions. The laundry has been shut down
since October 1993. Decommissioning and demolition process is active. All
utilities have been disconnected and asbestos removal is in progress.
Total demolition of the laundry is expected by the end of July 1994.

EVALUATOR Karen Kover
MANAGER, ENVIRONMENTAL [Signature]
FACILITY MANAGER S. S. Oliver

DATE 4/12/94
DATE 4-18-94
DATE 4/12/94

A11.0 S PLANT AND U PLANT

S Plant and U Plant have six registered stacks: 291-S-1, 296-S-2, 296-S-4, 296-S-6, 296-S-7W, and 291-U-1. Only the 296-S-7W stack is a designated stack. However, this stack is undergoing a reassessment by the upstream air concentration method.

STACK ASSESSMENT FOR
40 CFR 61, SUBPART H

BACK CALCULATION (3000ⁿ) SOURCE ASSESSMENT

FACILITY S-PLANT DISCHARGE POINT 291-S-1
NUMBER OF HEPA FILTER BANKS (n) 0 BACK CALCULATION FACTOR 500
(3000ⁿ)
Annual Air Emissions Report (year) 1992

Radionuclide	Quantity Released (Curies)	Back Calculation Factor	Potential Quantity Released (curies)	Projected Dose (mrem/yr)
1. <u>Pu 239,240</u>	<u>2.7×10^{-7}</u>	<u>500</u>	<u>13.5×10^{-5}</u>	<u>2.09×10^{-4}</u>
2. <u>Sr 90</u>	<u>1.8×10^{-8}</u>	<u>500</u>	<u>9.0×10^{-6}</u>	<u>3.21×10^{-8}</u>
3. _____	<u>1.0×10^{-8}</u>	_____	<u>5.0×10^{-6}</u>	_____
4. _____	_____	_____	_____	_____
5. _____	_____	_____	_____	_____
6. _____	_____	_____	_____	_____
7. _____	_____	_____	_____	_____
8. _____	_____	_____	_____	_____
9. _____	_____	_____	_____	_____
10. _____	_____	_____	_____	_____
11. _____	_____	_____	_____	_____
12. _____	_____	_____	_____	_____
13. _____	_____	_____	_____	_____
14. _____	_____	_____	_____	_____
15. _____	_____	_____	_____	_____
16. _____	_____	_____	_____	_____
Total Dose				<u>2.1×10^{-4}</u>

Method Used to Project Dose (CAP88) WHC-EP-0408

COMMENTS

SAND FILTER IN SYSTEM

EVALUATOR [Signature]
MANAGER, ENVIRONMENTAL [Signature]
FACILITY MANAGER [Signature]

DATE 11/22/93
DATE 11-23-93
DATE 11-23-93

check OK
[Signature]

STACK ASSESSMENT FOR
40 CFR 61, SUBPART H

NONDESTRUCTIVE ASSESSMENT [NDA]
(In Situ Gamma Spectroscopy)

FACILITY S Plant DISCHARGE POINT 296-S-2
NUMBER OF HEPA FILTER BANKS (n) 2

Emission and Effective Dose Equivalent (CAP88) values reported in the Radionuclide Air Emissions Report for the Hanford Site, CY 1992.

Radionuclide	Unabated Potential (Curies)	EDE (mrem Ci ⁻¹ y ⁻¹)	Projected Dose (mrem y ⁻¹)
1. <u>Cs-137</u>	<u>3.46 · 10⁻⁶</u>	<u>1.42 · 10⁻²</u>	<u>4.9 · 10⁻⁸</u>
2. <u>Total α (Sr-90)</u>	<u>3.46 · 10⁻⁶</u>	<u>2.6 · 10⁻²</u>	<u>9.0 · 10⁻⁸</u>
3. <u>Total α (Pu-239)</u>	<u>2.02 · 10⁻⁶</u>	<u>5.15</u>	<u>1.1 · 10⁻⁵</u>
4. _____	_____	_____	_____
5. _____	_____	_____	_____
6. _____	_____	_____	_____

Total Dose 1.1 · 10⁻⁵

COMMENTS

EVALUATOR [Signature]

DATE 1 Dec. '93

MANAGER, ENVIRONMENTAL [Signature]

DATE 12-1-93

FACILITY MANAGER [Signature]

DATE 12-1-93

STACK ASSESSMENT FOR
40 CFR 61, SUBPART H

BACK CALCULATION (3000ⁿ) SOURCE ASSESSMENT

FACILITY S-PLANT DISCHARGE POINT 296-S-4
 NUMBER OF HEPA FILTER BANKS (n) 1 BACK CALCULATION FACTOR $\frac{30,000\text{-m}}{3000}$
 Annual Air Emissions Report (year) 1992

Radionuclide	Quantity Released (Curies)	Back Calculation Factor	Potential Quantity Released (curies)	Projected Dose (mrem/yr)
1. <u>Pu^{239,240} (total)</u>	<u>7.5×10^{-10}</u>	<u>3×10^3</u>	<u>22.5×10^{-7} (5.1)</u>	<u>1.2×10^{-5}</u>
2. <u>Sr⁹⁰ (total)</u>	<u>5.1×10^{-7}</u>	<u>3×10^3</u>	<u>1.53×10^{-3} (0.024)</u>	<u>4.0×10^{-5}</u>
3. _____	_____	_____	_____	_____
4. _____	_____	_____	_____	_____
5. _____	_____	_____	_____	_____
6. _____	_____	_____	_____	_____
7. _____	_____	_____	_____	_____
8. _____	_____	_____	_____	_____
9. _____	_____	_____	_____	_____
10. _____	_____	_____	_____	_____
11. _____	_____	_____	_____	_____
12. _____	_____	_____	_____	_____
13. _____	_____	_____	_____	_____
14. _____	_____	_____	_____	_____
15. _____	_____	_____	_____	_____
16. _____	_____	_____	_____	_____
Total Dose				<u>1.6×10^{-5}</u> <u>5.2×10^{-5}</u>

Method Used to Project Dose (CAP88) WHC-EP-0498

COMMENTS

EVALUATOR T. B. Johnson
 MANAGER, ENVIRONMENTAL T. B. Johnson
 FACILITY MANAGER T. B. Johnson

DATE 11/22/93
 DATE 11-23-93
 DATE 11-22-93

STACK ASSESSMENT FOR
40 CFR 61, SUBPART H

BACK CALCULATION (3000ⁿ) SOURCE ASSESSMENT

FACILITY S-PLANT DISCHARGE POINT 296-S-6
 NUMBER OF HEPA FILTER BANKS (n) 0 BACK CALCULATION FACTOR 1
 (3000ⁿ)
 Annual Air Emissions Report (year) 1992

Radionuclide	Quantity Released (Curies)	Back Calculation Factor	Potential Quantity Released (curies)	Projected Dose (mrem/yr)
1. <u>$Pu^{239,240}$ (total)</u>	<u>2.0×10^{-7}</u>	<u>1</u>	<u>2.0×10^{-7} (5.15)</u>	<u>3.1×10^{-7}</u>
2. <u>Sr^{90} (total)</u>	<u>3.2×10^{-6}</u>	<u>1</u>	<u>3.2×10^{-6} (0.22)</u>	<u>3.1×10^{-8}</u>
3. _____	_____	_____	_____	_____
4. _____	_____	_____	_____	_____
5. _____	_____	_____	_____	_____
6. _____	_____	_____	_____	_____
7. _____	_____	_____	_____	_____
8. _____	_____	_____	_____	_____
9. _____	_____	_____	_____	_____
10. _____	_____	_____	_____	_____
11. _____	_____	_____	_____	_____
12. _____	_____	_____	_____	_____
13. _____	_____	_____	_____	_____
14. _____	_____	_____	_____	_____
15. _____	_____	_____	_____	_____
16. _____	_____	_____	_____	_____
Total Dose				<u>3.4×10^{-7} m</u>

Method Used to Project Dose (CAP88) WHC-EP-0408 1.1×10^{-6}

COMMENTS

EVALUATOR [Signature]
 MANAGER, ENVIRONMENTAL [Signature]
 FACILITY MANAGER [Signature]

DATE 11/22/93
 DATE 11-23-93
 DATE 11-22-93

Chad
R/B

STACK ASSESSMENT FOR
40 CFR 61, SUBPART H

BACK CALCULATION (3000ⁿ) SOURCE ASSESSMENT

FACILITY S-PLANT DISCHARGE POINT 296-S-7W
 NUMBER OF HEPA FILTER BANKS (n) 2 BACK CALCULATION FACTOR 9.0×10^6
 (3000ⁿ)
 Annual Air Emissions Report (year) 1992

Radionuclide	Quantity Released (Curies)	Back Calculation Factor	Potential Quantity Released (curies)	Projected Dose (mrem/yr)
1. <u>Pu^{239,240}</u>	<u>7.5×10^{-7}</u>	<u>9.0×10^6</u>	<u>6.75 (5.16)</u>	<u>34.8</u>
2. <u>Am²⁴¹</u>	<u>4.2×10^{-6}</u>	<u>9.0×10^6</u>	<u>37.8 (7.74)</u>	<u>2.9×10^2</u>
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				
14.				
15.				
16.				
Total Dose				<u>3.3×10^2</u>

Method Used to Project Dose (CAP88) WHC-EP-0498

COMMENTS

No Beta detected

EVALUATOR [Signature]
 MANAGER, ENVIRONMENTAL [Signature]
 FACILITY MANAGER [Signature]

DATE 11/22/93
 DATE 12-1-93
 DATE 11-22-93

STACK ASSESSMENT FOR
40 CFR 61, SUBPART H

BACK CALCULATION (3000ⁿ) SOURCE ASSESSMENT

FACILITY U-Plant DISCHARGE POINT 291-U-1
 NUMBER OF HEPA FILTER BANKS (n) 0 BACK CALCULATION FACTOR 500
 (3000ⁿ)
 Annual Air Emissions Report (year) 1992

Radionuclide	Quantity Released (Curies)	Back Calculation Factor	Potential Quantity Released (curies)	Projected Dose (mrem/yr)
1. <u>P^{239,240}</u>	<u>3.1×10^{-7}</u>	<u>500</u>	<u>1.55×10^{-4}</u>	<u>2.4×10^{-4}</u>
2. <u>Sr⁹⁰</u>	<u>1.5×10^{-5}</u>	<u>500</u>	<u>7.5×10^{-3}</u>	<u>5.9×10^{-5}</u>
3. <u>Cs¹³⁷</u>	<u>2.2×10^{-4}</u>	<u>500</u>	<u>0.11</u>	<u>4.7×10^{-4}</u>
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				
14.				
15.				
16.				
Total Dose				<u>7.7×10^{-4}</u>

Method Used to Project Dose (CAP88) WHC-EP-0478

COMMENTS

SAND FILTER IN SYSTEM

EVALUATOR [Signature]
 MANAGER, ENVIRONMENTAL
 FACILITY MANAGER [Signature]

DATE 11/22/93
 DATE 11-23-93
 DATE 11-23-93

A12.0 300 AREA

The 300 Area has six registered stacks: 377-GEL, 306-E-ULAB, 308-TRIGA, 308-GL-EX, 308-ET-EX, and 340-NT-EX. Two of these are designated stacks: 308-GL-EX and 340-NT-EX. The 308-GL-EX is scheduled to be shut down in the first half of 1994. Also the nondesignated stack 308-ET-EX is scheduled to be shut down. A description of the analysis of these two stacks is included.

STACK ASSESSMENT FOR
40 CFR 61, SUBPART HAPPENDIX D
SOURCE ASSESSMENTFACILITY 377 DISCHARGE POINT 377-GEL

FACILITY RADIOLOGICAL INVENTORY AT RISK

Radionuclide	Physical/ Chemical Form	Quantity (curies)	Release Factor	Potential Quantity Released (curies)	Projected Dose (mrem/yr)
1. Pu-239	particulate	.0525	.001	5.3E-5	9.1E-3
2. Sr-90	particulate	.0053	.001	5.3E-6	4.6E-6
3. H-3	gas	1.2E-5	1	1.2E-5	4.8E-9
4.					
5.					
6.					
7.					
8.					
9.					
10.					
11.					
12.					
13.					
14.					
15.					
16.					
Total Dose					9.1E-3

Method Used to Project Dose (CAP88) obtained from WHC-EP-0498

COMMENTS

Source of this information was obtained from: Internal Memo 88420-92-209, L. P. Diediker to H. L. Benny, "377 Facility Stack Monitoring," dated December 14, 1992.

