8

Radioactive Air Emissions Notice of Construction for Reactivation of the PUREX Storage Tunnel Number 2

**United States
Department of Energy**
Richland, Washington

Approved for Public Release

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Radioactive Air Emissions Notice of Construction for
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TERMS

1	
2	
3	
4	ALARACT
5	as low as reasonably achievable control technology
6	ANSI
7	American National Standards Institute
8	AMSE
9	American Society of Mechanical Engineers
10	APQ
11	annual possession quantity
12	
13	BARCT
14	best available radionuclide control technology
15	
16	Ci
17	curie
18	
19	DOE-RL
20	U.S. Department of Energy, Richland Operations Office
21	
22	EPA
23	U.S. Environmental Protection Agency
24	
25	HEPA
26	high-efficiency particulate air
27	
28	KCi
29	thousand curies
30	
31	MCi
32	million curies
33	MEI
34	maximally exposed individual
35	mrem
36	millirem
37	
38	NDA
39	nondestructive analysis
40	NOC
41	notice of construction
42	
43	PTE
44	potential-to-emit
45	PUREX
46	plutonium-uranium extraction (Plant)
47	
48	SEPA
49	State Environmental Policy Act
50	SWDB
51	22-ton steel waste disposal box
52	
53	TEDE
54	total effective dose equivalent
55	
56	WAC
57	Washington Administrative Code
58	WDOH
59	Washington State Department of Health

METRIC CONVERSION CHART

Into metric units

Out of metric units

If you know	Multiply by	To get	If you know	Multiply by	To get
Length			Length		
inches	25.40	millimeters	millimeters	0.0393	inches
inches	2.54	centimeters	centimeters	0.393	inches
feet	0.3048	meters	meters	3.2808	feet
yards	0.914	meters	meters	1.09	yards
miles	1.609	kilometers	kilometers	0.62	miles
Area			Area		
square inches	6.4516	square centimeters	square centimeters	0.155	square inches
square feet	0.092	square meters	square meters	10.7639	square feet
square yards	0.836	square meters	square meters	1.20	square yards
square miles	2.59	square kilometers	square kilometers	0.39	square miles
acres	0.404	hectares	hectares	2.471	acres
Mass (weight)			Mass (weight)		
ounces	28.35	grams	grams	0.0352	ounces
pounds	0.453	kilograms	kilograms	2.2046	pounds
short ton	0.907	metric ton	metric ton	1.10	short ton
Volume			Volume		
fluid ounces	29.57	milliliters	milliliters	0.03	fluid ounces
quarts	0.95	liters	liters	1.057	quarts
gallons	3.79	liters	liters	0.26	gallons
cubic feet	0.03	cubic meters	cubic meters	35.3147	cubic feet
cubic yards	0.76456	cubic meters	cubic meters	1.308	cubic yards
Temperature			Temperature		
Fahrenheit	subtract 32 then multiply by 5/9ths	Celsius	Celsius	multiply by 9/5ths, then add 32	Fahrenheit
Force			Force		
pounds per square inch	6.895	kilopascals	kilopascals	1.4504 x 10 ⁻⁴	pounds per square inch

Source: *Engineering Unit Conversions*, M. R. Lindeburg, PE., Second Ed., 1990, Professional Publications, Inc., Belmont, California.

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**RADIOACTIVE AIR EMISSIONS
NOTICE OF CONSTRUCTION FOR
REACTIVATION OF THE PUREX STORAGE TUNNEL NUMBER 2**

INTRODUCTION

The Plutonium-Uranium Extraction (PUREX) Plant Storage Tunnel Number 2 (hereafter referred to as the PUREX Tunnel) was built in 1964. Since that time, the PUREX Tunnel has been used for storage of radioactive and mixed waste. In 1991, the PUREX Plant ceased operations and was transitioned to deactivation. The PUREX Tunnel continued to receive PUREX Plant waste material for storage during transition activities. Before 1995, a decision was made to store radioactive and mixed waste in the PUREX Tunnel generated from other onsite sources, on a case-by-case basis.

This notice of construction (NOC) describes the activities associated with the reactivation of the PUREX Tunnel ventilation system and the transfer of up to 3.5 million curies (MCi) of radioactive waste to the PUREX Tunnel from any location on the Hanford Site.

The unabated total effective dose equivalent (TEDE) estimated for the hypothetical offsite maximally exposed individual (MEI) is 5.6 E-2 millirem (mrem). The abated TEDE conservatively is estimated to account for 1.9 E-5 mrem to the MEI.

The following text provides information requirements of Appendix A of Washington Administrative Code (WAC) 246-247 (requirements 1 through 18).

1.0 LOCATION

Name and address of the facility, and location (latitude and longitude) of the emission unit:

U.S. Department of Energy, Richland Operations Office
Hanford Site,
Richland, Washington

PUREX Storage Tunnel Number 2, 200 East Area
Latitude: 46° 32' 53" N
Longitude: 119° 31' 2" W

Figure 1 shows the location of the PUREX Tunnel within the 200 East Area. The exhaust stack is identified as 296-A-10.

200 East Area

H99050176.1

Figure 1. Location of 296-A-10 Stack in the 200 East Area.

2.0 RESPONSIBLE MANAGER

Name, title, address and phone number of the responsible manager:

Mr. L. D. Romine, Director,
Transition Program Division
U.S. Department of Energy, Richland Operations Office
P.O. Box 550
Richland, Washington 99352
509-376-4747

3.0 PROPOSED ACTIONS

Identify the type and proposed action for which this application is submitted.

The proposed action is considered an insignificant modification to an emission unit (296-A-10).

3.1 CURRENT STATUS OF PUREX STORAGE TUNNEL NUMBER 2

An initial NOC (DOE-RL-95-95) for the transfer of waste from the 324 Building to the PUREX Tunnel was approved by Washington State Department of Health (WDOH) on December 4, 1995 (AIR-95-120) and by the U.S. Environmental Protection Agency (EPA), Region 10, on December 6, 1995 (EPA 1995).

A subsequent NOC for the addition of liquid waste tank cars and 325 Building waste to the PUREX Tunnel (96-EAP-111) was approved by the EPA on May 28, 1996 (EPA 1996) and by WDOH on June 7, 1996 (AIR-96-603).

