**Radioactive Air Emissions
Notice of Construction
Canister Storage Building
(Revised Sealing
Configuration for
Spent Nuclear Fuel)
Project W-379**

Date Published
June 1998

**United States
Department of Energy**

P.O. Box 550
Richland, Washington 99352

Approved for Public Release

RELEASE AUTHORIZATION

Document Number: DOE/RL-98-30, Rev. 0

Document Title: Radioactive Air Emissions Notice of Construction
Canister Storage Building (Revised Sealing
Configuration for Spent Nuclear Fuel) Project W-379

This document, reviewed in accordance with DOE Order 1430.1D, "Scientific and Technical Information Management," and DOE G 1430.1D-1, "Guide to the Management of Scientific and Technical Information," does not contain classified or sensitive unclassified information and is:

APPROVED FOR PUBLIC RELEASE

V. L. Birkland
V. L. Birkland

6/17/98

Lockheed Martin Services, Inc.
Document Control/Information Clearance

Reviewed for Applied Technology, Business Sensitive, Classified, Copyrighted, Export Controlled, Patent, Personal/Private, Proprietary, Protected CRADA, Trademark, Unclassified Controlled Nuclear Information.

Trademark Disclaimer. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof or its contractors or subcontractors. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof. This report has been reproduced from the best available copy.

Printed in the United States of America.

Available to the U.S. Department of Energy and its contractors from the U.S. Department of Energy Office of Scientific and Technical Information, P.O. Box 62, Oak Ridge, TN 37831; Telephone: 423/576-8401.

Available to the public from the U.S. Department of Commerce National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161; Telephone: 703/487-4650.

CONTENTS

1			
2			
3			
4	GLOSSARY	vii	
5			
6	METRIC CONVERSION CHART	viii	
7			
8	1.0 INTRODUCTION	1-1	
9			
10	2.0 FACILITY LOCATION (Requirement 1)	2-1	
11			
12	3.0 RESPONSIBLE MANAGER (Requirement 2)	3-1	
13			
14	4.0 TYPE OF PROPOSED ACTION (Requirement 3)	4-1	
15			
16	5.0 STATE ENVIRONMENTAL POLICY ACT (Requirement 4)	5-1	
17			
18	6.0 PROCESS DESCRIPTION (Requirements 5 and 7)	6-1	
19	6.1 FACILITY AND EQUIPMENT DESCRIPTION	6-1	
20	6.1.1 Multi-Canister Overpack	6-2	
21	6.1.2 Multi-Canister Overpack Handling Machine	6-3	
22	6.1.3 Sampling and Weld Station	6-3	
23	6.1.4 Tube Vent and Purge Cart	6-4	
24	6.2 PROCESSES AT THE CANISTER STORAGE BUILDING	6-4	
25	6.2.1 Spent Nuclear Fuel Conditioning Process Validation	6-4	
26	6.2.2 Welding Cover Cap On Multi-Canister Overpacks	6-4	
27	6.2.3 Overpack Storage Tube Purge System	6-5	
28	6.2.4 Multi-Canister Overpack Processes At Canister Storage		
29	Building	6-6	
30	6.2.5 Venting of Transportation Cask	6-6	
31			
32	7.0 ANNUAL POSSESSION QUANTITY AND PHYSICAL FORM	7-1	
33			
34	8.0 CONTROL SYSTEM (Requirement 6)	8-1	
35	8.1 PROCESS CONTROL SYSTEMS	8-1	
36	8.1.1 Multi-Canister Overpack Handling Machine Ventilation		
37	and Exhaust System	8-1	
38	8.1.2 Sampling and Weld Station Ventilation Exhaust System	8-1	
39	8.1.3 Overpack Storage Tube Purge System	8-1	
40	8.1.4 Temporary Containment Enclosures For Contamination		
41	Control	8-1	
42	8.2 CANISTER STORAGE BUILDING VENTILATION EXHAUST SYSTEM	8-2	
43			
44	9.0 MONITORING SYSTEM (Requirement 9)	9-1	
45	9.1 PARTICULATE MONITORING	9-1	
46	9.2 SHROUDED PROBE	9-1	
47	9.3 OTHER DESIGN FACTORS	9-2	
48			
49	10.0 RELEASE RATES (Requirements 12 and 13)	10-1	
50			

CONTENTS (cont)

11.0	OFFSITE IMPACT (Requirements 8, 14 and 15)	11-1
11.1	UNABATED DOSE	11-1
11.2	ABATED DOSE	11-1
12.0	FACILITY LIFETIME (Requirement 17)	12-1
13.0	TECHNOLOGY STANDARDS (Requirement 18)	13-1
14.0	ACCIDENT SCENARIOS	14-1
15.0	REFERENCES	15-1

APPENDIX

A	DISCUSSION OF BEST AVAILABLE RADIONUCLIDE CONTROL TECHNOLOGY	APP A-i
B	DERIVATION OF PARTICULATE FRACTION OF SPENT NUCLEAR FUEL POSSESSION QUANTITY	APP B-i
C	INPUT PARAMETERS AND PROGRAM OUTPUT FOR CAP88PC	APP C-i