EVALUATOR L. Benny
MANAGER, ENVIRONMENTAL
FACILITY MANAGER H. Benny

DATE 11/12/93
DATE
DATE 11/12/93

STACK ASSESSMENT FOR
40 CFR 61, SUBPART H

BACK CALCULATION (3000ⁿ) SOURCE ASSESSMENT

FACILITY 306 DISCHARGE POINT 306E-ULAB
 NUMBER OF HEPA FILTER BANKS (n) 1 BACK CALCULATION FACTOR 3000
 (3000ⁿ)
 Annual Air Emissions Report (year) 1992

Radionuclide	Quantity Released (Curies)	Back Calculation Factor	Potential Quantity Released (curies)	Projected Dose (mrem/yr)
1. U-238	4.2E-8	3000	1.3E-4	7.1E-3
2. Sr-90	1.8E-7	3000	5.4E-4	4.7E-4
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				
14.				
15.				
16.				
Total Dose				7.6E-3

Method Used to Project Dose (CAP88) WHC-EP-0498

COMMENTS

Data obtained from "Radionuclide Air Emissions Report for the Hanford Site"
 CY 1992

EVALUATOR
 MANAGER, ENVIRONMENTAL
 FACILITY MANAGER

DATE 11/12/93
 DATE 11/12/93
 DATE 11/12/93

**Westinghouse
Hanford Company****Internal
Memo**

From: FMEF
Phone: 376-0484 N1-47
Date: November 16, 1993
Subject: NESHAP EVALUATION FOR 308 BUILDING

To: W. E. Davis H6-30

cc: L. P. Diediker T1-30 D. E. Rasmussen L4-30
J. O. Dittmer L4-30 J. W. Rich N1-40
I. L. Metcalf N1-40 J. F. Williams L4-30
J. K. Perry H6-20 JMS File/LB
D. L. Powell L4-32

The attached NESHAP Evaluation for the 308 Building is provided as requested in support of the EPA Compliance Plan for Hanford facilities. Any questions may be directed to me or to Mr. J. W. Rich of Project Support.

J. M. Steffen
Plant Manager

dc

Attachments 3

NESHAP EVALUATION
FOR THE 308 BUILDING

1.0 BACKGROUND

In years past, the 308 Building has manufactured experimental test fuel for the Plutonium Recycle Test Reactor, Fast Flux Test Facility (FFTF) Reactor, and the Experimental Breeder Reactor II. However, as a result of the decision to shutdown the FFTF, the 308 Building is no longer required, and hence the 308 Building is currently in transition to a shutdown condition. The details associated with the building shutdown are included in the 308 Building Shutdown Plan (WHC 1992c).

The Main Process Building portion of the 308 laboratory contains the following radiological enclosures, which are contaminated with radioisotopes resulting from their use in reactor fuels research and/or fabrication:

- 41 PuO₂ gloveboxes
- 2 PuO₂ pin decon enclosures
- 1 UO₂ pin decon enclosure
- 6 UO₂ open-faced hoods
- 2 UO₂ enclosures
- 1 uranium metal fuel glovebox
- 3 welding gloveboxes.

Essentially all of the gloveboxes (with the exception of the uranium metal fuel glovebox) contain residual plutonium oxide contamination; the open-faced hoods contain residual uranium oxide contamination. These enclosures and internal large equipment items will remain in place in the facility and shall be removed for future facility utilization or decontamination and decommissioning.

The facility also contains a Test Reactor and Isotope Production, General Atomics (TRIGA) reactor which is no longer being operated. The TRIGA reactor has been permanently shut down and the fuel elements have been transferred out of the core and into storage baskets around the periphery of the reactor pool. The TRIGA fuel is to remain under water until such time that another location for storage has been determined.

Surplus materials and equipment are currently being removed from the 308 Building. Plans for the first part of CY 1994 call for shutdown of active support systems, including the ventilation systems. After that time, only a few nonsurface contamination area rooms in the annex portion of the facility will be isolated from the remainder of the facility and will be operated at a reduced level commensurate with the surveillance needs for TRIGA fuel storage.

2.0 NESHA EVALUATION SCOPE

The 308 Building has three stacks that are registered with the Washington State Department of Health (DOH), the glovebox header exhaust 308-GL-EX, the etch tank exhaust 308-ET-EX, and the TRIGA reactor hall exhaust 308-TRIGA. The glovebox exhaust 308-GL-EX and the etch tank exhaust 308-ET-EX are both associated with the 308 Main Process Building ventilation system. The TRIGA reactor hall exhaust is associated with the 308 Annex Building ventilation system. A brief description of these ventilation system is included in the following sections.

There have been several methods proposed to evaluate the potential release of radionuclides for Hanford facilities to determine whether or not the individual source emission points (exhaust stacks) should be included in the list of significant stacks. The threshold value which determines this classification is based upon the potential to discharge radionuclides into the air in quantities which could cause an effective dose equivalent at the site boundary in excess of 1% of the 10 mrem/yr EDE standard or 0.1 mrem/yr.

The first evaluation technique considered is based upon back calculation using historical emissions data which is then adjusted by the appropriate decontamination factors to estimate the annual total unabated release potential from the stack. The second technique would require that data be collected using in-situ NDA techniques to determine the amount of radiological material located in each of the HEPA filters, and, then, using service history data, determine an estimated material accumulation rate for each HEPA filter. The third method of assessment is the Appendix D Source Assessment which is based on the inventory using release factors from 40 CFR 61 Appendix D. The release factors depend on the physical state of the radionuclides. They are: 1 for gases, 1×10^{-3} for liquids or particulate solids, and 1×10^{-6} for solids. The fourth method available is the Upstream of HEPA Filter Air Concentration Source Assessment, in which collected or historical data is used to characterize the flow streams entering the ventilation system or the concentrations in the flow stream upstream of the HEPA filters. The methods used for the evaluation of any given ventilation system are dependant upon the configuration of the system and the amount of historical information available.

3.0 NESHA EVALUATION OF GLOVEBOX EXHAUST 308-GL-EX

3.1 STACK 308-GL-EX DESCRIPTION

Exhaust fans EF-4 and EF-5 exhaust air from the gloveboxes and confinement hoods located in the Main Process Building through exhaust stack 308-GL-EX. The 308-GL-EX stack is composed of two separate atmospheric discharges located on the east side of the 308 Main Process Building which exhaust air at an approximate flow rate of 3300 CFM for exhaust fan EF-4 or an approximate flow rate of 3465 CFM for exhaust fan EF-5 (WHC 1992b). Normally, one of the two glovebox exhaust fans operates with the second in standby. The exhaust streams from the gloveboxes and hoods are routed through

three stages of HEPA filters (including the nontestable HEPA filter located at each of the gloveboxes) before being exhausted to the atmosphere.

3.2 STACK 308-GL-EX NESHAP ASSESSMENT

To date, all special nuclear material (SNM), other than holdup, has been removed from the 308 Main Process Building. During the August 1991 to January 1992 time period, the gloveboxes and exhaust ducts were assayed to support a facility-risk assessment (WHC 1992a) using in-situ nondestructive assay (NDA) techniques to determine residual plutonium quantities remaining in the facility. This effort involved approximately 2,071 ft of Zone I ventilation ducting that was surveyed at 126 different locations. Also surveyed were the 45 gloveboxes located throughout the facility. The best estimate holdup values of 21 g plutonium in the ducts and 374 g plutonium in the gloveboxes were established. Material holdup NDA values for ducts longer than 3 ft in length ranged from zero to 0.28 g plutonium per linear foot. The very small amount of residual material holdup is an indication that there are no significant accumulations in any one location and it is expected that the oxide powder has adhered to natural surface imperfections and irregularities in the same manner as it does in the gloveboxes. The gloveboxes were previously cleaned out and subsequently wiped down with damp rags to complete material recovery and accountability. The gloveboxes generally show only minimal visible material holdup, and NDA ranged from zero to approximately 84 g (for one of the pellet hydraulic pressing gloveboxes) of plutonium per glovebox, which is attributed to the specific characteristics and surface area inside the gloveboxes. The NDA results from gloveboxes associated with pellet hydraulic pressing operations established estimated quantities of 168 grams of a very hard, rock-like compound caused by the gradual combination of hydraulic oil residue and oxide material, which is attributed to long-term buildup over the course of approximately 20 yr. Some of this material holdup was removed, where accessible, in the past by hammering and chiseling. To further reduce the potential for emissions, the interiors of the gloveboxes have been coated with a fixative coating which effectively seals all materials which are held up on the surfaces inside of the gloveboxes. Because the material holdup is not in dispersible powder form, it does not represent a significant problem with respect to potential radiological release. The plutonium oxide materials historically used in the 308 Building have been composed of approximately 85% ^{239}Pu with approximately 13% ^{240}Pu , and small quantities of ^{238}Pu , ^{241}Pu and ^{241}Am (WHC 1993a).

In addition to the residual plutonium oxide material inside of the gloveboxes and the ventilation ducting, there are approximately 4 Kg's of depleted uranium oxide powder remaining within process equipment located in room 120 on the first floor of the facility. The equipment is located inside of enclosures which are connected to the glovebox ventilation system. Approximately 99.8% of this material is composed of the isotope ^{238}U with the remainder being ^{235}U with trace quantities of ^{234}U and ^{236}U . Since these materials constitute a very small portion of the source term, they will be treated as ^{238}U only.

The first evaluation technique considered was back calculation to estimate the annual total unabated release potential from the stack using

historical emissions data which was then adjusted by a decontamination factor of 3000^n where n is the number of stages of HEPA filters (in this case, $n = 3$). The results obtained from this method were based on the 1992 emissions data for gross Alpha of $4.2\text{E-}8$ curies and gross Beta of $1.8\text{E-}7$ curies (WHC 1993b). The gross Alpha was assumed to be the worst case radionuclide ^{239}Pu and the gross Beta was assumed to be the worst case radionuclide ^{90}Sr . Due to the small values associated with the historical release data, the large dose conversion factor for the radionuclides considered and the large number of filtration stages, the estimated annual release potential using the back calculation methodology was found to be $2.0\text{E+}5$ mrem/yr, which is well above the established limit of 0.1 mrem/yr.

A second evaluation was performed based on the Appendix D Source Assessment. The source term used was the best estimate holdup values of 21 g plutonium in the ducts plus 374 g plutonium in the gloveboxes for a total of 395 grams. A total of 227 grams of the plutonium oxide material is in the form of powder while the remaining 168 grams is in the form of a solid. The composition and source term contribution of these materials are detailed in the following table. In addition to the residual plutonium oxide, 4 Kg's of ^{238}U powder were also included in the source term.

Pu/Am Powders (227 grams total)				
Isotope	Mass Fraction	Mass in Residual (grams)	Specific Activity (Ci/g)	Quantity (Ci)
^{238}Pu	0.0009	0.2043	17.1	3.49
^{239}Pu	0.8471	192.2917	0.0622	11.96
^{240}Pu	0.1290	29.283	0.228	6.6765
^{241}Pu	0.0011	0.2497	103.1	25.744
^{241}Am	0.0176	3.9952	3.43	13.7035
Pu/Am Solids (168 grams total)				
Isotope	Mass Fraction	Mass in Residual (grams)	Specific Activity (Ci/g)	Quantity (Ci)
^{238}Pu	0.0009	0.1512	17.1	2.5855
^{239}Pu	0.8471	142.313	0.0622	8.8519
^{240}Pu	0.1290	21.672	0.228	4.9412
^{241}Pu	0.0011	0.1848	103.1	19.0529
^{241}Am	0.0176	2.9568	3.43	10.1418

The resulting projected unabated dose potential was calculated in the data sheet included as Attachment 2 and was found to be 7.45 mrem/yr. This evaluation is very conservative since the 374 grams of plutonium materials located in the gloveboxes have been sealed within the stabilization coatings applied to the glovebox interiors. It is obvious from this assessment, that while the potential unabated emissions using the conservative assumptions included in Appendix D of 40 CFR 61 are greater than the established limit of 0.1 mrem/yr which would cause this stack to be identified as a major stack, the actual emissions potential is well below the 10 mrem/yr EDE standard.

Based on the results of this NESHAP evaluation, the classification of stack 308-GL-EX should be "Major". Since operation of this stack will cease in approximately six months, and the stack will be capped and sealed, no upgrades or improvements to the effluent sampling and monitoring system are planned.

4.0 NESHAP EVALUATION OF THE ETCH TANK EXHAUST 308-ET-EX

4.1 STACK 308-ET-EX DESCRIPTION

Exhaust fans EF-6 and EF-7 are provided to exhaust air from the nonradiological welding fume hood and grinding hood located in the maintenance shop (room 231) and the cleaning troughs in room 131 both located in the Main Process Building. Normally, only one of the two fans operate with the second in standby. Fans EF-6 and EF-7 operate at an approximate flow rate of 3150 CFM for exhaust fan EF-6 or an approximate flow rate of 4265 CFM for exhaust fan EF-7 (WHC 1992b). The subsystem includes a scrubber and a fabricated testable HEPA filter housing located in room 131 which uses standard 24 in. x 24 in. HEPA filters for treatment of the exhaust from the cleaning troughs in room 131. A second manufactured filter housing which utilizes standard 24 in. x 24 in. HEPA filters with roughing filter is provided in room 231 for initial filtration of exhaust from the welding hood and the grinding hood. The final stage of HEPA filtration prior to being exhausted to the atmosphere is provided by a standard manufactured HEPA filter housing containing standard 24 in. x 24 in. HEPA filters (located in room 231). The cleaning troughs and scrubber located in room 131 were used in the past for cleaning nonradiological test pin hardware during the 1970s. Prior to being decontaminated and converted to a cleaning room, room 131 was used for glovebox and radiological operations. At the current time, the etch tanks and scrubber have been drained and are no longer in operation.