The approvals allowed for the transfer of waste, contaminated with up to 2 MCi of radioactive material, from the 324 Building to the PUREX Tunnel. The 296-A-10 Stack was allowed to operate as a minor stack, with the following conditions:

- Nondestructive analysis (NDA) of the high-efficiency particulate air (HEPA) filter on the tunnel exhaustor was to be completed before placement of the waste in the tunnel, as a baseline for determination of filter loading after the placement was completed.
- The tunnel exhaustor and existing emissions sampling equipment were to be operated continuously for a minimum of 6 months after placement of the waste.
- A repeat NDA of the HEPA filter was to be performed at the end of the 6-month period, and compared to the previous analysis.
- Stack sample analysis was to include monthly total alpha/beta analysis, and quarterly composites of alpha spectrometry, strontium 90 analysis, and high-resolution gamma spectrometry.
- A final condition was that sample results and offsite dose modeling were to be sent to EPA and WDOH at the conclusion of the mandatory 6-month period.

The sampling results and the dose modeling report (97-EAP-225) were provided to WDOH and EPA to comply with the approval conditions. The 296-A-10 Stack was shut down, deactivated, and blanked off.

A report of closure was filed with WDOH; however, the stack was closed in a manner that was reversible. The 296-A-10 Stack remained listed as inactive in the Air Operating Permit application (DOE/RL-95-07), with the intent to reactivate the stack for future transfers of additional radioactive and/or mixed waste.

3.2 AGREEMENT REACHED AT OCTOBER 28, 1997 MEETING

At a meeting on October 28, 1997, WDOH agreed that the PUREX Tunnel stack would remain a minor stack for the future addition of up to 3.5 MCi of radioactive waste. The approval was given with the condition that the sampling system would be upgraded before reactivating the stack and placing the 3.5 MCi of waste in the tunnel. In addition, the NOC application that would be submitted would need to clearly demonstrate that the potential-to-emit (PTE) would remain below 0.1 mrem per year to the MEI.

3.3 AGREEMENT REACHED AT AUGUST 17, 1999 ROUTINE TECHNICAL ASSISTANCE MEETING

At the Routine Technical Assistance Meeting held on August 17, 1999, the use of NDA for periodic confirmatory measurements was discussed as an alternative to upgrading the sampling system. WDOH agreed to review the approach, but stated that a cost/benefit evaluation must be provided. The cost/benefit evaluation was provided at the September 8, 1999 meeting, and is attached as Appendix A.

3.4 RESTARTING THE PUREX TUNNEL STACK FOR STORAGE OF WASTE

The proposed action is to transfer radiologically contaminated waste materials from various onsite facilities to the PUREX Tunnel. Before the transfers, scheduled to take place as early as fiscal year 2000, the 296-A-10 Stack will be reactivated. The waste will be moved by truck to the PUREX Tunnel in several transfers through fiscal year 2010. Stored waste will use the remaining 10 to 12 railcar positions currently available in the PUREX Tunnel. For each transfer to the PUREX Tunnel, the 296-A-10 stack would be operated intermittently as described in Section 9.0.

4.0 STATE ENVIRONMENTAL POLICY ACT

If the project is subject to the requirements of the State Environmental Policy Act (SEPA) contained in chapter 197-11 WAC, provide the name of the lead agency, lead agency contact person, and their phone number.

The proposed action is categorically exempt from the requirements of the SEPA under WAC 197-11-845.

5.0 CHEMICAL AND PHYSICAL PROCESSES

Describe the chemical and physical processes upstream of the emission unit.

The processes will consist of receiving up to 3.5 MCi of radioactive waste loaded into 22-ton steel waste disposal boxes (SWDBs) (Figure 2). The SWDBs will be transferred by truck, transferred onto railcars, and placed into the PUREX Tunnel.

5.1 STEEL WASTE DISPOSAL BOXES

Waste placed in the PUREX Tunnel will be received in SWDBs. The inner container will be a rectangular grout container, which is an open, carbon steel box. Dispersible waste will be contained in engineered containers (Figure 3) placed (maximum of 8) in the rectangular grout container. A filled rectangular grout container could hold engineered containers as well as nondispersible waste materials. Nondispersible waste (e.g., filters, ion exchange columns, cut-up metal tanks and racks, etc.) will be held directly inside the rectangular grout container. The rectangular grout container will be contained in a rectangular overpack disposal container. The rectangular overpack disposal container will be placed into a SWDB. This package configuration will be placed into the PUREX Tunnel.

The filled SWDB will be held by a SWDB overpack, which is inside the lower impact limiter. The SWDB overpack has a gasketed lid that is secured by bolts. The SWDB overpack is the containment boundary for the package, which is considered a closed container for transfer purposes. The upper impact limiter is bolted to the lower impact limiter, forming an additional seal. (The SWDB overpack and the impact limiter could be reused for subsequent transfers.)

Alternate packaging for receipt/storage, which will provide equivalent or greater degree of airborne control, would be presented to WDOH before use.

5.2 TRANSPORTING TO PUREX

The upper and lower impact limiters form a seal for the SWDB (Figure 2). The package meets transportation requirements to move the material by truck to the PUREX Tunnel rail cut. As a closed container, there are no expected emissions during the transportation phase.

5.3 TRANSFER TO RAILCARS

The truck will be parked in the rail cut just outside the PUREX Tunnel. The upper impact limiter and SWDB overpack lid will be removed and set aside. A mobile crane will be used to transfer the SWDB from the truck to the railcar. (The impact limiter and overpack could be reused for subsequent transfers.) The railcar could remain in the rail cut, with appropriate postings, or could be moved just inside the exterior door into the outer area of the PUREX Tunnel while waiting the next transfer.

5.4 PLACEMENT OF WASTE INTO PUREX TUNNEL

At least two SWDBs will fit onto a single railcar. When the railcar is ready for placement into the PUREX Tunnel, the water-fillable door to the storage tunnel will be opened after closing the exterior door. The railcar will be placed into the storage tunnel and allowed to roll slowly to its storage position. Once the railcar is in position, the water-fillable door will be closed. The initial transfer could involve more than one railcar, and could include the majority of the total inventory to be transferred.

Figure 2. 22-Ton Steel Waste Disposal Box.

Figure 3. Engineered Container.