FIGURES

1-1.	Flow Schematic of the Spent Nuclear Fuel Project.	1-2
2-1.	Location of the 200 East Area within the Hanford Site.	2-2
2-2.	Location of Canister Storage Building in the 200 East Area.	2-3
6-1.	Layout of the Floor Plan of the Canister Storage Building.	6-7
6-2.	Layout of the Superstructure and the Three Vaults.	6-8
6-3.	Canister Storage Building Heating, Ventilation, and Air Conditioning Flow Diagram.	6-9
6-4a.	The Storage Tube Installation	6-10
6-4b.	Cross-Sectional View of a Penetration With a Storage Tube, Multi-Canister Overpacks, and Floor Shield Plug Installed.	6-11
6-5.	Multi-Canister Overpack.	6-12
6-6.	Schematic of the Multi-Canister Overpack Sampling and Weld Station.	6-13
6-7.	Flow Diagram of the Canister Storage Building Major Processes.	6-14
6-8.	Flow diagram of the Monitor and Sample Process.	6-15
6-9.	Flow Diagram of Multi-Canister Overpack Welding Process.	6-16
6-10.	General Configuration of the Multi-Canister Overpack Handling Machine.	6-17
6-11.	Layout of the Multi-Canister Overpack Handling Machine Within the Operating Area.	6-18

FIGURES (cont)

9-1.	Schematic diagram of the Continuous Air Emission Monitoring System.	9-3
9-2.	Placement of the Shrouded Sample Probe in the Exhaust Stack. . . .	9-4
9-3.	Relationship of Operating Area Exhaust Stack to Building and Probe Locations.	9-5

TABLES

7-1.	Canister Storage Building Annual Possession Quantity and Physical Form	T7-1
10-1.	Approved Canister Storage Building Unabated Annual Emissions . .	T10-1
10-2.	Approved Canister Storage Building Abated Annual Emissions . . .	T10-2
11-1.	Canister Storage Building Potential Unabated Offsite Dose Using CAP88 PC Version	T11-1
11-2.	Comparison of CAP88 Mainframe and CAP88PC Values on Unabated Dose	T11-2
11-3.	Canister Storage Building Potential Abated Offsite Dose Using CAP88 PC Version	T11-3

GLOSSARY

1		
2		
3		
4	ALARA	as low as reasonable achievable
5	ALARACT	as low as reasonably achievable control technology
6		
7	BARCT	best available radionuclide control technology
8		
9	CAEMS	continuous air emission monitoring system
10	CFR	Code of Federal Regulations
11	CVD	Cold Vacuum Drying
12		
13	GTAW	gas tungsten arc welding
14		
15	HEPA	high-efficiency particulate air
16	HNF	Hanford Nuclear Facility (document identifier)
17		
18	IWTS	integrated water treatment system
19		
20	MEI	maximally exposed individual
21	MHM	multi-canister overpack handling machine
22	MCO	multi-canister overpack
23		
24	NOC	notice of construction
25		
26	PSIG	pounds per square inch gauge
27	PTE	potential to emit
28		
29	SEPA	(Washington) State Environmental Policy Act of 1971
30	SNF	spent nuclear fuel
31	SPR	single pass reactor
32		
33	TEDE	total effective dose equivalent
34		
35	WAC	Washington Administrative Code
36	WDOH	Washington State Department of Health
37		
38	Ci	curies
39		
40	mrem	milliroentgen equivalent man
41	MTU	metric tons of uranium
42		
43	rem	roentgen equivalent man
44		
45	scfm	standard cubic feet per minute
46		
47	μCi	microcuries
48	$\mu\text{Ci}/\text{ml}$	microcuries per milliliter
49	$\mu\text{Ci}/\text{L}$	microcuries per liter

METRIC CONVERSION CHART

The following conversion chart is provided to the reader as a tool to aid in conversion.

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
square miles	259	hectares	hectares	0.00391	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	0.76	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

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

1
2
3
4
5

This page intentionally left blank.

**RADIOACTIVE AIR EMISSIONS
NOTICE OF CONSTRUCTION
CANISTER STORAGE BUILDING
(REVISED SEALING CONFIGURATION FOR SPENT NUCLEAR FUEL)
PROJECT W-379**

1.0 INTRODUCTION

The purpose of this Notice of Construction (NOC) is to provide a rewritten NOC for obtaining regulatory approval for changes to the previous Canister Storage Building (CSB) NOCs (WDOH, 1996 and EPA, 1996) as were approved by the Washington State Department of Health (WDOH, 1996a) and U.S. Environmental Protection Agency (EPA, 1996a). These changes are because of a revised sealing configuration of the multi-canister overpacks (MCOs) that are used to store the SNF. A flow schematic of the SNF Project is provided in Figure 1-1.

A separate notification of startup will be provided apart from this NOC.

Spent Nuclear Fuel Project

Figure 1-1. Flow Schematic of the Spent Nuclear Fuel Project.