The Etch Tank and Shop Hood Exhaust System (stack 308-ET-EX) served by EF-6/EF-7 can be cross-connected with the glovebox exhaust system (stack 308-GL-EX) served by EF-4/EF-5 by opening a valve located in room 131 (upstream of the last stage HEPA filter). Any one of the four fans can accommodate the ventilation requirements of both subsystems. The cross-connect is normally closed and locked shut.

4.2 STACK 308-ET-EX NESHAP ASSESSMENT

There are no identifiable sources of radiological materials associated with the exhaust streams which feed into the 308-ET-EX exhaust system. Only materials held up within the ducting and filter housings from past operations could be identified as a potential source for any emissions. Evaluation of the 308-ET-EX exhaust system utilized the HEPA filter NDA Method. Data to support the NDA assessment was recorded on November 9, 1993. The results of the assessment will be transmitted in a separate report. It is likely that this stack will be identified as a "minor" stack.

At the current time, the etch tanks located in room 131 of the 308 Main Process Building have been shutdown and are not contaminated. The exhaust

fans associated with stack 308-ET-EX have continued to operate for the sole purpose of ventilating the nonradiological welding and grinding hoods located in room 231 and maintaining normal building air balance. During CY 1993 and the first quarter of CY 1994, this portion of the building will be prepared for shutdown. The exhaust ducts will be capped between the final HEPA filter and the exhaust fans. The system will be sealed as necessary to provide containment for any residual SNM which may held up in the ducting to preclude migration into the rooms during the time period that the building awaits renovation or decommissioning.

5.0 NESHAP EVALUATION OF THE ANNEX EXHAUST 308-TRIGA

5.1 STACK 308-TRIGA DESCRIPTION

The 308 Building Annex ventilation system is comprised of an air handler unit (AHU-158) with supply fan, filter, and heating and cooling coils which supplies a combination of recirculated and fresh air to the TRIGA reactor hall, control room, Test Loop Assembly Addition, and the Interim Fuel Storage Facility Addition. The ventilation air stream drawn from the Test Loop Assembly area and the Interim Fuel Storage Facility is recirculated through roughing filters and two stages of testable HEPA filters (composed of a standard manufactured HEPA filter housing with standard 24 in. x 24 in. HEPA filters) and returned to air handler unit AHU-158. The exhaust from the TRIGA reactor hall, Neutron Radiography Facility, photo darkroom, and counting room is discharged through roughing filters, two stages of standard 24 in. x 24 in. testable HEPA filters in a standard manufactured housing, and is exhausted to atmosphere through exhaust stack 308-TRIGA by fans EF-8 or EF-9 one of which runs with the other in standby. The 308-TRIGA stack is composed of a 12 inch diameter stack located on the roof of the 308-TRIGA and Test Loop Assembly Addition. The exhaust fans associated with this stack operate at an approximate flow rate of 2010 CFM for exhaust fan EF-8 or an approximate flow rate of 2508 CFM for exhaust fan EF-9 (WHC 1992b).

5.2 STACK 308-TRIGA NESHAP ASSESSMENT

Emissions from exhaust stack 308-TRIGA will continue beyond 1994 as needed to support storage of the TRIGA fuel in the fuel storage facility. Fuel assemblies which have been used in the TRIGA reactor are lightly irradiated and will remain under water in the storage baskets until such time that another location for storage has been determined. During the time the TRIGA reactor operated, there were no instances of fuel assembly failure and consequently, these fuel assemblies are considered to be sealed.

The exhaust system associated with stack 308-TRIGA also provides ventilation for two hoods. One hood is located in the photo darkroom and was used for nonradiological emissions from the film development process. The second hood is located in the counting room and was used for handling of irradiated activation samples to and from the reactor using a "rabbit" system. The irradiated samples handled were either nondispersible activated solids or activation samples contained in sealed capsules. Both of these hoods are

shutdown and neither of the hoods or their associated ducting contain any known residual radionuclides.

Exhaust stack 308-TRIGA was evaluated for NESHAP using the methods outlined in Appendix D of 40 CFR 61 and the results are documented by the following sections of this document. There are no dispersible radionuclides located in the 308 Building Annex. The fuel and fission products associated with the TRIGA reactor fuel are all located in sealed containers (the fuel elements), and need not be included in the source term calculation pursuant to the exemption provided for sealed materials by Appendix D. The potential release source term associated with the TRIGA reactor includes only those radionuclides which may have accumulated in the fuel cladding and reactor structures as a result of neutron activation. In addition, several boxes and drums are temporarily located in room 158 of the Annex which contain some components of a second TRIGA reactor which were originally destined to be installed in the FMEF. These components were removed from a previously decommissioned reactor at the Diamond Ordnance Radiation Facilities. Pacific Northwest Laboratories performed NDA measurements on the stored equipment (PNL 1993). The total contribution to the source term was found to be approximately $1.90\text{E-}3$ Curies of ^{60}Co . Of this total, approximately 68% is located in one drum, and could have been ignored by virtue of the fact that it is sealed. However, this source has been included in the attached assessment for conservatism.

5.2.1 308-TRIGA Component Characteristics

The materials included in the source term calculation include all unsealed portions of the core components, the core support structure and grid plates, the sample rack assembly, the lower portions of the sample rack drive rods and latch rods, the control rod drive shafts and the core reflector assembly. The graphite block which is included in the reflector assembly weighs approximately 1838 lb, but was not included as part of the source term since it is completely sealed by the top and bottom aluminum reflector assembly weldments. The characteristics of each 308 TRIGA reactor component included in the source term are included in the following table.

TRIGA REACTOR COMPONENTS

Item	GA Drawing Number	Material	Weight (lb)
Core Support Platform	TOS210D103	6061-T6 AL	54
Core Grid Plate-Top	TOS210E106	6061-T6 AL	9.7
Core Grid Plate-Bottom	TOS210E107	6061-T6 AL	6.2
Reflector Assembly			
Top Weldment	TIS210D113	6061-T6 AL	226.18
Bottom Weldment	TIS210E116	6061-T6 AL	135.28
Sample Rack Assembly	TOS614R130		
Bearing Housing	TOS614R135	6061-T6 AL	66.8
Bearing Retainer	TOS614B131	6061-T6 AL	NEGLIGIBLE
Support Plate	TOS614B139	6061-T6 AL	0.56
Shaft Bracket	TOS614B144	6061-T6 AL	0.23
Housing Top	TOS614D134	6061-T6 AL	7.5
Specimen Rack	TOS614E133	6061-T6 AL	35.5
Locking Shaft	TOS614B141	321 SS	0.12
Drive Shaft	TOS614B137	321 SS	0.26
Bearing Ring	TOS614C136	6061-T6 AL	4.25
Bearing	---	440C SS	9.0
2x2x3/8 Angle	TOS614R130	6061-T6 AL	0.8
Misc. Fasteners	TOS614R130	18-8 SS	7.0
Poison Control Rod	TOS250J300		
Duct	TOS250D135	6061-T6 AL	0.213
Top Fitting	TOS250B147	6061-T6 AL	0.116
Bottom Fitting	TOS250B148	6061-T6 AL	0.09
Connecting Rod	TOS250D130-1	6061-T6 AL	3.38
Guide Tube	TOS250D105	6061-T6 AL	1.92
Dowel and Misc.	TOS250D105	18-8 SS	0.10
Fuel Follow Control Rod	TP-SK-645		
Duct		304 SS	1.8
Bottom Fitting		304 SS	0.27
Top Fitting		304 SS	0.344
Stainless Clad Fuel Element			
Duct		304 SS	0.624
Top Fitting	TOS210B214	304 SS	0.942
Bottom Fitting	TOS210C219	304 SS	0.371
Aluminum Clad Fuel Element			
Duct		1100 AL	0.302
Top Fitting	TOS210B134	1100 AL	0.254
Spacer	TOS210B132	6061-T6 AL	0.700
Bottom Fitting	TOS210B136	1100 AL	0.124

Item	GA Drawing Number	Material	Weight (lb)
Neutron Source Rods			
Source Rod Body	TOS210C143	6061-T6 AL	2.22
Source Container	TOS210D140	6061-T6 AL	2.32

The core components located in the vessel include aluminum clad fuel elements, stainless steel clad fuel elements, poison control rods, fuel followed control rods and neutron source rods. Many of these elements had previous irradiation history. Also, many of the elements included in the reactor vessel were inserted into storage locations for storage only, and were never used in the TRIGA reactor as core components. The history and description of the various elements are described in the following sections.

5.2.2 Aluminum Clad Fuel Elements

There are a total of 66 aluminum clad fuel elements located in the TRIGA reactor vessel, all of which had previous irradiation history. The exact irradiation history of the elements prior to insertion into the 308 TRIGA reactor approximately 18 years ago is not known. Of these, 56 were used in the TRIGA core for the entire operating life of the reactor and the other 10 remained in the storage baskets for the entire life of the reactor. To account for the previous unknown irradiation history associated with these elements, the total estimated quantity of activation products was doubled for all of these fuel assemblies (doubling of the weight of each element accomplishes the same objective). Each element contains approximately 0.681 lb of 1100 series aluminum and approximately 0.70 lb of 6061-T6 aluminum. The sum total of these quantities doubled amounts to approximately 90 lb of 1100 series aluminum and approximately 92.4 lb of 6061-T6 aluminum.

5.2.3 Stainless Steel Clad Fuel Elements

There are a total of 38 stainless steel clad fuel elements located in the TRIGA reactor vessel, 12 were new when the 308 TRIGA reactor was initially started, and the rest had previous irradiation history. As with the aluminum clad fuel elements, to account for the previous unknown irradiation history associated with these elements, the total estimated quantity of activation products was doubled for all of these fuel assemblies (doubling of the weight of each element accomplishes the same objective). Each element contains approximately 1.937 lb of 304 stainless steel. The sum total of these quantities doubled amounts to approximately 147.2 lb of 304 stainless steel.

5.2.4 Neutron Source Rod Elements

There are two neutron source rods in the reactor vessel, one is in an element in the core and one is stored in the reactor vessel. The total of the unsealed components associated with the source rod element weighs approximately 4.54 lb. For conservatism, the 4.54 lb weight of the element was used for both for a total of 9.08 lb of 6061-T6 aluminum for the two of them.

5.2.5 Control Rod Elements

There are three poison control rods which were used in the core during operation of the TRIGA reactor. In addition, there are four fuel followed control rods in the storage racks which were not used in the core. Two of the fuel followed control rods had prior irradiation history and two have never been used and will not be included in the source term calculation. The unsealed components associated with each of the three poison control rods including the rod drive shaft and guide tube constitutes approximately 5.72 lb of 6061-T6 aluminum and approximately 0.1 lb of 18-8 stainless steel for a combined total of 17.16 lb of 6061-T6 aluminum and 0.3 lb of 18-8 stainless steel. The unsealed components of each of the two fuel followed control rods include approximately 2.4 lb of 304 stainless steel for a combined total of 4.8 lb of 304 stainless steel.

5.2.6 TRIGA Reactor Material Summary

The total weight and types of materials that were used as part of the source term calculation are summarized in the following table.

TRIGA REACTOR MATERIAL SUMMARY

Description	Weight of Material			
	18-8, 304 & 321 SS	440C SS	6061 AL	1100 AL
Stainless fuel rods	147.2 lb			
Aluminum fuel rods			92.4 lb	90 lb
Poison control rods	0.3 lb		17.16 lb	
Fuel follow control rods	4.8 lb			
Neutron source rods			9.1 lb	
Core platform			54 lb	
Top core grid plate			9.7 lb	
Bottom core grid plate			6.2 lb	
Reactor reflector assembly			361.5 lb	
Sample rack assembly	7.38 lb	9 lb	116 lb	
Totals (pounds)	159.68 lb	9 lb	666.1 lb	90 lb
Totals (grams)	72,430.8 g	4082.4 g	302,143 g	40,824 g

5.2.7 TRIGA Reactor Material Characteristics

Most of the materials used to fabricate the core components have a combination of alloying agents and/or impurities which contribute to the activation products produced and affect the source term. The material characteristics for each material type used in the calculations are defined as follows.