1 5.5 STORAGE OF WASTE IN TUNNEL

2 The PUREX Tunnel has been used for storage of radioactive and mixed waste from the PUREX Plant
3 and from other onsite sources. Material selected for storage in the PUREX Tunnel is loaded on railcars
4 modified to serve as both transport and storage platforms. The railcar storage positions are numbered
5 sequentially, commencing with Position 1 that abuts the railstop bumper at the south end of the tunnel.
6 Position 2 is the location of the railcar that abuts the railcar in position 1 and so forth. Each railcar is
7 retrievable; however, because the railcars are stored on a single, dead-end railroad track, the railcars can
8 be removed only in reverse order (i.e., last in, first out). Currently, 28 railcars are placed in the PUREX
9 Tunnel. Additional waste could be placed into the remaining (approximately 12) railcar positions over
10 the next 10 years.

11

12

13 6.0 PROPOSED CONTROLS

14 *Describe the existing and proposed abatement technology. Describe the basis for the use of the*
15 *proposed system. Include expected efficiency of each control device, and the annual average volumetric*
16 *flow rate in cubic meters/second for the emission unit.*

17

18 The SWDBs are engineered to minimize emissions during the loading, transportation, and transfer
19 processes. The 296-A-10 Stack is a minor stack that exhausts the PUREX Tunnel.

20

21

22 6.1 SOLID WASTE DISPOSAL BOX

23 The SWDBs and rectangular overpack disposal containers are passively vented with NucFil®¹ filters
24 (Figure 2). Nondispersible material is controlled by two separate successive filters, while dispersible
25 material is controlled by three, with the additional successive filter provided on the engineered containers
26 (Figure 3). The NucFil® filters are tested and rated by the manufacturer at 99.97 percent efficiency or
27 greater, but are not testable in-place. The engineered containers are the same type used for dispersible
28 material in the previous transfer to the PUREX Tunnel, and are equipped with NucFil® filters. The
29 engineered containers are designed for placement in a horizontal position, without impact to the NucFil®
30 filters.

31

32 The proposed activity calls for storage of transuranic material in waste containment, and it is expected
33 that heat and hydrogen gas will be generated. The Nucfil® filters are designed to allow for venting of
34 gasses while controlling particulate emissions. Furthermore, Nucfil® filters have been successfully used
35 for similar purposes onsite, as approved by WDOH at the Central Waste Complex. This information
36 serves as the bases for using the NucFil® filters as process controls and abatement technology.

37

38

39 6.2 PUREX TUNNEL NUMBER 2

40 The 296-A-10 Stack is a minor stack that last operated in 1996. The stack has a discharge height of
41 4.6 meters, with an annual average flow rate of 2.0 cubic meters per second. The stack has a single stage
42 of HEPA filters (3x3) with a particulate removal efficiency of at least 99.95 percent.

43

44 The 296-A-10 Stack currently is shutdown and capped. The stack will be upgraded with new stack flow
45 test ports. The HEPA filters will be tested before placement of the first railcar into the PUREX Tunnel

¹ NucFil® is a registered trademark of Nuclear Filter Technology, Inc., Golden, Colorado.

1 as described in this NOC. The stack will operate during waste placement. Depending on the length of
2 time before the next transfer, the stack could be shutdown and capped between transfers, especially if the
3 next transfer is not expected for a year or more. If the next transfer is expected within the same year, the
4 stack could be operated between transfers. Testing of the HEPA filters will be performed such that the
5 HEPA filters are not used for powered ventilation of the PUREX Tunnel (i.e., damper open) if the annual
6 period covered by the HEPA testing has expired.

7 8 9 **7.0 DRAWINGS OF CONTROLS**

10 *Provide conceptual drawings showing all applicable control technology components from the point of*
11 *entry of radionuclides into the vapor space to release to the environment.*

12
13 Figure 4 depicts of the NucFil® filter that will be used in the SWDBs and engineered containers.
14 A diagram of the 296-A-10 Stack showing the HEPA filters and the aerosol and stack flow test port
15 locations is provided as Figure 5.

16 17 18 **8.0 RADIONUCLIDES OF CONCERN**

19 *Identify each radionuclide that could contribute greater than ten percent of the potential to emit TEDE to*
20 *the MEI, or greater than 0.1 mrem/yr potential to emit TEDE to the MEI.*

21
22 The inventory in the PUREX Tunnel for railcar positions 1 to 21, decay-corrected to December 1995,
23 was provided in the original NOC (DOE/RL-95-95). This inventory is shown in Table 1, and is decay-
24 corrected to June 1999. The inventory added to the PUREX Tunnel in 1996 also is shown in Table 1,
25 and is decay-corrected to June 1999. Radionuclides that could contribute greater than 10 percent of the
26 PTE TEDE to the MEI consist of strontium-90, cesium-137, plutonium-239/240, and americium-241.

27
28 The total current inventory, shown in Table 1, is less than 1 MCi, decay-corrected to June 30, 1999. Up
29 to 3.5 MCi of radioactive waste could be placed into the remaining (approximately 12) railcar positions
30 of the PUREX Tunnel over the next 10 years. Up to 1 percent (35 thousand curies) of the additional
31 waste could be transuranic. Any radionuclide could be present in the 3.5 MCi of additional waste, but
32 the radionuclides that could contribute greater than 10 percent of the PTE TEDE to the MEI
33 conservatively are assumed to be strontium-90 for beta/gamma and americium-241 for alpha.

H99050176.4R2

Figure 4. NucFil® Filter.

Figure 5. 296-A-10 Stack.

Table 1. PUREX Tunnel Inventory (Annual Possession Quantity).