2.0 FACILITY LOCATION (Requirement 1)

The CSB is located within the 200 East Area of the Hanford Site. The 200 East Area is approximately 24 miles northwest of the city of Richland, Washington. Figure 2-1 shows the location of the 200 East Area and Figure 2-2 shows the location of the CSB site.

The latitude and longitude for the CSB are:

46.0 degrees 33.0' 19.70182" N 119.0 degrees 32.0' 58.60232" W

Address: U.S. Department of Energy,
Richland Operations Office
P.O. Box 550
Hanford Site
Richland, Washington 99352.

Figure 2-1. Location of the 200 East Area within the Hanford Site.

Canister Storage Building

HG98040175.4

Figure 2-2. Location of Canister Storage Building in the 200 East Area.

This page intentionally left blank.

3.0 RESPONSIBLE MANAGER (Requirement 2)

The responsible manager's name and address are as follows:

Ms. E. D. Sellers, Division Director
Spent Nuclear Fuels Project Division
U.S. Department of Energy
Richland Operations Office
Mail Stop S7-41
P.O. Box 550
Richland, WA. 99352
(509) 376-1465.

1
2
3
4
5

This page intentionally left blank.

1 **4.0 TYPE OF PROPOSED ACTION** (Requirement 3)
2
3

4 Approval of the 1996 NOC addressed the construction and operation of a
5 new emission unit, i.e., the CSB for the storage of SNF.
6

7 This NOC revision describes changes in facility processes.

1
2
3
4
5

This page intentionally left blank.

1 **5.0 STATE ENVIRONMENTAL POLICY ACT** (Requirement 4)
2
3

4 The proposed activity is categorically exempt from SEPA requirements per
5 WAC 197-11-845.

1
2
3
4
5

This page intentionally left blank.

6.0 PROCESS DESCRIPTION (Requirements 5 and 7)

The CSB is a vault type, natural convection cooled, dry storage structure for SNF from the 105-K Basins. The CSB consists of load-in/load-out areas, mechanical and electrical support areas, MCO weld/sample station, and a subgrade vault storage area. Figures 6-1 and 6-2 present a general layout of the CSB showing principle components and systems.

6.1 FACILITY AND EQUIPMENT DESCRIPTION

The CSB construction was started in May 1996 using design modifications to the building originally planned to house the Hanford Waste Vitrification Plant (HWVP). The original plan for the CSB was for storing vitrified glass logs containing radioactive waste. The use of the modified design based on the original design was deemed feasible because of similar design requirements for the storage of SNF.

The subgrade reinforced concrete vault area is designed to accommodate three equal-sized, below grade compartments with each compartment cooled by convection and having separate ventilation inlet and exhaust plenums. Because there is physical separation from the SNF source term in this belowgrade vault, there is no control technology nor emission monitoring of the exhaust from this area. The physical separation consists of the following barriers: MCO and storage tube.

Over the vault will be a structural steel and metal building with heating and ventilation systems, and a uniquely designed material handling machine for use in the lifting, loading, and management of MCOs. The air space above the operating deck will be maintained at a negative pressure with respect to atmosphere during all MCO handling, storage and monitoring operations. The exhaust from this portion of the building ventilation system will be filtered by testable HEPA filters and sampled before exhausting through a separate building operating area stack. An operating deck separates the subgrade vault from the above grade-level working area. Figure 6-2 shows the layout of the superstructure and the three vaults. The CSB heating, ventilation, and air conditioning (HVAC) flow diagram is shown in Figure 6-3.

A continuous air emission sampling/monitoring system (CAEMS) will be installed in the (296-H-212) process exhaust stack, which has an outside diameter of 28 inches and an outlet 56 feet above the top of the utilities annex. Additional details of this system are provided in Section 9.0.

Structural support and radiation protection design standards require the operating deck to be constructed of 5-foot-thick reinforced concrete. There are 226 penetration holes in the concrete deck in each of the three compartments in the vaulted area. MCOs containing the SNF will be stored in the 226 vertical storage tubes in the north vault (also known as vault 1). Vaults 2 and 3 will be used for the storage of sealed/immobilized high-level waste. Modifications required for the use of vaults 2 and 3 are not included in this NOC.

Steel storage tubes which will prevent migration of radioactivity will be inserted through existing penetrations and will extend from the operating deck to the floor of the vault. Access to the interior of the tubes will be through penetrations in the operating deck. Each tube can contain two MCOs and will be equipped with a shield plug that will be vented to the operating deck but which can also be isolated. The storage tube installation is illustrated in Figure 6-4a.

The MCO storage tubes will be fabricated from 28 inch diameter, 1/2-inch-thick carbon steel pipes and will extend from the operating deck to the concrete floor of the vault subcompartment. The storage tube anchor plates are designed to provide additional structural support for each tube. Each storage tube assembly will be approximately 42 foot long from the top surface of the operating deck to the floor of the vault.

A compression bellows will be placed in the upper portions of the steel storage tubes to compensate for expansion and contraction of the tube while sealing the lower plenum from the operating deck. Compression bellows are flexible metal components welded to the storage tube and operating deck. All operating deck components will be flush with the top surface of the deck to provide a smooth working floor. A floor plan of the operating deck is shown in Figure 6-1 and a cross-sectional view of a penetration with a storage tube, MCOs, and a floor shield plug installed is shown on Figures 6-4a and 6-4b.