- ALUMINUM, 1100 (UNS A91100), Fed. Spec. QQ-A-250/1

This alloy is generally to be 99% pure aluminum; however, the total of all maximum impurities allowed by the standards adds up to greater than 100%. The following constituents which includes the maximum allowed quantities of all identified impurities was used. Besides the constituents listed below, a total of 0.15% additional unidentified impurities may be permitted by the specifications with each limited to 0.05% maximum. These potential additional undefined impurities had to be ignored but should have only minimal impact on the final results.

Si + Fe:	1.0% maximum combined
Mn:	0.05% maximum
Cu:	0.20% maximum
Zn:	0.10% maximum

- ALUMINUM, 6061 (UNS A96061), Fed. Spec. QQ-A-250/11

The following constituents which included the maximum allowed quantities of all identified impurities were used. Besides the constituents listed below, a total of 0.15% additional unidentified impurities may be permitted by the specifications with each limited to 0.05% maximum. These potential additional undefined impurities had to be ignored but should have only minimal impact on the final results.

Si:	0.80% maximum
Mn:	0.15% maximum
Cu:	0.40% maximum
Zn:	0.25% maximum
Ti:	0.15% maximum
Mg:	1.20% maximum
Cr:	0.35% maximum
Fe:	0.70% maximum

- STAINLESS STEELS, 18-8, 321 AND 304

Most of the stainless steels identified are very similar. The 18-8 stainless steels include 302, 304, 304L, 321, 347 and 348. It is not possible from the drawings to identify the exact material in some cases. The only constituents which vary from one grade to the next are the "C" (which is 0.080% for all except 302 SS which has 0.15%), "Cr" (which is either 19% maximum for 302, 321, 347 and 348 or 20% maximum for 304) and Ni (which is 10% for 302, 12% for 304 and 321, and 13% for 347 and 348). The following constituents were used to envelope all of the various grades of 18-8, 321 and 304 stainless steel.

C:	0.15% maximum
Mn:	2.00% maximum
Si:	1.00% maximum
P:	0.045% maximum
S:	0.03% maximum
Cr:	20.0% maximum
Ni:	13.0% maximum

- STAINLESS STEEL, 440C

The following constituents were used for the 440C stainless steel.

C:	1.2% maximum
Mn:	1.00% maximum
Si:	1.00% maximum
P:	0.04% maximum
S:	0.03% maximum
Cr:	18.0% maximum
Mo:	0.75% maximum

5.2.8 308-TRIGA Source Term Calculation Results

To establish a quantitative estimate of the neutron activation products which may have been generated within the reactor components, a very conservative analysis was performed based upon the reactors operating history and the materials of construction. First the materials which were used in the fabrication and construction of the TRIGA reactor and its support structure were identified, quantified and characterized as in the above sections. Then the reactor operating history was determined from the operations log books. It was determined that the TRIGA reactor was operated for approximately 563,900 kilowatt-hours over a period of approximately 2770 operating hours. The average power of approximately 203.6 kilowatts was estimated based on the total exposure history divided by the operating time. To account for the flux profile within the core, the average power was multiplied by a factor of 1.6 (WHC 1975) to establish an estimated peak power level. An analysis was performed using the ORIGEN code (ORNL 1991) to estimate the activation products which would be generated by exposing the various materials used in the reactor to the neutron flux corresponding to the peak power levels within the reactor core over the reactors operating history. The reactor was operated intermittently over approximately thirteen years. For conservatism, the decay of isotopes during the years in which the reactor was operated was ignored. The reactor was last operated approximately four and one half years ago, and decay of isotopes during that time was included when establishing the estimated source term. The following table summarizes the estimated quantity of activation isotopes per 100 grams of material for the various materials used in the reactor with various decay times of 0 hours to approximately 4.7 years.

Isotope	0.0 HR	1.0 HR	1.68 YR	2.68 YR	3.68 YR	4.18 YR	4.68 YR
ACTIVATION OF TYPE 18-8 STAINLESS STEEL RADIOACTIVITY, Curies PER 100 GRAMS OF MATERIAL							
⁵² V	8.883E-02	1.355E-06	0.000E+00	0.00E+00	0.000E+00	0.000E+00	0.000E+00
⁵¹ Cr	1.326E+01	1.325E+01	2.843E-06	3.059E-10	3.292E-14	3.413E-16	3.666E-18
⁵⁵ Cr	1.819E-01	1.486E-06	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
⁵⁴ Mn	1.732E-01	1.732E-01	4.439E-02	1.974E-02	8.781E-03	5.856E-03	3.906E-03
⁵⁶ Mn	3.262E+01	2.493E+01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
⁵⁵ Fe	6.568E-01	6.568E-01	4.196E-01	3.214E-01	2.462E-01	2.155E-01	1.886E-01
⁵⁹ Fe	1.916E-01	1.915E-01	1.500E-05	5.406E-08	1.947E-10	1.169E-11	7.016E-13
⁵⁸ Co	1.168E+00	1.168E+00	2.864E-03	8.007E-05	2.238E-06	3.743E-07	6.258E-08
⁶⁰ Co	8.284E-04	8.284E-04	6.641E-04	5.823E-04	5.105E-04	4.780E-04	4.476E-04
⁶³ Ni	1.420E-02	1.420E-02	1.402E-02	1.392E-02	1.381E-02	1.376E-02	1.371E-02
⁶⁵ Ni	1.698E-01	1.289E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Isotope	0.0 HR	1.0 HR	1.68 YR	2.68 YR	3.68 YR	4.18 YR	4.68 YR
ACTIVATION OF TYPE 440C STAINLESS STEEL RADIOACTIVITY, CURIES PER 100 GRAMS OF MATERIALS							
⁵² V	7.968E-02	1.216E-06	0.000E+00	0.00E+00	0.000E+00	0.000E+00	0.000E+00
⁵¹ Cr	1.194E+01	1.193E+01	2.560E-06	2.755E-10	2.965E-14	3.074E-16	3.302E-18
⁵⁵ Cr	1.606E-01	1.312E-06	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
⁵⁴ Mn	2.118E-01	2.118E-01	5.427E-02	2.414E-02	1.074E-02	7.161E-03	4.776E-03
⁵⁶ Mn	1.703E+01	1.302E+01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
⁵⁵ Fe	7.914E-01	7.914E-01	5.056E-01	3.873E-01	2.967E-01	2.596E-01	2.272E-01
⁵⁹ Fe	2.342E-01	2.341E-01	1.834E-05	6.610E-08	2.382E-10	1.430E-11	8.584E-13
⁹⁹ Mo	2.551E-01	2.525E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
¹⁰¹ Mo	6.352E-02	3.694E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
¹⁰¹ Tc	6.352E-02	1.377E-02	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Isotope	0.0 HR	1.0 HR	1.68 YR	2.68 YR	3.68 YR	4.18 YR	4.68 YR
ACTIVATION OF TYPE 1100 ALUMINUM RADIOACTIVITY, CURIES PER 100 GRAMS OF MATERIAL							
²⁴ Na	4.149E-01	3.962E-01	0.000E+00	0.00E+00	0.000E+00	0.000E+00	0.000E+00
²⁷ Mg	1.984E+01	2.447E-02	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
²⁸ Al	4.757E+01	4.114E-07	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
⁵⁴ Mn	2.716E-03	2.716E-03	6.960E-04	3.096E-04	1.337E-04	9.183E-05	6.124E-05
⁵⁶ Mn	8.062E-01	6.162E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
⁵⁵ Fe	1.015E-02	1.015E-02	6.484E-03	4.966E-03	3.804E-03	3.329E-03	2.914E-03
⁵⁹ Fe	3.004E-03	3.002E-03	2.352E-07	8.472E-10	3.053E-12	1.832E-13	1.100E-14
⁶⁰ Co	1.121E-05	1.121E-05	8.990E-06	7.882E-06	6.910E-06	6.471E-06	6.059E-06
⁶³ Ni	8.158E-06	8.158E-06	8.055E-06	7.995E-06	7.935E-06	7.905E-06	7.875E-06
⁶⁴ Cu	6.023E-01	5.703E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
⁶⁶ Cu	1.298E-01	3.729E-05	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
⁶⁵ Zn	1.157E-02	1.156E-02	2.021E-03	7.155E-04	2.534E-04	1.508E-04	8.972E-05
⁶⁹ Zn	2.751E-02	1.419E-02	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
^{69m} Zn	1.848E-03	1.758E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Isotope	0.0 HR	1.0 HR	1.68 YR	2.68 YR	3.68 YR	4.18 YR	4.68 YR
ACTIVATION OF TYPE 6061 ALUMINUM RADIOACTIVITY, CURIES PER 100 GRAMS OF MATERIAL							
²⁴ Na	4.127E-01	3.941E-01	0.000E+00	0.00E+00	0.000E+00	0.000E+00	0.000E+00
²⁷ Mg	1.942E+00	2.395E-02	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
²⁸ Al	4.631E+01	4.005E-07	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
³¹ Si	5.675E-03	4.357E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
⁵¹ Cr	2.319E-01	2.317E-01	4.971E-08	5.350E-12	5.756E-16	6.183E-18	3.457E-19
⁵⁴ Mn	1.901E-03	1.901E-03	4.872E-04	2.167E-04	9.638E-05	6.428E-05	4.287E-05
⁵⁶ Mn	2.383E+00	1.821E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
⁵⁵ Fe	7.104E-03	7.104E-03	4.539E-03	3.476E-03	2.663E-03	2.331E-03	2.040E-03
⁶⁰ Co	2.236E-05	2.236E-05	1.793E-05	1.572E-05	1.378E-05	1.290E-05	1.208E-05
⁶³ Ni	1.632E-05	1.632E-05	1.611E-05	1.599E-05	1.587E-05	1.581E-05	1.575E-05
⁶⁴ Cu	1.205E+00	1.141E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
⁶⁶ Cu	2.595E-01	7.458E-05	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
⁶⁵ Zn	2.891E-02	2.891E-02	5.051E-03	1.789E-03	6.334E-04	3.769E-04	2.243E-04
⁶⁹ Zn	6.878E-02	3.548E-02	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
^{69m} Zn	4.621E-03	4.394E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

TRIGA REACTOR ACTIVATION PRODUCTS
AFTER 4.18 YEARS DECAY TIME

Description	⁵¹ Cr	⁵⁴ Mn	⁵⁵ Fe	⁵⁹ Fe	⁵⁸ Co	⁶⁰ Co	⁶³ Ni	⁶⁵ Zn
Curies/100g of 18-8 SS	3.413E-16	5.856E-3	2.155E-1	1.169E-11	3.743E-7	4.78E-4	1.376E-2	
100s of grams of 18-8 SS	724.3	724.3	724.3	724.3	724.3	724.3	724.3	
Curies Total for 18-8 SS	2.472E-13	4.2415	156.087	8.467E-9	2.7E-4	0.3462	9.9664	
Curies/100g of 440C SS	3.074E-16	7.161E-3	2.596E-1	1.43E-11				
100s of grams of 440C SS	40.82	40.82	40.82	40.82				
Curies Total for 440C SS	1.255E-14	0.2923	10.597	5.84E-10				
Curies/100g of 1100 AL		9.183E-5	3.329E-3	1.832E-13		6.471E-6	7.905E-6	1.508E-4
100s of grams of 1100 AL		408.24	408.24	408.24		408.24	408.24	408.24
Curies Total for 1100 AL		0.0375	1.359	7.48E-11		0.0026	0.0032	0.0616
Curies/100g of 6061 AL	6.183E-18	6.428E-5	2.331E-3			1.29E-5	1.581E-5	3.769E-4
100s of grams of 6061 AL	3021.43	3021.43	3021.43			3021.43	3021.43	3021.43
Curies Total for 6061 AL	1.868E-14	0.1942	7.043			0.039	0.0478	1.1388
Curies Total	2.784E-13	4.7655	175.086	9.126E-9	2.7E-4	0.3878	10.0174	1.2004

A-318

WMC-SD-EN-RPT-007

Rev. 0

Isotope	Total Activation Products (Curies)	Per Annum Release Potential ⁽²⁾ (Curies)	Dose Conversion Factor (mrem) ⁽³⁾	Per Annum Offsite Dose Potential (mrem/yr)
⁵¹ Cr	2.784E-13	2.784E-19	1.26E-3	3.508E-22
⁵⁴ Mn	4.7655	4.7655E-6	1.10E-1	5.242E-7
⁵⁵ Fe	175.086	1.75E-4	3.86E-3 ⁽¹⁾	6.755E-7
⁵⁹ Fe	9.126E-9	9.126E-15	6.38E-2	5.822E-16
⁵⁸ Co	2.7E-4	2.7E-10	6.43E-2	1.736E-11
⁶⁰ Co ⁽⁴⁾	0.3897	3.897E-7	5.79E-1	2.256E-7
⁶³ Ni	10.0174	1.002E-5	4.05E-3	4.058E-8
⁶⁵ Zn	1.2004	1.2004E-6	1.86E-1	2.2327E-7
Total				1.689E-6
<p>(1) The dose conversion factor for Fe 55 was obtained from Larry Diediker. The factor was determined for a 10-m stack using CAP 88 and will be added to WHC-EP-0498 (WHC 1991).</p> <p>(2) Per annum release potential is based on a re-suspension factor of 1×10^{-6} for solids per 40 CFR 61, Appendix D.</p> <p>(3) Unless otherwise noted, the dose conversion factors were taken from Table C-10 of WHC-EP-0498, "Unit Dose Calculation Methods and Summary of Facility Effluent Monitoring Plan Determinations" for a 10-m stack (WHC 1991).</p> <p>(4) The total activation products for Co 60 includes 0.0019 curies associated with components temporarily stored in room 158.</p>				

As shown in the above table, the final estimated unabated off-site annual dose potential associated with the 308-TRIGA stack was found to be 1.689E-6 mrem/yr which is five orders of magnitude less than the threshold value of 0.1 mrem/yr identified in 40 CFR 61. Based on this, stack 308-TRIGA is a "minor" stack.