Radionuclide	Physical form	Original NOC inventory (Ci) decayed 12/95	Original NOC inventory (Ci) decayed 6/99	Additional inventory (Ci) added 1996	Additional inventory (Ci) decayed 6/99	Total Current inventory (Ci) decayed 6/99	Proposed inventory (Ci) added NOC	Proposed inventory (Ci) total
H-3	gas	7.7 E+01	6.3 E+01					
Kr-85	gas	1.6 E+03	1.2 E+03					
Sr-89	particulate	9.1 E-06	2.2 E-13					
Sr-90/Y-90	particulate	1.5 E+04	1.4 E+04	3.6 E+05	3.4 E+05			
Y-91	particulate	3.5 E-04	9.3 E-11					
Zr-95	particulate	2.7 E-03	2.6 E-09					
Nb-95	particulate	5.9 E-03	5.9 E-14					
Ru-103	particulate	8.3 E-09	1.4 E-18					
Ru-106	particulate	3.2 E+03	2.9 E+02					
Sb-125	particulate	8.4 E+02	3.5 E+02					
Te-127	particulate	5.4 E-02	1.6 E-05					
Te-129	particulate	7.7 E-13	2.8 E-24					
Cs-134	particulate	1.4 E+03	4.2 E+02					
Cs-137	particulate	1.8 E+04	1.7 E+04	6.1 E+05	5.7 E+05			
Ce-141	particulate	1.4 E-11	2.0 E-23					
Ce-144	particulate	5.2 E+03	2.3 E+02					
Pm-147	particulate	1.6 E+04	6.3 E+03					
U-234	particulate	3.0 E+00	3.0 E+00					
U-235	particulate	8.5 E-02	8.5 E-02					
U-236	particulate	2.1 E-01	2.1 E-01					
Np-237*	particulate	0.0 E+00	4.7 E+02					
U-237	particulate	6.6 E+05	7.0 E-52					
U-238	particulate	1.6 E+00	1.6 E+00					
Pu-238	particulate	4.6 E+02	4.5 E+02					
Pu-239	particulate	2.4 E+02	2.4 E+02					
Pu-240	particulate	1.2 E+02	1.2 E+02					
Am-241**	particulate	1.8 E+02	6.1 E+03					
Pu-241	particulate	1.1 E+04	9.4 E+03					
Pu-242	particulate	2.7 E-02	2.7 E-02					
Total Beta/Gamma (as Sr-90)		6.1 E+04	3.9 E+04	9.7 E+05	9.0 E+05	9.4 E+05	3.5 E+06	4.4 E+06
Total Alpha (as Am-241)		6.7 E+05	1.7 E+04	7.4 E+01	7.4 E+01	1.7 E+04	3.5 E+04	5.2 E+04
Total		7.3 E+05	5.6 E+04	9.7 E+05	9.0 E+05	9.6 E+05	3.5 E+06	4.5 E+06

* Np-237 calculated from decay of U-237 and Am-241.

** Am-241 ingrowth calculated from decay of Pu-241.

NOC = notice of construction.

Ci = curie.

NOTE: Totals shown represent any/all radionuclides that could be present in the annual possession quantity, conservatively assumed as Sr-90 and Am-241.

9.0 MONITORING

Describe the effluent monitoring system for the proposed control system. Describe each piece of monitoring equipment and its monitoring capability, including detection limits, for each radionuclide that could contribute greater than ten percent of the potential to emit TEDE to the MEI, or greater than 0.1 mrem/yr potential to emit TEDE to the MEI, or greater than twenty-five percent of the TEDE to the MEI, after controls. Describe the method for monitoring or calculating those radionuclide emissions. Describe the method with sufficient detail to demonstrate compliance with the applicable requirements.

Periodic confirmatory measurements to confirm low emissions from the 296-A-10 Stack will be performed. As discussed in the September 8, 1999 meeting, NDA will be used to provide periodic confirmatory measurements. NDA provides detection of cesium-137 loaded on HEPA filters at well below micro curie levels. The loading of strontium-90, plutonium-239/240/ and americium-241 on the HEPA filters will continue to be calculated from ratios with cesium-137 from reported actual emissions as described in Appendix B. NDA methodology for the 296-A-10 Stack was provided in 97-EAP-225.

NDA would be required each year when a railcar is placed in the tunnel, or when the stack is uncapped and used for powered ventilation. A single NDA measurement would be sufficient regardless of how many railcars are placed in the PUREX Tunnel during a given year. During years in which no waste is placed in the PUREX Tunnel and the 296-A-10 Stack is capped (weather tight), NDA would not be required until the stack is reactivated for the next transfer.

Periodic confirmatory measurements for transfer operations at the PUREX rail cut will be provided by smears taken of the SWDBs before storage in the PUREX Tunnel.

10.0 ANNUAL POSSESSION QUANTITY

Indicate the annual possession quantity for each radionuclide.

Table 1 summarizes the current inventory and the proposed increase due to this modification.

11.0 PHYSICAL FORM

Indicate the physical form of each radionuclide in inventory: Solid, particulate solids, liquid, or gas.

The physical form of each radionuclide of concern in the inventory is assumed to be particulate solids. As indicated in Table 1, inconsequential levels of gases/vapors also could be present, but in amounts much less than any radionuclide potentially contributing greater than 10 percent of the estimated PTE.

12.0 RELEASE FORM

Indicate the release form of each radionuclide in inventory: Particulate solids, vapor or gas. Give the chemical form and ICRP 30 solubility class, if known.

Gaseous or vaporous radionuclides also could be present, but in amounts much less than any radionuclide potentially contributing greater than 10 percent of the estimated PTE. For purposes of emission or offsite dose estimates, any emissions from the radionuclides in the inventory presented in Table 1 are assumed to be released as particulate solids.

13.0 RELEASE RATES

Give the predicted release rates without any emissions control equipment (potential to emit) and with the proposed control equipment using the efficiencies described in subsection (6) of this section. Indicate whether the emission unit is operating in a batch or continuous mode.

The predicted release rates for each radionuclide, without any emissions control equipment (unabated), are presented in Table 2 and the PTE calculations in Appendix B. The predicted release rates using the control equipment efficiencies in Section 6.0 also are presented in Table 2 and Appendix B. The 296-A-10 Stack will operate in a batch mode; however, the emission calculations in Appendix B conservatively assume that the entire 3.5 MCi would be transferred in a single year.

Actual emissions for 1996 from the 296-A-10 Stack were 1.9 E-08 curies of total alpha and 1.3 E-07 curies of total beta/gamma. The increase in abated emissions from the 296-A-10 Stack or the actual fugitive emissions from the proposed activities are not expected to be measurable. Emission estimates and release fractions for each phase of the transfer operation are discussed in Appendix B.

14.0 LOCATION OF MAXIMALLY EXPOSED INDIVIDUAL

Identify the MEI by distance and direction from the emission unit.

The MEI is located approximately 20.2 kilometers east south east of the 200 East Area (refer to Figure 1).