There will be no radioactive emissions in the exhaust plenum from the belowgrade concrete vault area because of the physical separation of this portion of the building and the MCOs through the use of the storage tubes. No emissions from the building air space over the operating deck are expected during the interim storage of fuel, which will occur after all of the MCOs have been seal welded and storage tubes have been sealed through use of a single O-Ring seal on the tube plug.

6.1.1 Multi-Canister Overpack

The function of the MCO is to confine, contain, and maintain the SNF in a critically safe array to ensure safe operations and to support processing the fuel at the Cold Vacuum Drying Facility (CVDF), and transport to the CSB.

After transport, the MCOs will be seal welded in the sample and weld station located in the CSB, thus hermetically sealing the SNF contained in the MCO. Sealing will be accomplished by welding a stainless steel cover over the top of the MCO that will completely enclose the mechanically-sealed plug and port openings. Gas tungsten arc welding (GTAW) will be used and the welds will be inspected to ensure weld quality.

The MCO will be fabricated from a 24-inch outside diameter stainless steel pipe with a half-inch thick wall (Figure 6-5). The bottom is flat with a central depression to allow water to be removed from the MCO through a central dip tube. The top is a thick shield plug mechanically sealed by bolting and gasketing to the body. The shield plug has passages and ports to facilitate the sampling and exchange of process gases inside the MCO.

A MCO will be approximately 13 feet 4 inches long. The maximum loaded weight will be approximately 20,000 pounds. The MCO, its components, and rerack baskets will be made almost entirely of 304L stainless steel. The design pressure is 450 pounds per square inch gauge (psig) with a significantly higher ultimate pressure. Normal operating pressure is predicted to be less than 50 psig.

The MCO will remain in the transport cask until removed at the CSB. The cask and MCO assembly combined have 8 inches of shielding around the fuel. Together, these components shield operations personnel working in the vicinity of the cask from radiation emanating from the fuel. The transport cask will be cleaned of exterior contamination before removal from the 105-K Basins.

6.1.2 Multi-Canister Overpack Handling Machine

The MCO handling machine (MHM) is a fully shielded machine used to move MCOs with or without a welded cap within the CSB. The MHM consists of a crane equipped with a shielded cask/turret system. The function of the cask/turret system for the MHM is to lift MCOs out of and transfer MCOs among the receiving pit, storage tubes, and sampling weld station in a shielded environment. The MHM has its own ventilation system equipped with a testable HEPA filtered exhaust, providing a net flow of air into the cask/turret interior.

Around the lower end of the cask turret system is a retractable shield skirt attached such that this can be lowered down to the operating deck and seated against a machined seat ring. The shield skirt will be lowered at any of the operating stations to provide continuous shielding whenever a MCO is engaged. The MHM cask exhaust ventilation and exhaust system is provided to maintain the cavity of the MHM at a slightly negative pressure with respect to the building air space.

6.1.3 Sampling and Weld Station

A sampling and weld station will be located at the south end of the CSB operating area. This area will consist of seven process pits, 4 feet in diameter and 19 feet 8 inches deep. Three of the pits will be equipped for MCO gas sampling and for GTAW of the caps on the MCOs. Weld inspection and helium leak checking of the seal weld will also be accomplished here. Figure 6-6 is a schematic of the MCO Sampling and Weld Station.

An exhaust enclosure will be provided for confinement around the top of the MCO during sampling and welding. This is an integral and connected component of the weld equipment carried by a gantry crane and is designed to be positioned on top of the MCO. The enclosure will be constructed of stainless steel with plastic windows. The function of the enclosure is to capture any potential airborne contamination. There is a net airflow into the enclosure. An exhaust duct will run from the enclosure to a fan and through a testable HEPA filter that will exhaust into the building ventilation exhaust

1 system for the CSB operating area upstream of the building exhaust testable
2 HEPA filters.

6.1.4 Tube Vent and Purge Cart

7 The tube vent and purge cart will house the storage tube purge system,
8 which is designed to monitor and maintain an inert gas environment around any
9 MCO placed in the overpack storage tubes and to monitor the atmosphere in any
10 of the other storage tubes as required. The vent and purge cart could be
11 driven to any of the 226 storage tubes.

13 The vent and purge cart equipment will include inert gas supply
14 cylinders, flexible steel hoses, an airtight sampling connection, a
15 radioactive gas monitor, a hydrogen gas monitor and associated interlocks and
16 alarms, a vacuum pump and its cooling unit, a high efficiency particulate
17 filter, and an oxygen monitor and associated alarms.

6.2 PROCESSES AT THE CANISTER STORAGE BUILDING

21 A flow diagram of the major processes at the CSB is shown in Figure 6-7.

6.2.1 Spent Nuclear Fuel Conditioning Process Validation

27 A process for validating the process parameters with respect to storing
28 the MCOs in a sealed configuration is planned. A representative sample of
29 MCOs will be part of this process validation.