4.0 REFERENCES

- WHC 1993a WHC-SD-FL-SAR-002, Addendum 4, 308 Building Final Safety Analysis Report, Discussion, Analysis, and Operation of the 308 Building in the Shutdown Mode.
- WHC 1993b Internal Memo 38420-93-043. L. P. Diediker to B. G. Erlandson, 300/400 Areas Effluent Summary for the Fourth Quarter Calendar Year 1992.
- WHC 1993c Internal Memo 15560-93-75. P. A. Powell to D. E. Rasmussen, NDA Glove Box 219A, dated July 6, 1993.

PNL 1993 Letter, Daniel L. Haggard (PNL) to Ms. Lisa A. Johnson (WHC), "Results of Gamma Characterization Measurements", dated August 9, 1993.

WHC 1992a WHC-SP-0796, Radiological Release Assessment for the 308 Building

WHC 1992b Maintenance Engineering Services Preventive Maintenance Procedure 950, Rev. 1, data sheets dated 6/11/92

WHC 1992c 308 Building Shutdown Plan, Correspondence No. 9256732

WHC 1991 WHC-EP-0498, Unit Dose Calculation Methods and Summary of Facility Effluent Monitoring Plan Determinations.

ORNL 1991 ORIGEN 2.1, Isotope Generation and Depletion Code Matrix Exponential Method, Oak Ridge National Laboratory, Oak Ridge, Tennessee.

WHC 1975 Final Safety Analysis Report Neutron Radiography Facility, TC-344, Westinghouse Hanford Company, Richland, Washington.

STACK ASSESSMENT FOR
40 CFR 61, SUBPART HAPPENDIX D
SOURCE ASSESSMENTFACILITY 308 DISCHARGE POINT 308-TRIGA

FACILITY RADIOLOGICAL INVENTORY AT RISK

Radionuclide	Physical/ Chemical Form	Quantity (curies)	Release Factor	Potential Quantity Released (curies)	Projected Dose (mrem/yr)
1. ⁵¹ Cr	Solid	2.784E-13	1.0E-6	2.784E-19	3.508E-22
2. ⁵⁴ Mn	Solid	4.7655	1.0E-6	4.7655E-6	5.242E-7
3. ⁵⁵ Fe	Solid	1.7509E+2	1.0E-6	1.75E-4	6.755E-7
4. ⁵⁹ Fe	Solid	9.126E-9	1.0E-6	9.126E-15	5.822E-16
5. ⁵⁸ Co	Solid	2.7E-4	1.0E-6	2.7E-10	1.736E-11
6. ⁶⁰ Co	Solid	0.3897	1.0E-6	3.897E-7	2.256E-7
7. ⁶³ Ni	Solid	10.0174	1.0E-6	1.002E-5	4.058E-8
8. ⁶⁵ Zn	Solid	1.2004	1.0E-6	1.2004E-6	2.2327E-7
9.					
10.					
11.					
12.					
13.					
14.					
15.					
16.					
Total Dose					1.689E-6

Method Used to Project Dose (CAP88) WHC-EP-0498

COMMENTS

EVALUATOR J. W. Rich *[Signature]*
MANAGER, ENVIRONMENTAL
FACILITY MANAGER J. M. Steffen *[Signature]*

DATE 11/16/93
DATE
DATE 11/16/93

STACK ASSESSMENT FOR
40 CFR 61, SUBPART H

APPENDIX D
SOURCE ASSESSMENT

FACILITY 308 DISCHARGE POINT 308-GL-EX

FACILITY RADIOLOGICAL INVENTORY AT RISK

Radionuclide	Physical/ Chemical Form	Quantity (curies)	Release Factor	Potential Quantity Released (curies)	Projected Dose (mrem/yr)
1. ^{238}Pu	Powder	3.49	1.0E-3	3.49E-3	0.5584
2. $^{239}\text{Pu}/^{240}\text{Pu}$	Powder	18.6365	1.0E-3	1.864E-2	3.224
3. ^{241}Pu	Powder	25.744	1.0E-3	2.5744E-2	0.0705
4. ^{241}Am	Powder	13.7035	1.0E-3	1.37E-2	3.59
5. ^{238}Pu	Solid	2.5855	1.0E-6	2.586E-6	4.138E-4
6. $^{239}\text{Pu}/^{240}\text{Pu}$	Solid	13.7931	1.0E-6	1.379E-5	2.386E-3
7. ^{241}Pu	Solid	19.0529	1.0E-6	1.905E-5	5.22E-5
8. ^{241}Am	Solid	10.1418	1.0E-6	1.014E-5	2.657E-3
9. ^{238}U	Powder	1.32E-3	1.0E-3	1.32E-6	7.47E-5
10. _____	_____	_____	_____	_____	_____
11. _____	_____	_____	_____	_____	_____
12. _____	_____	_____	_____	_____	_____
13. _____	_____	_____	_____	_____	_____
14. _____	_____	_____	_____	_____	_____
15. _____	_____	_____	_____	_____	_____
16. _____	_____	_____	_____	_____	_____
Total Dose					7.45

Method Used to Project Dose (CAP88) WHC-EP-0498

COMMENTS

EVALUATOR J. W. Rich *J. W. Rich*
MANAGER, ENVIRONMENTAL
FACILITY MANAGER J. M. Steffen *J. M. Steffen*

DATE 11/16/93
DATE
DATE 11/16/93

STACK ASSESSMENT FOR
40 CFR 61, SUBPART H

NONDESTRUCTIVE ASSESSMENT [NDA]
(In Situ Gamma Spectroscopy)

FACILITY 308 Building DISCHARGE POINT 308-ET-B1
NUMBER OF HEPA FILTER BANKS (n) 2

Emission and Effective Dose Equivalent (CAP88) values reported in the Radionuclide Air Emissions Report for the Hanford Site, CY 1992.

Radionuclide	Unabated Potential (Curies)	EDE (mrem Ci ⁻¹ y ⁻¹)	Projected Dose (mrem y ⁻¹)
1. <u>Cs-137</u>	<u>$9.3 \cdot 10^{-7}$</u>	<u>0.472</u>	<u>$4.5 \cdot 10^{-2}$</u>
2. <u>Mn-54</u>	<u>$1.9 \cdot 10^{-2}$</u>	<u>0.11</u>	<u>$2.1 \cdot 10^{-8}$</u>
3. <u>Total (Sr-90)</u>	<u>$9.3 \cdot 10^{-2}$</u>	<u>0.872</u>	<u>$8.1 \cdot 10^{-7}$</u>
4. <u>Total (Pu-239)</u>	<u>$1.9 \cdot 10^{-2}$</u>	<u>1.73</u>	<u>$3.1 \cdot 10^{-5}$</u>
5. _____	_____	_____	_____
6. _____	_____	_____	_____

Total Dose $3.24 \cdot 10^{-5}$

COMMENTS

EVALUATOR *J. R. [Signature]*

DATE 29 Nov. '93

MANAGER, ENVIRONMENTAL *[Signature]*

DATE 11-29-93

FACILITY MANAGER *[Signature]*

DATE 12/2/93

STACK ASSESSMENT FOR
40 CFR 61, SUBPART HBACK CALCULATION (3000ⁿ) SOURCE ASSESSMENT

FACILITY 340 DISCHARGE POINT 340-NT-EX
NUMBER OF HEPA FILTER BANKS (n) 2 BACK CALCULATION FACTOR 4.5E+7
Annual Air Emissions Report (year) 1992
(3000ⁿ)

Radionuclide	Quantity Released (Curies)	Back Calculation Factor	Potential Quantity Released (curies)	Projected Dose (mrem/yr)
1. Pu-239,240	2.1E-8	4.5E+7	9.45E-1	1.63E+2
2. Sr-90	8.9E-8	4.5E+7	4.01	3.5
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				
14.				
15.				
16.				
Total Dose				167

Method Used to Project Dose (CAP88) WHC-EP-0498

COMMENTS

340 has one bank of prefilters and one bank of charcoal filters

EVALUATOR [Signature]
MANAGER, ENVIRONMENTAL
FACILITY MANAGER [Signature]

DATE 11/12/93
DATE _____
DATE 11/12/93

A13.0 400 AREA

The 400 Area has four registered stacks: FFTF-CB-EX, FFTF-HT-TR, FFTF-RE-SB, and 437-MN and 437-ST. None of these stacks are designated stacks.

STACK ASSESSMENT FOR
40 CFR 61, SUBPART H

BACK CALCULATION (3000ⁿ) SOURCE ASSESSMENT

FACILITY FFTF DISCHARGE POINT FFTF-CB-EX
 NUMBER OF HEPA FILTER BANKS (n) 0 BACK CALCULATION FACTOR 1
 (3000ⁿ)
 Annual Air Emissions Report (year) 1992

Radionuclide	Quantity Released (Curies)	Back Calculation Factor	Potential Quantity Released (curies)	Projected Dose (mrem/yr)
1. Pu-239,240	1.1E-06	1	1.1E-06	1.265E-05
2. Cs-137	6.7E-06	1	6.7E-06	2.124E-07
3. Ar-41	8.5E+00	1	8.5E+00	1.403E-04
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				
14.				
15.				
16.				
Total Dose				1.53E-04

Method Used to Project Dose (CAP88) CAP88 from WHC-EP-0498

COMMENTS

Data taken from "RADIONUCLIDE AIR EMISSIONS REPORT FOR THE
HANFORD SITE" CALENDER YEAR 1992

EVALUATOR NR DAHL
 MANAGER, ENVIRONMENTAL PC MILLER
 FACILITY MANAGER GB GRIFFIN

DATE 11/10/93
 DATE 11/10/93
 DATE 11/10/93

STACK ASSESSMENT FOR
40 CFR 61, SUBPART H

BACK CALCULATION (3000ⁿ) SOURCE ASSESSMENT

FACILITY FTFE DISCHARGE POINT FTFE-HT-TR
 NUMBER OF HEPA FILTER BANKS (n) 0 BACK CALCULATION FACTOR 1
 (3000ⁿ)
 Annual Air Emissions Report (year) 1992

Radionuclide	Quantity Released (Curies)	Back Calculation Factor	Potential Quantity Released (curies)	Projected Dose (mrem/yr)
1. <u>Pu-239,240</u>	<u>7.5E-08</u>	<u>1</u>	<u>7.5E-08</u>	<u>8.625E-07</u>
2. <u>Cs-137</u>	<u>4.6E-07</u>	<u>1</u>	<u>4.6E-07</u>	<u>1.458E-08</u>
3. <u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
4. <u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
5. <u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
6. <u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
7. <u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
8. <u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
9. <u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
10. <u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
11. <u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
12. <u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
13. <u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
14. <u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
15. <u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
16. <u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>

Total Dose 8.8E-07

Method Used to Project Dose (CAP88) CAP88 from WHC-EP-0498

COMMENTS

Data taken from "RADIONUCLIDE AIR EMISSIONS REPORT FOR THE
HANFORD SITE" CALENDER YEAR 1992

EVALUATOR NR DAHL
 MANAGER, ENVIRONMENTAL PC MILLER
 FACILITY MANAGER GB GRIFFIN

DATE 11/10/93
 DATE 11/10/93
 DATE 11/10/93

STACK ASSESSMENT FOR
40 CFR 61, SUBPART H

BACK CALCULATION (3000ⁿ) SOURCE ASSESSMENT

FACILITY FFTF DISCHARGE POINT FFTF-RE-SB
 NUMBER OF HEPA FILTER BANKS (n) 0 BACK CALCULATION FACTOR 1
 (3000ⁿ)
 Annual Air Emissions Report (year) 1992

Radionuclide	Quantity Released (Curies)	Back Calculation Factor	Potential Quantity Released (curies)	Projected Dose (mrem/yr)
1. Pu-239,240	7.8E-07	1	7.8E-07	8.97E-06
2. Cs-137	5.2E-06	1	5.2E-06	1.65E-07
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				
14.				
15.				
16.				
Total Dose				9.2E-06

Method Used to Project Dose (CAP88) CAP88 from WHC-EP-0498

COMMENTS

Data taken from "RADIONUCLIDE AIR EMISSIONS REPORT FOR THE
HANFORD SITE" CALENDER YEAR 1992

EVALUATOR NR DAHL
 MANAGER, ENVIRONMENTAL PC MILLER
 FACILITY MANAGER GB GRIFFIN

DATE 11/10/93
 DATE 11/10/93
 DATE 11/10/93

STACK ASSESSMENT FOR
40 CFR 61, SUBPART H

NONDESTRUCTIVE ASSESSMENT [NDA]
(In Situ Gamma Spectroscopy)

FACILITY MASF - 400 Area DISCHARGE POINT 432-MHAST
NUMBER OF HEPA FILTER BANKS (n) 2

Emission and Effective Dose Equivalent (CAP88) values reported in the
Radionuclide Air Emissions Report for the Hanford Site, CY 1992.