15.0 TOTAL EFFECTIVE DOSE EQUIVALENT TO THE MAXIMALLY EXPOSED INDIVIDUAL (Requirement 15)

Calculate the TEDE to the MEI using an approved procedure. For each radionuclide identified in subsection (8) of this section, determine the TEDE to the MEI for existing and proposed emission controls, and without any existing controls using the release rates from subsection 13 of this section. Provide all input data used in the calculations.

Approval for an alternate method to calculate PTE for the transfers in the PUREX Plant rail cut was requested from WDOH at the August 17, 1999 meeting, in accordance with WAC 246-247-030(21)(e), and was approved on September 16, 1999. The PTE calculations are summarized in Table 2 and discussed in Appendix B.

Table 2. Potential-to-Emit for PUREX Tunnel.

1. Storage of Existing Tunnel Inventory (based on total NDA loading on HEPA filters, decay corrected and annualized)					
Radionuclides	Annual PTE Ci/yr	Release factor	Dose factor CAP88-PC* mrem/Ci	Unabated offsite dose mrem/yr	Abated offsite dose mrem/yr
Sr-90 (calculated from NDA)	3.9 E-05	1.0 E+00	1.1 E-01	4.3 E-06	2.1 E-09
Cs-137 (measured by NDA)	2.3 E-05	1.0 E+00	2.7 E-02	6.2 E-07	3.1 E-10
Pu-239 (calculated from NDA)	2.5 E-06	1.0 E+00	8.2 E+00	2.1 E-05	1.0 E-08
Am-241 (calculated from NDA)	6.0 E-06	1.0 E+00	1.3 E+01	7.8 E-05	3.9 E-08
Baseline Emissions				1.0 E-04	5.2 E-08
2. Transfers at PUREX Rail Cut (based on release factor for concrete burial box in previous NOC, for 1 year duration)					
Radionuclides	Annual PTE Ci/yr	Release factor	Dose factor CAP88-PC mrem/Ci	Unabated offsite dose mrem/yr	Abated offsite dose mrem/yr
Total beta/gamma (as Sr-90)	3.5 E+06	6.6 E-08	1.1 E-01	2.5 E-02	8.4 E-06
Total alpha (as Am-241)	3.5 E+04	6.6 E-08	1.3 E+01	3.0 E-02	1.0 E-05
Subtotal for Transfers				5.5 E-02	1.8 E-05
3. Placement of Railcars into PUREX Tunnel (based on increased NDA loading on HEPA filters, for seven railcars placed in PUREX tunnel in 1996)					
Radionuclides	Annual PTE Ci/yr	Release factor	Dose factor CAP88-PC mrem/Ci	Unabated offsite dose mrem/yr	Abated offsite dose mrem/yr
Sr-90 (calculated from NDA)	5.9 E-05	1.0 E+00	1.1 E-01	6.5 E-06	3.2 E-09
Cs-137 (measured by NDA)	3.5 E-05	1.0 E+00	2.7 E-02	9.5 E-07	4.7 E-10
Pu-239 (calculated from NDA)	3.9 E-06	1.0 E+00	8.2 E+00	3.2 E-05	1.6 E-08
Am-241 (calculated from NDA)	9.1 E-06	1.0 E+00	1.3 E+01	1.2 E-04	5.9 E-08
Subtotal (for seven railcars)				1.6 E-04	7.9 E-08
Subtotal * 2 (for 12 railcars)				3.2 E-04	1.6 E-07
4. Storage of Proposed Additional Inventory in PUREX Tunnel (based on 3.5 MCi ratio with 0.96 MCi baseline)					
Formula 1.0 E-04 mrem/yr (Section 1) * 3.5 MCi/0.96 MCi (Appendix B)				Unabated offsite dose mrem/yr	Abated offsite dose mrem/yr
Additional 3.5 MCi				3.6 E-04	1.8 E-07
TOTALS	Total Modification Increase (Sections 2.0, 3.0, and 4.0)			5.6 E-02	1.9 E-05
	Total Stack Potential Dose (Sections 1.0, 3.0, and 4.0)			7.8 E-04	3.9 E-07

Ci/yr = curies per year; HEPA = high-efficiency particulate air; MCi = million curies; mrem/yr = millirem per year;
NDA = nondestructive assay; PTE = potential-to-emit

* HNF-3602.

The total unabated dose for this modification (including transfers in the PUREX rail cut, placement of railcars into the PUREX Tunnel, and storage of increased inventory) conservatively is estimated to be 5.6 E-02 mrem per year to the MEI, with a total abated dose estimate of 1.9 E-05 mrem per year to the MEI. The total unabated dose due to emissions from the 296-A-10 Stack (including current inventory, placement of railcars into the PUREX Tunnel, and proposed increase in inventory) conservatively is estimated to be 7.8 E-04 mrem per year to the MEI, with a total abated dose estimate of 3.9 E-07 mrem per year to the MEI.

16.0 COST FACTOR IF NO ANALYSIS

Provide cost factors for construction, operation and maintenance of the proposed control technology components and the system, if a BARCT or ALARACT demonstration is not submitted with the NOC.

Pursuant to WAC 246-247-110, App. A (16), cost factors for construction, operation, and maintenance of proposed technology requirements are not required, as the following discussion is provided as an as low as reasonably achievable control technology (ALARACT) demonstration:

WDOH has provided guidance that HEPA filters generally are considered best available radionuclide control technology (BARCT) for particulate emissions (AIR 92-107). WDOH has accepted Nucfil® filters as ALARACT for vented containers at the Central Waste Complex. Because the radionuclides of concern are particulates, it is proposed that the controls described in Section 6.0 for the 296-A-10 Stack and the SWDBs will be accepted as ALARACT.

17.0 DURATION OR LIFETIME

Provide an estimate of the lifetime for the facility process with the emission rates provided in this application.

Transfers of additional radioactive material from various onsite facilities to the PUREX Tunnel will take place in fiscal years 2000 through 2010. It is planned that the material will remain in storage until a means is identified to accommodate processing and repackaging of the material for disposal or further storage or until another final disposition option becomes available.

18.0 STANDARDS

Indicate which of the following control technology standards have been considered and will be complied with in the design and operation of the emission unit described in this application:

ASME/ANSI AG-1, ASME/ANSI N509, ASME/ANSI N510, ANSI/ASME NQA-1, 40 CFR 60, Appendix A Methods 1, 1A, 2, 2A, 2C, 2D, 4, 5, and 17, and ANSI N13.1

For each standard not so indicated, give reasons to support adequacy of the design and operation of the emission unit as proposed.