31 MCOs used in the process validation will be representative of the types
32 of SNF processed through the CVDF, and will be periodically sampled and
33 monitored within the confines of the CSB. Figure 6-8 is a flow diagram of the
34 monitor and sample process. While the MCOs are stored awaiting monitoring,
35 the MCOs also will be sealed through the use of a mechanical seal on the MCO
36 shield plug.

6.2.2 Welding Cover Cap On Multi-Canister Overpacks

41 The weld station processes will include welding, weld inspection, MCO
42 sampling, MCO purging, and leak testing of the MCO mechanical seal and cap
43 weld. Figure 6-9 is a flow diagram of this process. On confirmation that the
44 seal of an MCO is acceptable, the MCOs will be placed in interim storage for
45 up to 40 years.

47 The MHM will transit the length of the CSB to the south end where the
48 sample/weld station is located and the MCO will be placed in a service pit to
49 be accessed by equipment through quick-connect fittings on the shield plug.
50 Each of the MCO ports will be mechanically sealed with a bolted and gasketed
51 flange plate when not in use. One of the fittings will penetrate to the top
52 space of the MCO, while the other will have a tube that reaches the bottom of

1 the MCO. After the top of the MCO is accessed in the service pit, the cover
2 plate on the quick-connect fitting will be removed and the purge station
3 equipment will be coupled to it to obtain a pressure reading from the purge
4 station pressure gauge. Following purging with helium and monitoring to
5 ensure there is no leakage, the MCO will be fitted with a steel cap and seal
6 welded. The evacuated gases generated by purging the MCO will be collected by
7 a hood connected to an 8-inch duct and directed to high-efficiency particulate
8 filters, and then into the ventilation exhaust system for the CSB upstream of
9 the operating area testable HEPA filters. Figure 6-3 provides a schematic of
10 the CSB ventilation system.

11
12 The same exhaust enclosure that will be used for MCO sampling will be
13 provided for capturing airborne emissions around the top of the MCO during
14 welding. This is an integral and connected component of the weld equipment
15 carried by a gantry crane and will be designed to seal tightly to the top of
16 the MCO when lowered into place. The enclosure will be constructed of
17 stainless steel with plastic windows. The function is to seal the space
18 around the top of the MCO so that the exhaust system can develop a lowered
19 pressure within the enclosure to capture any potential airborne contamination.
20 An exhaust duct will run from the enclosure to a fan and through a testable
21 HEPA filter that will exhaust into the ventilation exhaust system for the CSB
22 upstream of the operating area HEPA filters.

23 24 25 6.2.3 Overpack Storage Tube Purge System 26

27 The storage tube purge system will provide four major operational
28 activities on the six overpack storage tubes and other standard storage tubes
29 if required: initial vacuum purge of air from the tube, tube venting, tube
30 refill, and pressure purging.

31
32 The initial vacuum purge of air from the overpack tube will pull a vacuum
33 on the tube as soon as possible after the MCO has been placed in the tube.
34 The air drawn from the tube will be monitored for hydrogen and the pump will
35 be shutdown if the hydrogen concentration reaches 25 percent of the lower
36 flammability limit. Following tube evacuation, the tube will be refilled with
37 inert gas to a pressure of 3 to 4 psig and the tube shield plug seals will be
38 checked.

39
40 If an MCO inside a storage tube needs to be moved, e.g., to be sampled,
41 the tube will be vented through the vent and purge cart high-efficiency
42 particulate filter to the CSB operating area to reduce any overpressure before
43 removing the tube shield plug.

44
45 Overpack storage tubes could be refilled with inert gas, if required
46 because of removal of an MCO or leakage from the tube. The vent and purge
47 cart will be used to refill the tube with inert gas to a pressure of 3 to
48 4 psig and the tube shield plug seals will be checked.

49
50 Pressure purging could be performed if the pressure in a tube exceeds
51 4 psig. The gas in the tube will be analyzed and vented to the CSB operating
52 area through the vent and purge cart high-efficiency particulate filter. The

vent and fill cycle will be repeated as necessary to maintain an inert environment inside the storage tube.

6.2.4 Multi-Canister Overpack Processes At Canister Storage Building

Upon receipt at the CSB, MCOs can be either temporarily stored in a tube for validation, temporarily stored for MCO welding if the weld station is not available, or sent directly for cover cap welding as described in Figure 6-7.

During these modes of storage, the storage tubes will be closed with a shield plug that incorporates a seal, filtered vent, and an isolation valve. The vent on the storage tubes normally will be open during storage but could be closed periodically to check for pressure buildup in the tubes.

6.2.5 Venting of Transportation Cask

When the transportation cask containing a processed MCO is received from the CVDF, the cask will be taken into the CSB receiving bay (see section 9.3). The cask and its MCO will be moved into the service pit where instruments will be used to measure the cask pressure before the cask lid is removed. If the pressure is not within specification, the cask will be vented and purged with an inert gas. A flexible hose will be connected to the access port on the cask lid to vent the cask through a testable HEPA filter. The filtered gases will be piped to the inlet side of the building process testable HEPA filters where the gases will be filtered again before being exhausted from the building. If required, a sample of the cask gas could be taken and sent to a laboratory for analysis.