Radionuclide	Unabated Potential (Curies)	EDE (mrem $\text{Ci}^{-1} \text{y}^{-1}$)	Projected Dose (mrem y^{-1})
1. <u>Cs-137</u>	<u>$7.69 \cdot 10^{-5}$</u>	<u>0.0317</u>	<u>$2.4 \cdot 10^{-6}$</u>
2. <u>Co-60</u>	<u>$1.3 \cdot 10^{-4}$</u>	<u>0.0395</u>	<u>$5.0 \cdot 10^{-6}$</u>
3. <u>Mn-54</u>	<u>0.2</u>	<u>$7.29 \cdot 10^{-3}$</u>	<u>$1.5 \cdot 10^{-3}$</u>
4. <u>Total (Cs-90)</u>	<u>$7.9 \cdot 10^{-5}$</u>	<u>0.058</u>	<u>$4.5 \cdot 10^{-6}$</u>
5. <u>Total (Pu-239)</u>	<u>$2.0 \cdot 10^{-5}$</u>	<u>11.5</u>	<u>$2.3 \cdot 10^{-4}$</u>
6. _____	_____	_____	_____

Total Dose $1.7 \cdot 10^{-3}$

COMMENTS

Measured activity has been calculated for ten years and
this value is used as the annual unabated potential.

EVALUATOR John Patrick Smith

DATE 29 Nov. '93

MANAGER, ENVIRONMENTAL AP Smith

DATE 11-29-93

FACILITY MANAGER AP Smith

DATE 12-2-93

A14.0 100 AREA

The 100 Area has seven registered stacks: 116-N, 109-N-Z-1, 109-N-C-6, 105-KE, 105-KW, 1706-KE, and 1706-KER. None of these stacks are designated stacks.

STACK ASSESSMENT FOR
40 CFR 61, SUBPART H

BACK CALCULATION (3000**n) SOURCE ASSESSMENT

FACILITY: N-REACTOR

DISCHARGE POINT: 116-N

NUMBER OF HEPA FILTER BANKS (n): 1
BACK CALCULATION FACTOR (BCF): 3000

Annual Air Emissions Report: 1992

Item	Radionuclide	Release (Ci)	BCF	Potential Release (Ci)	Dose Factor (mr/Ci)	Projected Dose (mr/yr)
1	Co-60	4.7E-07	3000	1.4E-03	1.29E-02	1.8E-05
2	Sr-90	2.7E-06	3000	8.1E-03	1.94E-02	1.6E-04
3	Ru-106	1.7E-05	3000	5.1E-02	9.26E-03	4.7E-04
4	Cs-137	1.9E-06	3000	5.7E-03	1.06E-02	6.0E-05
5	Pu-239/240	1.0E-08	3000	3.0E-05	3.85E+00	1.2E-04

TOTAL DOSE 8.2E-04

Method Used to Project Dose: CAP-88 Dose Estimate. Location to the Individual at the Hanford Site Boundary 9900 Meters West. Eight-nine Meter Stack Height Assumed. Reference: WHC-EP-0498, Table C-7
Certain data from Revision 1 to CAPDR.WR1, December 1991, P.D. Rittman.

Comments: None

Evaluator: B. L. Curn, EEM

Date: 11/16/93

Reviewed:

M. R. Morton, D&D

Environmental Compliance Officer

Date: 11/23/93

Approved:

R. J. Simera, D&D

N Reactor Manager

Date: 11.23.93

STACK ASSESSMENT FOR
40 CFR 61, SUBPART H

BACK CALCULATOR (3000**n) SOURCE ASSESSMENT

FACILITY: N-REACTOR

DISCHARGE POINT: 109-N Zone 1

NUMBER OF HEPA FILTER BANKS (n): 1
BACK CALCULATION FACTOR (BCF): 3000

Annual Air Emissions Report: 1992

Item	Radionuclide	Release (Ci)	BCF	Potential Release (Ci)	Dose Factor (mr/Ci)	Projected Dose (mr/yr)
1	Co-60	0.0E+00	3000	0.0E+00	1.29E-02	0.0E+00
2	Sr-90	0.0E+00	3000	0.0E+00	1.94E-02	0.0E+00
3	Ru-106	0.0E+00	3000	0.0E+00	9.26E-03	0.0E+00
4	Cs-137	0.0E+00	3000	0.0E+00	1.06E-02	0.0E+00
5	Pu-239/240	0.0E+00	3000	0.0E+00	3.85E+00	0.0E+00
TOTAL DOSE						0.0E+00

Method Used to Project Dose: CAP-88 Dose Estimate. Location to the Individual at the Hanford Site Boundary 9900 Meters West. Eight-nine Meter Stack Height Assumed. Reference: WHC-EP-0498, Table C-7
Certain data from Revision 1 to CAPDR.WR1, December 1991, P.D. Rittman.

Comments: This exhaust fan has not operated since September 1990. It was de-energized as part of N Reactor lay-up. The stack has not been removed or physically isolated from the environment.

Evaluator: B. L. Curn, EEM

12/21/93
Date:

Reviewed: M. R. Morton, D&D
Environmental Compliance Officer

12/22/93
Date:

Approved: R. J. Giersa, D&D
N Reactor Manager

12.22.93
Date:

STACK ASSESSMENT FOR
40 CFR 61, SUBPART M

BACK CALCULATION (3000**n) SOURCE ASSESSMENT

FACILITY: N-REACTOR

DISCHARGE POINT: 109-N Cell 6

NUMBER OF HEPA FILTER BANKS (n): 1
BACK CALCULATION FACTOR (BCF): 3000

Annual Air Emissions Report: 1992

Item	Radionuclide	Release (Ci)	BCF	Potential Release (Ci)	Dose Factor (mr/Ci)	Projected Dose (mr/yr)
1	Co-60	0.0E+00	3000	0.0E+00	1.29E-02	0.0E+00
2	Sr-90	0.0E+00	3000	0.0E+00	1.94E-02	0.0E+00
3	Ru-106	0.0E+00	3000	0.0E+00	9.26E-03	0.0E+00
4	Cs-137	0.0E+00	3000	0.0E+00	1.06E-02	0.0E+00
5	Pu-239/240	0.0E+00	3000	0.0E+00	3.85E+00	0.0E+00
TOTAL DOSE						0.0E+00

Method Used to Project Dose: CAP-88 Dose Estimate. Location to the Individual at the Hanford Site Boundary 9900 Meters West. Eight-nine Meter Stack Height Assumed. Reference: WHC-EP-0498, Table C-7
Certain data from Revision 1 to CAPDR.WR1, December 1991, P.D. Rittman.

Comments: This exhaust fan has not operated since September 1990. It was de-energized as part of N Reactor lay-up. The stack has not been removed or physically isolated from the environment.

Evaluator: B. L. Curn, EEM

Date: 12/21/93

Reviewed: M. R. Morton, D&D
Environmental Compliance Officer

Date: 12/22/93

Approved: R. J. Giviera, D&D
N Reactor Manager

Date: 12.22.93

STACK ASSESSMENT FOR
40 CFR 61, SUBPART H

BACK CALCULATION (3000**n) SOURCE ASSESSMENT

FACILITY: K-BASINS

DISCHARGE POINT: 105-KE

NUMBER OF HEPA FILTER BANKS (n): 0

BACK CALCULATION FACTOR (BCF): 1

Annual Air Emissions Report: 1992

Item	Radionuclide	Release (Ci)	BCF	Potential Release (Ci)	Dose Factor (mr/Ci)	Projected Dose (mr/yr)
1	Co-60	1.3E-06	1	1.3E-06	4.28E-02	5.6E-08
2	Sr-90	1.6E-04	1	1.6E-04	6.45E-02	1.0E-05
3	Ru-106	1.3E-05	1	1.3E-05	3.08E-02	4.0E-07
4	Sb-125	1.1E-05	1	1.1E-05	6.13E-03	6.7E-08
5	Cs-137	2.3E-04	1	2.3E-04	3.53E-02	8.1E-06
6	Pu-238	1.3E-06	1	1.3E-06	1.18E+01	1.5E-05
7	Pu-239/240	8.5E-06	1	8.5E-06	1.28E+01	1.1E-04
8	Pu-241	3.9E-05	1	3.9E-05	2.03E-01	7.9E-06
9	Am-241	5.1E-06	1	5.1E-06	1.94E+01	9.9E-05
TOTAL DOSE						2.5E-04

Method Used to Project Dose: CAP-88 Dose Estimate. Location to the
Individual at the Hanford Site Boundary 9900 Meters West. Ten Meter
Stack Height Assumed. Reference: WHC-EP-0498, Table C-7
Certain data from Revision 1 to CAPDR.WR1, December 1991, P.D. Rittman.

Comments: None

Evaluator: R.G. Gant

Date: 11-15-93

Reviewed: B.L. Curn, EEM

J.P. Schmidt, ECO, K Basins

J.E. Truax, Manager, K Basins

STACK ASSESSMENT FOR
40 CFR 61, SUBPART H

BACK CALCULATION (3000**n) SOURCE ASSESSMENT

FACILITY: K-BASINS

DISCHARGE POINT: 105-KW

NUMBER OF HEPA FILTER BANKS (n): 0
BACK CALCULATION FACTOR (BCF): 1

Annual Air Emissions Report: 1992

Item	Radionuclide	Release (Ci)	BCF	Potential Release (Ci)	Dose Factor (mr/Ci)	Projected Dose (mr/yr)
1	Co-60	1.4E-06	1	1.4E-06	4.28E-02	6.0E-08
2	Sr-90	9.9E-07	1	9.9E-07	6.45E-02	6.4E-08
3	Ru-106	6.2E-06	1	6.2E-06	3.08E-02	1.9E-07
4	Cs-137	2.7E-05	1	2.7E-05	3.53E-02	9.5E-07
5	Eu-154	4.9E-06	1	4.9E-06	2.69E-02	1.3E-07
6	Pu-238	3.0E-08	1	3.0E-08	1.18E+01	3.5E-07
7	Pu-239/240	1.8E-07	1	1.8E-07	1.28E+01	2.3E-06
TOTAL DOSE						4.1E-06

Method Used to Project Dose: CAP-88 Dose Estimate. Location to the
Individual at the Hanford Site Boundary 9900 Meters West. Ten Meter
Stack Height Assumed. Reference: WHC-EP-0498, Table C-7
Certain data from Revision 1 to CAPDR.WR1, December 1991, P.D. Rittman.

Comments: None

Evaluator: R.G. Gant

Date:

11/15/93

Reviewed: B.L. Curn, EEM

J.P. Schmidt, ECO, K Basins

J.E. Truax, Manager, K Basins

STACK ASSESSMENT FOR
40 CFR 61, SUBPART H

BACK CALCULATION (3000**n) SOURCE ASSESSMENT

FACILITY: K-BASINS

DISCHARGE POINT: 1706-KE

NUMBER OF HEPA FILTER BANKS (n): 1
BACK CALCULATION FACTOR (BCF): 3000

Annual Air Emissions Report: 1992

Item	Radionuclide	Release (Ci)	BCF	Potential Release (Ci)	Dose Factor (mr/Ci)	Projected Dose (mr/yr)
1	Sr-90	1.0E-07	3000	3.0E-04	6.45E-02	1.9E-05
2	Ru-106	6.2E-08	3000	1.9E-04	3.08E-02	5.7E-06
3	Pu-238	4.5E-10	3000	1.4E-06	1.18E+01	1.6E-05
4	Pu-239/240	2.5E-09	3000	7.5E-06	1.28E+01	9.6E-05
TOTAL DOSE						1.4E-04

Method Used to Project Dose: CAP-88 Dose Estimate. Location to the
Individual at the Hanford Site Boundary 9900 Meters West. Ten Meter
Stack Height Assumed. Reference: WHC-EP-0498, Table C-7
Certain data from Revision 1 to CAPDR.WR1, December 1991, P.D. Rittman.