Cited documents will be provided to WDOH upon request. Standards available at the time of construction were as follows:

1 • ASME/ANSI AG-1:

2
3 The 296-A-10 Stack HEPA filtration system was built in 1964, before ASME/ANSI AG-1 was issued.
4 The HEPA filters and existing stock of replacement HEPA filters meet MIL-F-51068 and MIL-F-51079.
5 If the HEPA filters need replacement (e.g., failing the efficiency test, becoming excessively loaded, etc.),
6 replacement filters that meet AG-1 will be used.
7

8 • ASME/ANSI N509:

9
10 The 296-A-10 HEPA filtration system does not comply with ANSI N509, as it was built before ANSI
11 N509 was issued. Furthermore, the HEPA filters were custom designed on the Hanford Site for the
12 PUREX Tunnel exhaust system. In accordance with the agreement reached with WDOH at the October
13 28, 1997 meeting, the 296-A-10 Stack is a minor stack and an upgrade to the HEPA filtration system was
14 not required. Drawings of the PUREX Tunnel and the 296-A-10 Stack have been provided to WDOH.
15

16 • ASME/ANSI N510:

17
18 Because a system that is not compliant with ANSI/ASME N509 is by definition noncompliant with
19 ANSI/ASME N510, documentation to show full compliance with ANSI/ASME N510 cannot be
20 provided. To demonstrate the adequacy of the design and operation, the following information is
21 provided:
22

- 23 – HEPA filters described in Section 6.0 will be tested as described in Section 6.2. The HEPA
24 filters are in-place tested to meet the intent of ANSI/ASME N510.
25
- 26 – NDA that was performed (97-EAP-225) on the HEPA filters, showing the minimal loading of
27 radionuclides, combined with the past sample measurements and filter testing results,
28 demonstrate the adequacy of the design system.
29

30 • ANSI/ASME NQA-1:

31
32 Quality assurance is addressed in HNF-0528-3, *NESHAP Quality Assurance Project Plan for*
33 *Radioactive Airborne Emissions* (all of Sections 2.0, 3.0 and 5.0) as a compatible alternative to NQA-1.
34

35 • ANSI/ASME NQA-2:

36
37 The standard is no longer an active National Standard and has been incorporated into NQA-1.
38 Compliance compatible with NQA-1 was described previously.
39

40 • 40 CFR 60, Appendix A

41
42 Stack flow will be tested using Methods 1 and 2. The upgrade to the sampling system will include the
43 installation of test ports that will conform to Methods 1 and 2. Methods 1A, 2A, 2C, and 2D are not
44 applicable to the stack dimensions/design. Methods 4, 5, and 17 are not applicable to radioactive
45 airborne emissions.
46

1 • ANSI N13.1:

2
3 The use of NDA for periodic confirmatory measurements was discussed as an alternative to upgrading
4 the sampling system to meet ANSI N13.1-1969 criteria at the RTAM held on August 17, 1999. The
5 cost/benefit evaluation requested by WDOH was provided at the RTAM on September 8, 1999, and is
6 attached as Appendix A. The 296-A-10 Stack will be operated intermittently, and NDA will be
7 performed to provide periodic confirmatory measurements as described in Section 9.0 and Appendix A.
8
9

10 **REFERENCES**

- 11
12 AIR 92-107, Letter, A. W. Conklin, Washington State Department of Health, to J. D. Bauer,
13 U.S. Department of Energy, Richland Operations Office, no subject, October 5, 1992.
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15 AIR 95-1201, Letter, Allen W. Conklin, WDOH, to James E. Rasmussen, DOE-RL, dated December 4,
16 1995, State of Washington, Department of Health, Olympia, Washington.
17
18 AIR 96-603, Letter, Allen W. Conklin, WDOH, to James E. Rasmussen, DOE-RL, dated June 7, 1996,
19 State of Washington, Department of Health, Olympia, Washington.
20
21 ANSI N13.1, *Sampling and Monitoring Releases of Airborne Radioactive substances from the Stacks and*
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24 96-EAP-111, Letter, James E. Rasmussen, DOE-RL, to A. W. Conklin, WDOH, and A. J. Frankel, EPA,
25 May 20, 1996, "Radioactive Air emissions Notice of Construction (NOC) for Storage of the
26 Liquid Waste Tank Cars and the 325 Building Waste in the Plutonium Uranium Extraction
27 (PUREX) Storage Tunnel Number 2".
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29 97-EAP-225, Letter, James E. Rasmussen, DOE-RL, to Allen W. Conklin, WDOH, "Sample Results and
30 Offsite Dose Modeling for the PUREX Storage Tunnel Number 2," U.S. Department of Energy,
31 Richland Operations Office, Richland, Washington.
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33 DOE/RL-95-07, *Hanford Site Air Operating Permit Application*, U.S. Department of Energy, Richland
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36 DOE/RL-95-95, "Radioactive Air Emissions Notice of Construction Transfer and Receipt of Waste in
37 the 324 Building for Storage in PUREX Storage Tunnel Number 2," U.S. Department of Energy,
38 Richland Operations Office, Richland, Washington.
39
40 EPA, 1995, Letter, J. Leitch, U.S. Environmental Protection Agency, Region 10, to J. E. Rasmussen,
41 DOE-RL, no subject, December 6, 1995.
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43 EPA, 1996, Letter, Letter, Anita Frankel, U.S. Environmental Protection Agency, to J. E. Rasmussen,
44 DOE-RL, no subject, September 3, 1996.
45
46 HNF-0528, *NESHAP Quality Assurance Project Plan for Radioactive Airborne Emissions*, Fluor Daniel
47 Hanford, Richland, Washington.
48
49 HNF-3602, *Volume 1: Calculating Potential to emit Releases and Doses for FEMPs and NOCs*, Fluor
50 Daniel Hanford, Inc., Richland, Washington.