Following venting, the cask could be purged by successive cycles of pressurization and venting until a satisfactory cask atmosphere is obtained. The cask lid could then be removed and the MCO could be accessed.

Figure 6-1. Layout of the Floor Plan of the Canister Storage Building.

Figure 6-2. Layout of the Superstructure and the Three Vaults.

Figure 6-3. Canister Storage Building Heating, Ventilation, and Air Conditioning Flow Diagram.

Figure 6-4a. The Storage Tube Installation.

Figure 6-4b. Cross-Sectional View of a Penetration With a Storage Tube, Multi-Canister Overpacks, and Floor Shield Plug Installed.

Figure 6-5. Multi-Canister Overpack.

Figure 6-6. Schematic of the Multi-Canister Overpack Sampling and Weld Station.

MULTI-CANISTER OVERPACK (MCO) PROCESSES AT CANISTER STORAGE BUILDING

H389040175.1

Figure 6-7. Flow Diagram of the Canister Storage Building Major Processes.

HQ39040175.2R1

Figure 6-8. Flow diagram of the Monitor and Sample Process.

WELD COVER CAP ON MCO

MCO COVER CAP ON WELDING STEPS

HG98040175.3R1

Figure 6-9. Flow Diagram of Multi-Canister Overpack Welding Process.

H98050140.1

Figure 6-10. General Configuration of the Multi-Canister Overpack Handling Machine.

Figure 6-11. Layout of the Multi-Canister Overpack Handling Machine Within the Operating Area.

7.0 ANNUAL POSSESSION QUANTITY AND PHYSICAL FORM

(Requirements 10 and 11)

The annual possession quantity of SNF being planned for storage in the CSB has not changed from the quantity approved in the earlier NOCs (WDOH, 1996 and EPA, 1996), i.e., approximately 2,100 metric tons.

The annual possession quantity and its physical form as previously estimated (WDOH, 1996 and EPA, 1996) are described in Table 7-1. These remain bounding in nature based on more recent characterization data. The WDOH and EPA will be notified of any changes in the annual possession quantity and its physical form that would cause the PTE described in Sections 10 and 11 to increase.

The potential source for airborne radionuclide emissions will be 2,100 metric tons of irradiated uranium fuel stored in the MCOs prior to them being sealed by welding a cover cap on top of the MCO. This fuel was irradiated eleven to twenty seven years ago and is decreasing in activity due to normal radioactive decay processes. The activity level of the radionuclides was calculated using decay to December 31, 1997.

The emission potential at the CSB exists until the MCOs are sealed. The source of these potential emissions will be any corrosion products from the fuel contained in the MCOs. The inventory of radionuclides from the fuel is listed in Table 7-1.

The results of tests on samples of sludge from the 105-K East Basin show that a small portion of the total fuel has corroded and is dispersed as particulate matter in the sludge which is dispersed in the fuel canisters and on the floor of the basins. Most of the fuel remains intact as a metallic solid in the form of high grade metallic fuel elements clad with zirconium or aluminum alloy. To estimate the potential emissions, it was assumed that a certain quantity of water would remain in the MCOs after the CVD process step and react with the uranium fuel to form uranium oxide corrosion products.

The potential-to-emit calculation for the CSB is based on the inventory method procedure described in 40 CFR 61, Appendix D, and uses an estimated amount of particulate material in the MCOs, i.e., 4 percent. Appendix B describes the estimated amount of particulate material in an MCO. These remain bounding in nature based on more recent fuel characterization data.

1
2
3
4
5

This page intentionally left blank.

Table 7-1. Canister Storage Building Annual Possession Quantity
and Physical Form.
All Fuel from 105-K East and 105-K West Basins.

Radionuclide	Physical Form s = solid (99.6%) p = particulates (0.4%)	Annual Possession Quantity (curies) (solid/particulates)
H ³	gas (generated)	4.38 E+01
H ³	s (matrixed in fuel)	3.49 E+04
C ¹⁴	gas (generated)	8.28 E-01
C ¹⁴	s (matrixed in fuel)	6.60 E+02
Co ⁶⁰	s/p	3.98 E+03 / 1.60 E+01
Kr ⁸⁵	gas (generated)	7.24 E+02
Kr ⁸⁵	s (matrixed in fuel)	5.77 E+05
Sr ⁹⁰	s/p	9.74 E+06 / 3.91 E+04
Y ⁹⁰	s/p	9.74 E+06 / 3.91 E+04
Sb ¹²⁵	s/p	3.36 E+04 / 1.35 E+02
Te ^{125m}	s/p	8.16 E+03 / 3.28 E+01
I ¹²⁹	gas (generated)	7.41 E-03
I ¹²⁹	s (matrixed in fuel)	5.91 E+00
Cs ¹³⁴	s/p	1.69 E+04 / 6.77 E+01
Cs ¹³⁷	s/p	1.26 E+07 / 5.04 E+04
Ba ^{137m}	s/p	1.19 E+07 / 4.78 E+04
Pm ¹⁴⁷	s/p	4.89 E+05 / 1.96 E+03
Sm ¹⁵¹	s/p	1.67 E+05 / 6.72 E+02
Eu ¹⁵⁴	s/p	1.00 E+05 / 4.02 E+02
Eu ¹⁵⁵	s/p	2.12 E+04 / 8.52 E+01
U ²³⁴	s/p	8.74 E+02 / 3.51 E+00
U ²³⁵	s/p	3.40 E+01 / 1.36 E-01
U ²³⁶	s/p	1.27 E+02 / 5.08 E-01
U ²³⁸	s/p	6.96 E+02 / 2.78 E+00
Pu ²³⁸	s/p	1.22 E+05 / 4.88 E+02
Pu ²³⁹	s/p	2.25 E+05 / 9.00 E+02
Pu ²⁴⁰	s/p	1.30 E+05 / 5.20 E+02
Pu ²⁴¹	s/p	6.39 E+06 / 2.56 E+04
Am ²⁴¹	s/p	3.45 E+05 / 1.39 E+03
Total		5.29 E+07