Comments: None

Evaluator: R.G. Gant

Date: 11/15/93

Reviewed: B.L. Curn, EEM

J.P. Schmidt, ECO, K Basins

11/15/93

J.E. Truax, Manager, K Basins

11/15/93

STACK ASSESSMENT FOR
40 CFR 61, SUBPART H

BACK CALCULATION (3000**n) SOURCE ASSESSMENT

FACILITY: K-BASINS

DISCHARGE POINT: 1706-KER

NUMBER OF HEPA FILTER BANKS (n): 1
BACK CALCULATION FACTOR (BCF): 3000

Annual Air Emissions Report: 1991

Item	Radionuclide	Release (Ci)	BCF	Potential Release (Ci)	Dose Factor (mr/Ci)	Projected Dose (mr/yr)
1	Sr-90	1.9E-08	3000	5.7E-05	6.45E-02	3.7E-06
2	Ru-106	2.4E-06	3000	7.2E-03	3.08E-02	2.2E-04
3	Cs-134	1.8E-07	3000	5.4E-04	4.62E-02	2.5E-05
4	Pu-238	4.2E-10	3000	1.3E-06	1.18E+01	1.5E-05
5	Pu-239/240	2.4E-09	3000	7.2E-06	1.28E+01	9.2E-05

TOTAL DOSE

3.6E-04

Method Used to Project Dose: CAP-88 Dose Estimate. Location to the
Individual at the Hanford Site Boundary 9900 Meters West. Ten Meter
Stack Height Assumed. Reference: WHC-EP-0498, Table C-7
Certain data from Revision 1 to CAPDR.WR1, December 1991, P.D. Rittman.

Comments: Did not operate in 1992

Evaluator: R.G. Gant

Date: 11/15/93

Reviewed: B.L. Curn, EEM

J.P. Schmidt, ECO, K Basins

11/15/93

J.E. Truax, Manager, K Basins

11/15/93

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APPENDIX B

DESIGNATED STACKS DESCRIPTIONS

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B1.0 DESIGNATED STACKS DESCRIPTIONS

The following is a brief description of the source terms for these stacks, the description of the stacks, and their sampling monitoring systems.

B1.1 291-A-1

The source term used in the CAP88 model for predicting the potential dose for the 291-A-1 stack was derived using the back calculation method. Applying the release factors from Appendix D would also indicate that this stack would require continuous monitoring because of the contamination inventory. Nondestructive assessment (NDA) was not applied because of difficulties in applying NDA to all of the high-efficiency particulate air (HEPA) filters that were upstream of the stack. Air sampling would also be difficult because of the multiple areas that would need to be sampled.

A description of the 291-A-1 stack and sampling/monitoring system is provided in the *Facility Effluent Monitoring Plan for the Plutonium-Uranium Extraction Facility* (Thompson and Sontag 1991) and a comparison of the sampling/monitoring system provided by *PUREX Plant Comparison with 40 CFR 61, Subpart H, and Other Referenced Guidelines for Stack 291-A-1* (Greger et al. 1992). Both documents point out that the monitoring system is in compliance, except that the 291-A-1 flow meter was not certified. Since these documents were written, the 291-A-1 flow meter has been certified (1993) and the stack sampling/monitoring system is in compliance with the requirements in 40 CFR Part 61, Subpart H.

The 61-m (200-ft) stack is located south of the PUREX. The average flow rate is between 28 and 61 m³/s (6×10^4 and 1.3×10^5 ft³/minute).

The sampling is provided by two ANSI N13.1 (ANSI 1969) sample probes at the 60- and 74-ft level of the stack.

B1.2 296-A-1

Back calculations were used to estimate the potential emission from the 296-A-1 stack. Based on these emissions the resulting dose would exceed 0.1 mrem/yr. In addition, emissions-based release factors from Appendix D would also identify this stack as requiring continuous monitoring. Upstream air concentration measurements would be difficult for this facility because multiple measurements would be required to reach a point upstream of the HEPA filters in the hoods. For the same reason, NDA would be difficult for this stack. Note: the back calculation method for this stack indicates a total of 2.8×10^5 Ci. The contamination sources for the 296-A-1 stack are from the product removal room and its hoods, "N" and "Q" cells. These source areas have approximately 14,000 Ci of contamination, which is an order of magnitude less than the back calculation estimate.

The PUREX product removal (296-A-1) stack was newly identified as requiring continuous monitoring. A description of the 296-A-1 stack and sampling/monitoring system is provided in the *Facility Effluent Monitoring*

Plan for the Plutonium-Uranium Extraction Facility (Thompson and Sontag 1991). A document is being prepared to compare the stack sampling/monitoring system with 40 CFR 61, Subpart H, and other referenced guidelines.

The 296-A-1 stack is located on the north side of the northwest corner of PUREX. The average flow rate of the stack is $2.0 \text{ m}^3/\text{s}$ ($4,300 \text{ ft}^3/\text{min}$).

Sampling is provided by a probe located at the 14 m (46 ft) level of the stack.

B1.3 291-B-1

The back calculation method was used to perform the assessment on the 291-B-1 stack emissions. None of the other methods were employed because they were impractical. No source term is readily identifiable and the HEPA filters are too contaminated to allow NDA. Upstream air sampling was not considered representative of air emissions.

The sources for the 291-B-1 stack are the 221-B Canyon, the 221-B process cells and vessels, and the sealed 224-B process vessels. Because processing is no longer taking place in either 221-B or 224-B process vessels, the inventory is mainly residual contamination from previous productions campaigns.

Descriptions of the 291-B-1 stack and sampling/monitoring system are provided in the *Facility Effluent Monitoring Plan for B Plant* (Peterson and Daubert 1991) and the *Technical Information Package on the 291-B-1 Stack* (Beam 1994). A point-by-point comparison of the sampling/monitoring system with ANSI N13.1 (1969) standards and other regulations is provided in the *B Plant Comparison with 40 CFR 61, Subpart H, and Other Referenced Guidelines for Stack 291-B-1* (Sowa et al. 1992).¹

Flow testing to determine whether flow measurements being made by the monitoring system are accurate was completed in February 1994. A request is currently being made to the EPA for approval of the sampling/monitoring system as compliant with 40 CFR 61, Subpart H.

The 61-m (200-ft) stack is located south of B Plant and has an average flow rate of between 14 and $21 \text{ m}^3/\text{s}$ (3×10^4 and $4 \times 10^4 \text{ ft}^3/\text{min}$). Sampling is provided by a sample probe assembly located at approximately the 15 m (50-ft) level of the stack.

B1.4 296-A-17

Release factors from Appendix D were used to assess the Tank Farm stacks. The reason for this is that during the time the assessments were being performed a work stand down was in place.

¹Technical Information Package has been externally released as a supporting document, WHC-SD-WM-ER-307, March 1994, T. G. Beam.

The 296-A-17 stack serves the 241-A-702 primary ventilation system four, double-shell (DST) 1-Mgal tanks in the 241-AZ Tank Farms. The 241-A-702 system provides containment of radionuclides, removal of decay heat from radionuclides, and removal of water vapor evaporating from the liquid waste. The 241-AZ Tank Farms (two tanks in each farm) are located in the 200 East Area, northeast of the PUREX facility.

The 241-A-702 system serves as primary ventilation for these tanks. The 241-AX-152 diverter station, the 241-AZ-151 catch tank, and the 241-AZ-154 catch tank are also ventilated via this system. The ventilation system includes three condensers operating in parallel, two deentrainers, a steam air heater, six parallel pairs of HEPA filter assemblies (each with two sets in series), and two exhaust fans feeding the 296-A-17 stack.

The 15.2 m (50-ft) stack is 46 cm (18 in.) in diameter with exhaust powered by the one of two fans that are rated each at $1.9 \text{ m}^3 \text{ s}^{-1}$ ($4 \times 10^3 \text{ ft}^3/\text{min}$). The sampler probe is located 200 cm (79 in.) above the fan inlet to stack but only 91 cm (36 in.) above the flow recirculation duct loop. It is also 74 cm (29 in.) below the ceiling of the building. Another 160 cm (64 in.) above the roof there is a single port (open, not threaded) to take flow measurements.

B1.5 296-A-22

Release factors from Appendix D were used to assess the Tank Farm stacks. The reason for this is that during the time the assessments were being performed a work standdown was in place.

The 296-A-22 stack system (Crummel et al. 1992b) ventilates the 242-A Evaporator vessel and associated equipment. The 242-A Evaporator is located to the south of the AZ Tank Farm facility in the 200 East Area.

The 242-A Evaporator is used to remove water from the nonboiling, high-level liquid waste primarily from adjacent tank farms, principally the 241-AW Tank Farm. Concentrated waste is returned to DSTs in the 200 East Area.

The 296-A-22 stack serves as the exhaust point for the 242-A vacuum condenser after it is routed through three condensers in series, a deentrainer system, a prefilter/demister system, a heater, and two HEPA filters in series. Also ventilated through this system is the process condensate collection tank.

The stack is an 20-cm- (8-in.-) diameter circular stack that begins on the third level of the condenser room (220 m [722.5 ft] msl and 9.3 m [30.5 ft] above ground level) above the exhaust fan. At 0.9 m (3 ft) above this floor the stack has flared out to its 20-cm (8-in.) circular diameter. The sampling port is 4 m (13 ft) above the third level floor of the condenser room. At a height of 14.7 m (48.2 ft) above ground level or 5.4 m (17.8 ft) above the third level of the condenser room, the stack makes a 90° turn through the building exterior wall. Once outside, it makes another 90° turn to a vertical position and terminates at a height of 18.7 m (61.5 ft) above ground level, i.e., 9.4 m (31 ft) above the third floor of the condenser room.

B1.6 296-A-27

Release factors from Appendix D were used to assess the Tank Farm stacks. The reason for this is that during the time the assessments were being performed a work stand down was in place.

The 296-A-27 stack system (Crummel et al. 1991) ventilates six, 1-Mgal DSTs in the 241-AW Tank Farm. The 241-AW Tank Farm is located just south of the 242-A Evaporator in the 200 East Area.

The primary ventilation system consists of a deentrainer system for removal of moisture from vented air, an electric heater for lowering the relative humidity of the vented air, a prefilter system for reducing the number of large particles that load the filter system, and a two-stage HEPA filter system. The primary exhaust system has an automatic switchover to a backup system if the primary system fails. Each 241-AW tank exhausted through independent 12-in. steel pipelines running to the central exhaust station.

The 4.8-m (15.75-ft) stack has a 25.4-cm (10-in.) diameter. The exhaust is powered by two fans rated each at $0.5 \text{ m}^3\text{s}^{-1}$ (1,000 ft³/min). The two fans can be operated together if additional vacuum is required.

The sample probe for the record sampler is 1.8 diameters below the top probe, which is sampling for the CAM. The top probe is 4.5 diameters from the top of the stack.

B1.7 296-A-29

Release factors from Appendix D were used to assess the Tank Farm stacks. The reason for this is that during the time the assessments were being performed a work standdown was in place.

The 296-A-29 stack system (Crummel et al. 1991) ventilates seven, 1-Mgal DSTs in the 241-AN Tank Farm. The 241-AN Tank Farm is located near the intersection of Canton Avenue and 7th Street in the 200 East Area.

The primary ventilation system consists of a deentrainer system for removal of moisture from vented air, an electric heater for lowering the relative humidity of the vented air, a prefilter system for reducing the number of large particles that load the filter system, and a two-stage HEPA filter system. The primary exhaust system has an automatic switchover to a backup system if the primary system fails. Each 241-AN tank exhausted through 0.3-m (1-ft) steel pipes, which travel underground to the central exhaust station.

The 4.5-m (14.9-ft) circular stack has a 25.4-cm (10-in.) diameter. Exhaust is provided by one of the two fans, which are rated at $0.28 \text{ m}^3\text{s}^{-1}$ (600 stdft³/min at 70 °F).

The sampler probe for the record sampler is the bottom probe, which is 1.6 diameters below the top probe. The top probe is sampling for the CAM. The top probe is 4.5 diameters from the top of the stack.

B1.8 296-A-40

Release factors from Appendix D were used to assess the Tank Farm stacks. The reason for this is that during the time the assessments were being performed a work standdown was in place.

The 296-A-40 stack system (Crummel et al. 1992a) ventilates eight, 1-Mgal DSTs in the 241-AP Tank Farm. The 241-AP Tank Farm is located northeast of the PUREX Plant.

The primary ventilation system consists of a deentrainer system for removal of moisture from vented air, an electric heater for lowering the relative humidity of the vented air, a prefilter system for reducing the number of large particles that load the filter system, and a two-stage HEPA filter system. The primary exhaust system has an automatic switchover to a backup system if the primary system fails.