- 1
- 2 Meeting Minutes, October 28, 1997, (BWHC, DOE-RL, FDH, WDOH), "Restarting the PUREX Tunnel
- 3 Stack for Storage of Additional 300 Area Waste," Richland, Washington.
- 4
- 5 Routine Technical Assistance Meeting, WDOH, August 17, 1999.
- 6
- 7 Routine Technical Assistance Meeting, WDOH, September 8, 1999.
- 8

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APPENDIX A

**COST/BENEFIT EVALUATION FOR THE USE OF NONDESTRUCTIVE ANALYSIS RATHER
THAN UPGRADING THE 296-A-10 STACK MONITORING SYSTEM AT THE PUREX
STORAGE TUNNEL**

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Cost/Benefit Evaluation For The Use Of Nondestructive Analysis Rather Than Upgrading The 296-A-10 Stack Monitoring System At The PUREX Storage Tunnel

A meeting was held on October 28, 1997 with WDOH to discuss requirements for restarting the PUREX Tunnel Stack (296-A-10) and placing additional radioactive waste in the tunnel. At that meeting, WDOH agreed that only the stack sampling system would have to be upgraded, and that the HEPA filtration system would not require an upgrade. While a minor stack (i.e., the PTE is less than 0.1 mrem per year) only has to meet the ANSI standards as applicable after cost/benefit evaluation, it was stated that the upgraded sampling system should meet one of the recognized standards (e.g., ANSI N13.1-1999).

The revised ANSI N13.1 standard, approved in January 1999, is performance based. Not only must the sampling system use recognized technology, such as a shrouded probe, but it also must be demonstrated that the sample probe location allows a representative sample to be obtained. The new standard also recognizes measurements of the material accumulated on the ventilation filters as a valid approach for estimating potential emissions. The use of NDA was discussed as an alternative to upgrading the sampling system at the Routine Technical Assistance Meeting held on August 17, 1999. WDOH stated that a cost/benefit evaluation must be provided. The following discussion demonstrates that NDA is a much more cost effective method to provide periodic confirmatory measurements of emissions from the 296-A-10 Stack, with the same benefits achieved by a sampling system upgrade to comply with ANSI N13.1 requirements.

Cost Comparison for Nondestructive Analysis Instead of Shrouded Probe

Description	Shrouded probe	Nondestructive analysis
Erect scaffolding, electrical work, remove cap and blanks, HEPA testing, stack flow	same	same
Procure shrouded probe	\$ 3,600	-
Install probe, pump, rotometer, etc.	\$ 5,000	-
Qualify probe location (based on existing modeling)	\$ 15,000	-
Stack modification (mixer and extension)	\$100,000	-
Total alpha/beta (@ \$600/sample, average of two samples each for 12 tunnel openings for waste placement)	\$ 14,400	-
NDA measurement following initial waste placement	-	\$ 6,000
NDA for subsequent waste placement (three additional tunnel openings for waste placement @ \$4,000 each)	-	\$ 12,000
Annual HEPA testing (for years that waste placement occurs)	same	same
Temporary capping during inactive status	same	same
Total costs (excluding common ones)	\$138,000	\$ 18,000
Annualized costs (10 years)	\$ 13,800	\$ 1,800

ASSUMPTIONS

- Stack will operate intermittently, only during years that the tunnel is opened for waste placement, for a period of 10 years, supporting existing deactivation schedules.
- Costs to reactivate stack are essentially the same for either option.

3. Several years will experience no opening of the tunnel at all. All 12 railcar positions could be placed during a single year, but more likely opening the tunnel to add waste would occur in 3 or 4 of the 10 years.

4. Sampling would require pre- and post-sample measurements, plus measurements during or between periods when the tunnel is opened. Multiple tunnel openings for waste placement in a year could eliminate the need for some samples. An average of two samples/tunnel opening was assumed for the shrouded probe option.

5. Preliminary model results for a stack of similar design, which also has a fan at the base of the stack, could be used to minimize qualification costs for the 296-A-10 Stack. The 296-A-10 Stack only would require a velocity profile for the new probe location, relying on the model results for the other stack in lieu of the additional qualification tests. Unfortunately, those same model results demonstrate that the existing stack configuration, modified to include a shrouded probe, would not provide a representative sample or qualify per ANSI N13.1 requirements. Model results indicate that a mixer would be required at the transition in the stack just above the fan, and the probe location should be 8 diameters downstream of the mixer. The remainder of the stack would need to be replaced by an extension approximately 3.05 meters taller than the existing stack. Design and stack modification costs would be a minimum of \$100,000, assuming that the base of the stack would support the increased length. Otherwise, the entire stack would need to be replaced at a much higher cost.

6. The use of NDA already has been accepted by WDOH to demonstrate that the 296-A-10 stack is a minor stack. WDOH has stated that the increased loading accumulated on the HEPA filters after placement of additional waste in the PUREX tunnel would represent the potential emissions from the stack. NDA would be an acceptable periodic confirmatory measurement method in lieu of sampling. The tested removal efficiency of greater than 99.95 percent could be applied to the NDA measurement results to estimate actual emissions. NDA only would be required for years in which a railcar is placed in the tunnel, and a single NDA measurement would be sufficient regardless of how many railcars are placed in the tunnel during a given year. During years in which no waste is placed in the PUREX tunnel, the 296-A-10 Stack could be capped, with no periodic confirmatory measurements required.

CONCLUSIONS

Using NDA for each year that waste is placed in the tunnel would provide periodic confirmatory measurements of low emissions in accordance with WAC 246-247-075(3). NDA also meets the general considerations addressed in Section 5.2.1 of ANSI N13.1 standard. The 296-A-10 Stack only will operate intermittently, so consideration is given to collection of contaminants of the entire stream and treating the entire stream as the sample. NDA will accomplish this by considering the increased loading on the HEPA filters to represent the entire stack emissions during a given year that waste is placed in the tunnel. The NDA results would represent the potential unabated emissions, and coupled with the in situ HEPA efficiency measurements, provide an estimate of actual emissions that is consistent with WAC 246-247-030 (21)(c).

Upgrading the probe to one that fully is compliant with the new standard, as described in the earlier agreement at the October 1997 meeting, would cost at least \$120,000 more than the NDA option. The shrouded probe option would provide a more accurate measurement of actual emissions, as opposed to the estimate of actual emissions provided by NDA. However, the previous NDA measurements clearly showed that in 1996, when over 1 million Ci of radioactive waste were placed in the PUREX Tunnel, the

- 1 impact was three orders of magnitude less than the 0.1 mrem per year threshold. There is no benefit to
- 2 the public by using the more expensive shrouded probe option, as controls and actual emissions are the
- 3 same for each option.