Gas = 7.69 E+02

Solids = 5.27 E+07

Particulates = 2.06 E+05

Fuel decay date basis December 31, 1997.

1
2
3
4
5

This page intentionally left blank.

8.0 CONTROL SYSTEM (Requirement 6)

Descriptions of the process control systems and the CSB ventilation exhaust system are discussed in the following sections.

8.1 PROCESS CONTROL SYSTEMS

Ventilation systems used to control the release of particulate airborne radiological contamination from individual processes will be as follows:

- MHM cask extract ventilation and exhaust system
- Sampling/weld station ventilation and exhaust system
- Overpack storage tube purge system
- Temporary containment enclosure for contamination control

8.1.1 Multi-Canister Overpack Handling Machine Ventilation and Exhaust System

The MHM cask extract system will consist of an extract fan, testable HEPA filter, non-return damper, ductwork, and instrumentation to monitor flow and filter differential pressure. The system will exhaust to the CSB air space.

The system will connect to an exhaust header on the MHM. The HEPA filter will be situated upstream of all equipment to minimize contamination of the other system components. The HEPA filter will be sized at approximately 1,000 standard cubic feet per minute (scfm). A pre-filter will be provided upstream of the HEPA filter to prolong the life of the HEPA filter.

8.1.2 Sampling and Weld Station Ventilation Exhaust System

A sampling and weld station will be provided with its own ventilation system to provide local ventilation. The system will consist of a fan, ducts, dampers, and testable HEPA filter. The air pulled from the sample and weld station will be directed by ducts to the CSB process stack ventilation system upstream of the main HEPA filters so the air will be filtered a second time.

8.1.3 Overpack Storage Tube Purge System

The control system for potential particulate emissions from the vent and purge cart is an inline testable HEPA filter that will filter all discharges from the storage tubes. The exhaust airstream, following filtration, will be discharged into the CSB operating area.

8.1.4 Temporary Containment Enclosures For Contamination Control

Temporary containment enclosures consisting of an enclosure, fan and testable HEPA filter could be used occasionally in the CSB as secondary

1 containment as an "as low as reasonably achievable" (ALARA) measure during
2 operations and maintenance activities that have the potential for dispersing
3 radioactive contaminants in the workplace. The ventilation system for the
4 temporary containment enclosure will pull air from the CSB operating area and
5 return the air back to the operating area.
6
7

8 8.2 CANISTER STORAGE BUILDING VENTILATION EXHAUST SYSTEM

9

10 The ventilation system is designed to maintain a negative pressure within
11 the working area of the CSB including the sampling and weld station relative
12 to the outside of the building (refer to Figure 6-3). Two redundant fans and
13 banks of testable HEPA filters will draw air from the CSB operating area and
14 exhaust the air outside through the exhaust stack located in the utilities
15 annex.
16

17 Potential airborne radioactive particulate emissions from the CSB will be
18 controlled by a single stack equipped with HEPA filters. The HEPA filters
19 will be testable to assure a minimum collection efficiency of 99.97 percent
20 for 0.3 micron median diameter particles. The maximum design ventilation flow
21 rate will be approximately 9,000 cubic feet per minute. There will be
22 parallel systems in the CSB ventilation system to ensure continuous operation.
23 All of the ventilation air from operating areas of the CSB containing vented
24 MCOs will be exhausted through the CSB ventilation exhaust system.

9.0 MONITORING SYSTEM (Requirement 9)

This section describes the air emission monitoring system for the CSB. The CAEMS will sample radioactive particulate contaminants.

Figure 9-1 is a flow schematic of the CAEMS system. Figure 9-2 shows the placement of the shrouded sample probe in the exhaust stack for single point sampling. Figure 9-3 shows the relationship of the CAEMS stack to the building and probe locations.