Each 241-AP tank exhausted through 0.3-m (1-ft) steel pipes and combined into a common 0.3-m- (12-in.-) diameter duct. This duct passes underground to the central exhaust station and feeds parallel deentrainers, heaters, prefilters, and HEPA filter assemblies in series with blower systems.

The 4-m (13.25-ft) circular stack has a 25.4-cm (10-in.) circular diameter. The stack is exhausted by one of the two fans, which are rated at $0.6 \text{ m}^3/\text{s}$ ($1,170 \text{ stdft}^3/\text{min}$ at 70°F). The sample probe is located 51 cm (20 in.) below the top of the stack.

B1.9 296-P-16

Release factors from Appendix D were used to assess the Tank Farm stacks. The reason for this is that during the time the assessments were being performed a work standdown was in place.

The 296-P-16 portable exhauster and stack system ventilates tanks 241-C-105, 241-C-106, and indirectly through a cascade effect, 241-C-104 in the 241-C Tank Farm. The 241-C Tank Farm is located north of the PUREX plant in the 200 East Area.

The 241-C Tank Farm contains single-shelled tanks, which first received waste in 1943. Tanks 104, 105, and 106 each have a fill volume of 0.5 Mgal.

The ventilation system for tanks 104, 105, and 106 consists of two exhaust heaters, a prefilter, two HEPA filters, and the 296-P-16 portable exhauster. The stack is exhausted by a single fan rated at $3.3 \text{ m}^3/\text{s}$ ($7,000 \text{ ft}^3/\text{min}$ at 70°F).

The 3-m (10-ft) circular stack has a 41-cm (16-in.) diameter. The sample probe is located 0.9 m (3 ft) below the top of the stack.

B1.10 296-P-23

Release factors from Appendix D were used to assess the Tank Farm stacks. The reason for this is that during the time the assessments were being performed a work standdown was in place.

The 296-P-23 stack system ventilates the three, 1-Mgal DSTs in the 241-SY Tank Farm. The 241-SY Tank Farm is located south of the Plutonium Finishing Plant in the 200 West Area.

The primary ventilation system connects to the tanks through 12-in. risers that run independently to the exhaust system. Manually operated butterfly valves control airflow to each of the three tanks. The exhaust system consists of one deentrainer system, one heater system, two prefilters, two HEPA filters, and one blower system. The 296-P-23 tank exhaust system relies on a portable exhaust system, 296-P-28, as backup.

The circular 3.4-m (11-ft) stack has a 20-cm (8-in.) circular diameter. The sampler probe assembly enters the stack 46 cm (18 in.) below the top of the stack. The exhaust is provided by one fan rated at $0.33 \text{ m}^3\text{s}^{-1}$ (700 ft³/min at 200 °F).

B1.11 296-S-15

Release factors from Appendix D were used to assess the Tank Farm stacks. The reason for this is that during the time the assessments were being performed a work standdown was in place.

The 296-S-15 stack system ventilates 241-SX Tank Farm, tanks 101 through 112 and 114, providing containment of radiological materials, and removal of heat and vapor. The 241-SX Tank Farm is located south of the Plutonium Finishing Plant in the 200 West Area.

The 241-SX tanks are single-shelled tanks, first used to contain waste in 1953. The tanks ventilated by the 296-S-15 stack system are each 1 Mgal.

Inlet air enters the ventilation system through heater/prefilter/HEPA filter units at tanks 107 through 112 and 114. This air is exhausted through vent lines in each of these tanks through deentrainer/heater/prefilter/HEPA filters/blowers and stack 296-S-15. Tanks 101 through 106 have no air inlet system but are maintained at negative pressure through a connection to the ventilation system at tank 109.

The 4.6-m (15-ft) stack has a 107-cm (42-in.) diameter. The sample probe is located at 1.4 m (4.5 ft) from the top of the stack. The stack is exhausted by one of the two fans, which are rated at $2.9 \text{ m}^3\text{s}^{-1}$ (6,100 ft³/min).

B1.12 296-S-7W

Release factors from Appendix D were used to estimate potential emissions from the 296-S-7W stack. Upstream air sampling will be taken to confirm the

designation of the stack. NDA could not be performed on the stack because of problems with gaining access to the HEPA filters.

The potential source for this stack is plutonium oxide contamination. Approximately 1,140 grams of plutonium oxide contamination were inventoried in this facility. A fixative has been applied to reduce the smearable contamination. After the fixative had been applied, a later survey indicated approximately 400 grams were smearable.

The Plutonium Concentration Facility (233-S Building) areas that are exhausted include the product removal can loadout room, control and equipment rooms, pipe gallery, and the process and viewing room. Nearly all of the potential source for offsite contamination resides in the process area. Exhaust ductwork ventilates all of these areas to the nearby filterhouse building (233-SA). The filterhouse is divided into a west (primary) and east (backup) filter bank, each consisting of roughing filter and dual HEPA filtration. The existing monitoring system for the west (296-7-SW stack) and east (296-S-7E stack) filter banks consists of a common alpha CAM and record sampler, both of which are switched to the operating and inactive fans. The monitoring upgrade is expected to be installed and tested (pending the stack redesignation based on the upstream monitoring results) by April 1995 when the stack sampling/monitoring systems will be in compliance with the requirements in 40 CFR Part 61, Subpart H.

The 9.1-m (30-ft) stack with a 61-cm (24-in.) diameter is located on the north side of the 233-SA Facility. The sample probe is located at the 3.7-m (12-ft) level in the stack. The average flow rate through the 296-S-7W stack is $4.2 \text{ m}^3/\text{s}$ ($9,000 \text{ ft}^3/\text{min}$).

B1.13 291-Z-1

Release factors from Appendix D were used to estimate a potential source term for the 291-Z-1 stack. Back calculations for this stack would also yield a source term that would cause a dose that would exceed the 0.1-mrem/yr NESHAP requirement. NDA is difficult to perform because of the numerous HEPA filters upstream from the final HEPA filters. For the same reason, upstream air sampling would be difficult for this stack. To properly sample, upstream measurements would have to be taken in hoods and process cells.

A description of the 291-Z-1 stack and sampling/monitoring system is provided in the *Facility Effluent Monitoring Plan for the Plutonium Finishing Plant* (Garner and Moeller 1991) and a comparison of the sampling/monitoring system is provided by *Plutonium Finishing Plant Comparison with 40 CFR 61, Subpart H, and Other Referenced Guidelines for Stack 291-Z-1* (Kristofzski et al. 1991). Since these documents were written, the 291-Z-1 is upgrading the monitoring system by moving the stack flow measurement site. The flow measurement equipment is expected to be installed and tested by April 1995 when the stack sampling/monitoring system will be in compliance with the requirements in 40 CFR Part 61, Subpart H.

The 61-m (200-ft) stack is located south of the Plutonium Finishing Plant. The average flow rate is $1.2 \times 10^2 \text{ m}^3/\text{s}$ ($2.5 \times 10^5 \text{ ft}^3/\text{min}$ with a standard deviation of $3.7 \times 10^3 \text{ ft}^3/\text{min}$).

The sampling is provided by ANSI N13.1 (1969) sample probes at the 15.2-m (50-ft) level of the stack.

B1.14 296-Z-3

Back calculations were used to estimate the potential emissions from the 296-Z-3 stack. Both back calculations and release factors from Appendix D calculations would produce emissions that could cause a dose that would exceed the 0.1 mrem/yr. NDA was not attempted because alpha emissions would not be properly represented. Also the HEPA filter configuration would not allow easy access. Upstream air sampling was not performed because of the difficulty in making measurements.

A description of the 291-Z-3 stack and sampling/monitoring system is provided in the *Facility Effluent Monitoring Plan Determinations for the 200 Area Facilities* (Nickels 1991).

The 7.3-m- (24-ft-), 36-cm- (14-in.-) diameter stack is located south of the Plutonium Finishing Plant. The average flow rate is $1.1 \times 10^3 \text{ m}^3 \text{ s}^{-1}$ (2,337 ft³/min) with a standard deviation of $1 \times 10^{-1} \text{ m}^3 \text{ s}^{-1}$ (220 ft³/min).

Sampling is provided by a sample probe at the 6-m (20-ft) level of the stack.

B1.15 308-GL-EX

Release factors from Appendix D were used to estimate the potential emissions from 308-GL-EX stack. Because this stack is to be removed from service in early 1994, no other method was applied.

The potential sources for this stack is contamination in the Main Process Building of approximately 374 g plutonium in gloveboxes and confinement hoods and 21 g plutonium in the air ducting. In addition, approximately 4 kg of depleted uranium oxide powder remains within the process equipment, which is ventilated to the gloveboxes.

This stack discharged to the atmosphere through a rectangular duct on the east side of the 308 Building. The stack was exhausted by one of two fans, which have a volume flow rate of $1.6 \text{ m}^3 \text{ s}^{-1}$ (3,300 ft³/min) for the EF-4 exhaust fan, or $1.63 \text{ m}^3 \text{ s}^{-1}$ (3,465 ft³/min) for the EF-5 exhaust fan.

This stack was blanked off on March 1, 1994.

B1.16 340-NT-EX

The 340 Facility serves as a radioactive/mixed liquid waste handling facility servicing the laboratories of the Pacific Northwest Laboratory (PNL), located in the 300 Area. Waste is received at the facility from these laboratories via the Radioactive Liquid Waste System (RLWS), an underground pipeline. The facility accumulates, stores, and ships this waste via rail tankers to the DSTs.

The RLWS is essentially a gravity-drain sewer system that drains to the 340 Facility via a network of piping that interconnects the PNL laboratories. Access to the RLWS is via concrete valve boxes that are located in various parts of the 300 Area. These valve boxes each contain isolation valves, sumps, and a leak detector alarm system for the sumps and piping encasement.

Once the waste reaches the 340 Facility, it is usually stored in one of two 56,781-L (15,000-gal) stainless steel tanks, located below ground east of the 340 Building. Each of these tanks is equipped with agitators to homogenize the waste, and pumps to transfer the waste to another storage tank or to a railcar. Additional storage, if needed, is provided by six, 30,283-L (8,000-gal) aboveground tanks located in the 340-A Building. These tanks gravity drain back into the 56,781-L (15,000-gal) tanks.

The 340 Facility is an interim storage (less than 90-day) facility. Therefore, only one, 56,781-L (15,000-gal) tank is receiving waste at any time. When the end of the 90-day period is approaching, the receiving tank is isolated and samples are taken for analysis. The other tank then begins collecting waste. When sample results are obtained, load calculations are performed and the sampled tank is pumped into a railcar that is staged in the 340-B East Building. The railcar is transported to 204-AR, the unloading facility, where the waste is pumped to a DST.

The storage tank system is ventilated through an exhaust system. This exhaust system uses blowers that provide 1 in. of negative water gauge pressure inside the vault and 5 in. of negative water gauge pressure inside all the tanks. The current volume of air passed out the vault stack is a constant $0.85 \text{ m}^3\text{s}^{-1}$ (1,800 ft³/min.)

The current stack system (Berneski et al. 1992; Nickels et al. 1991) consists of an in-air supply fan at the south end of the vault, and two alternating blowers at the base of the stack, which create the airflow within the RLWS system. The stack is made of 46-cm- (18-in.-) diameter Schedule 55, 304 stainless steel.

The stack monitoring system uses a multipoint isokinetic probe to collect the exhaust flow that is split into three streams used in record sampling, alpha CAM, and the beta/gamma-radioiodine CAMs. The probe is located approximately 0.9 m (3 ft) from the top of the 5.5-m (18-ft) stack. This sampling system uses ~21 m (70 ft) of piping before a sample is collected.

Project 94C-EWW-337 will upgrade this monitoring system to meet current ANSI and NESHAP standards by locating a new monitoring system at the stack and using a new probe and piping system. Additionally, a new vacuum pump system will be installed. All piping will be routed to a new instrument cabinet at the base of the stack, and have only one 90° bend. CAMs will be located on the stack itself, with remote heads, and associated instrumentation and alarms located in the 340 control room.

This project is currently on schedule, and will be complete by December 31, 1994.

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APPENDIX C

UNREGISTERED WHC STACKS (POWERED EXHAUST)

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UNREGISTERED WHC STACKS (POWERED EXHAUST)
(as of 4/30/94)

100 Areas	200 East Area	200 West Area	300 Area	400 Area
105-N 14-ft Decontamination Room 105-N Transfer Area 107-N 1706-KEL	296-B-12 296-B-22 through 27 296-P-26 296-P-35	296-P-28 296-S-23 296-T-7 296-U-11 224-UA Building (6 roof exhausters for calciner cells; one primary bag room roof exhauster) 224-U Building (10 roof exhausters)	304-CON-EX 308-PK-EX 309-PR-TR 309-RTF-EX 340-B-BLDG 340-DECON	437-1-61 (MASF)

Total Unregistered WHC Stacks: 39

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DATE

FILMED

7/21/94

END