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APPENDIX B

**POTENTIAL-TO-EMIT CALCULATIONS
FOR THE PUREX TUNNEL (STACK 296-A-10)**

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EMISSION CALCULATIONS AND RELEASE FACTORS

There are four types of potential emissions associated with this NOC, as summarized in Table 1.

1. Current inventory storage PTE.

The last NDA that was performed on December 30, 1996 for the 296-A-10 Stack HEPA filters showed a total loading of 2.3 E-05 Ci/yr of Cs-137, decay corrected and annualized for the 13 year period since the HEPA filters were replaced. The loading of other radionuclides on the HEPA filters was based on the composite sample results for actual 1996 emissions for the 296-A-10 Stack. The relative distribution of radionuclides on the HEPA filters was calculated by the ratios with Cs-137 for the actual emissions. Because the total loading of particulate radionuclides on the HEPA filters represents the potential emissions from the stack without abatement, the release factor is shown as 1.0.

Total unabated offsite dose, shown in Section 1 of Table 2, for the current inventory (0.96 MCi), as demonstrated by the NDA, is $1.0 \text{ E-04 mrem per year}$. This potential exists whether anything is ever added to the PUREX tunnel or not.

2. Transfers at PUREX Rail Cut PTE.

Packaged waste will be transferred from trucks to railcars via mobile crane at the PUREX rail cut. Radioactive waste (e.g., TRU) that requires venting will be packaged in SWDBs as a minimum (Figure 1).

The SWDBs have 2.54-centimeter diameter openings for the NucFil® filters. A release fraction is needed to represent passive ventilation from the openings without abatement (i.e., the NucFil® filters were not installed). There was a discussion on airborne release fractions in Appendix C of the original NOC (DOE/RL-95-95). The discussion considered the fraction escaping from a general purpose concrete box, with passive ventilation consisting of two holes drilled in the box at some vertical separation. Modeling was done to show the impact of hydrogen generation from the concrete box. The model considered factors such as the heat generated by the radionuclides, absorption of gamma radiation by the concrete (assumed to be 7% water), and ventilation rates from various sized holes of 2.54-centimeter to 10.2-centimeter diameter. Because the SWDBs and the engineered containers are made of steel, rather than concrete, the hydrogen generation issue modeled for the general purpose concrete boxes used for the original NOC is modified as follows.

The release fraction identified as a result of the modeling discussed previously, for 2.54-centimeter holes with hydrogen generation, was 8.2 E-06 . The release fraction needed for the SWDBs (2.54-centimeter holes without hydrogen generation) was not addressed. The model did consider, however, release fractions for a concrete box without holes (i.e., cracks only) with hydrogen generation (8.9 E-07) and without hydrogen generation (7.2 E-09). A release fraction for a box with holes and no hydrogen generation could be derived by comparing the release fraction for a box with holes and hydrogen generation with the release fractions for a box without holes with hydrogen generation and without hydrogen generation. The release fraction for the SWDBs (open 2.54-centimeter holes without hydrogen generation) was calculated as 6.6 E-08 (8.2 E-06 multiplied by 7.2 E-09 divided by 8.9 E-07) by assuming a constant ratio for the release fractions with and without hydrogen generation.

The total unabated offsite dose for transfer operations at the PUREX rail cut, conservatively assuming the entire 3.5 MCi of radioactive waste is transferred in 1 year and sits in vented containers outside of the tunnel for the entire year, is shown in Section 2 of Table 2 as $5.5 \text{ E-02 mrem per year}$.

3. Insertion of railcars into PUREX Tunnel PTE.

The NDA results, shown in Table 8 of the report, "Sample Results and Offsite Dose Modeling for the PUREX Storage Tunnel Number 2," (97-EAP-225), indicated an increase in Cs-137 loading on the 296-A-10 HEPA filters of 3.5 E-05 Ci between the final NDA measurement on December 30, 1996 and the baseline measurement on November 16, 1995. The same assumptions that were used in Section 1 for the relative distribution of radionuclides and the release factor were used in Section 3 of Table 2.

The increased loading on the HEPA filters between the two NDA measurements likely was due to the process of placing railcars into the PUREX Tunnel, i.e., from moving air and stirring up contamination as the railcars move along the track to their storage positions, and disturbing the existing inventory as the railcars bump into adjacent railcars. This is supported by the total alpha results in 1996 from the 296-A-10 Stack, reported in 97-EAP-225. The only detectable alpha measurement was the month of July 1996, which followed the insertion of four railcars in June 1996.

The unabated dose for Section 3 of Table 2 conservatively assumed that the increased loading on the HEPA filters was due entirely to the insertion process without considering the increase in inventory or baseline annual potential TEDE. Six railcars were placed in the PUREX Tunnel in 1996 (thus bumping the chain of railcars six times). The total unabated offsite dose for insertion of 12 railcars (maximum number of positions available) into the PUREX tunnel, conservatively assuming that all 12 are placed into the tunnel in 1 year, is estimated at $3.2 \text{ E-04 mrem per year}$. This is double the measured NDA results for seven railcars placed into the tunnel in 1996 ($1.6 \text{ E-04 mrem per year}$).

4. Long-term storage PTE for proposed additional inventory.

By ratio with the baseline potential of $1.0 \text{ E-04 mrem per year}$ from the existing inventory of 0.96 MCi, the addition of 3.5 MCi of waste to the PUREX tunnel, as shown in Section 4 of Table 2, would increase this potential TEDE by $3.6 \text{ E-04 mrem per year}$. The same assumptions that were used in Sections 1 and 3 of Table 2 for the relative distribution of radionuclides and the release factor were used to establish the ratio used in Section 4 of Table 2.

The total unabated dose for this modification (including transfer, insertion, and storage of increased inventory) is $5.6 \text{ E-02 mrem per year}$, with a total abated dose of $1.9 \text{ E-05 mrem per year}$. The total unabated dose exhausting from the 296-A-10 Stack (including current inventory, insertion, and proposed increase in inventory) is $7.8 \text{ E-04 mrem per year}$, with a total abated dose of $3.9 \text{ E-07 mrem per year}$.

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