The sampling and monitoring system is designed with a minimum collection efficiency of 50 percent or more for 10 micron sized particles. A shrouded probe, designed for the 9,000 cubic feet per minute stack flow rate, will be used to extract the sample. The CAEMS will be tested to ensure the system meets the requirements of 40 CFR 52, Appendix E, 40 CFR 60, Appendix A, and 40 CFR 61, Subpart H, as required by the design standards found in WAC 246-247-075. The sampler will operate continuously and will be calibrated periodically. In addition, for operational purposes, the stack will contain continuous monitors for alpha and beta/gamma radiation.

The sample filters will be delivered to a laboratory for a complete alpha-beta analysis and scanned with a lower detection limit of 1 picocurie. The filters will be composited quarterly for a gamma scan (cesium-137, et al.) and an isotopic analysis for strontium-90, americium-241, and plutonium (plutonium 239/240 and 241).

9.1 PARTICULATE MONITORING

The CAEM equipment will have a 4-hour detection threshold of 6.0 E^{-12} picocuries per millileter (pci/ml) for gamma detection (cesium-137 and barium-137m), and 4.0 E^{-12} for beta detection (strontium-90). For the CSB ventilation system, continuous exhaust at these concentrations would be equivalent to 8.0 E^{-4} curies per year for the gamma emitters and 5.4 E^{-4} curies per year for the beta emitters.

This system will have a 4-hour alpha detection threshold of 4.0 E^{-12} pci/ml for the alpha emitters (plutonium and americium). For the CSB ventilation system, this is equivalent to 5.4 E^{-4} curies per year.

9.2 SHROUDED PROBE

The shrouded probe is the Graseby-Anderson Model 35-712-111 which has an intake nozzle diameter of 0.72 inch, designed for representative sample collection at a 2 cubic-feet-per-minute sample flow rate in an effluent velocity of 25.6 to 52.5 feet per second. The probe is typical of the design that was verified by test and documented (PNL-10816). Refer to Figure 9-2 for details on the probe.

1 9.3 OTHER DESIGN FACTORS
2

3 The CSB design and operation will ensure that potentially contaminated
4 air exhausts through testable HEPA filters and the monitored stack by means of
5 maintaining a negative pressure within the CSB with respect to atmosphere.
6 Other internal process high efficiency particulate filters, such as the MCO
7 filters and process equipment filters, are incorporated into the design but
8 are not factored into the emission calculations. No fugitive emissions are
9 expected.
10

11 There will be a significant opening in the building containment when the
12 20-foot wide by 30-foot high roll-up door is opened for trailer access to the
13 load/unload ramp within the building. Potential emissions will be prevented
14 by the following conditions:
15

- 16 • The trailer parking area will be in an enclosed chamber that is closed
17 to the CSB by means of a 37-foot wide by 41-foot high inner door.
18 Only one door will be opened at a time.
- 19 • The doors will not be opened unless the building ventilation system is
20 in operation. The 9,000 cubic feet per minute ventilation flow rate
21 has the objective of maintaining an inward flow of air through the
22 open door.
- 23 • The doors will be maintained in a closed position except during
24 trailer ingress and egress.
25
26

Figure 9-1. Schematic diagram of the Continuous Air Emission Monitoring System.

Figure 9-2. Placement of the Shrouded Sample Probe in the Exhaust Stack.

Figure 9-3. Relationship of Operating Area Exhaust Stack to Building and Probe Locations.

This page intentionally left blank.

10.0 RELEASE RATES (Requirements 12 and 13)

1
2
3
4 The inventory of radionuclides in the CSB as listed in Table 10-1 is
5 divided into physical state categories of solids, particulates, and gases as
6 described in section 7.0. The maximum potential unabated emissions from this
7 inventory were calculated based on the inventory method procedure described in
8 40 CFR 61, Appendix D, and are summarized also in Table 10-1. The maximum
9 potential abated emissions from this inventory were calculated in a similar
10 fashion but used an abatement factor for particulate radioactive airborne
11 contamination and are summarized in Table 10-2.

1
2
3
4
5

This page intentionally left blank.

Table 10-1. Approved Canister Storage Building Unabated Annual Emissions. (sheet 1 of 2)

Radionuclide	Physical Form s = solid (99.6%) p = particulates (0.4%)	Possession Quantity (curies)	Unabated Emissions (curies per year)
H ³	gas (generated)	4.38 E+01	4.38 E+01
H ³	s (matrixed in fuel)	3.49 E+04	3.49 E-02
C ¹⁴	gas (generated)	8.28 E-01	8.28 E-01
C ¹⁴	s (matrixed in fuel)	6.60 E+02	6.60 E-04
Co ⁶⁰	s/p	3.98 E+03 / 1.60 E+01	2.00 E-02
Kr ⁸⁵	gas (generated)	7.24 E+02	7.24 E+02
Kr ⁸⁵	s (matrixed in fuel)	5.77 E+05	5.77 E-01
Sr ⁹⁰	s/p	9.74 E+06 / 3.91 E+04	4.89 E+01
Y ⁹⁰	s/p	9.74 E+06 / 3.91 E+04	4.89 E+01
Sb ¹²⁵	s/p	3.36 E+04 / 1.35 E+02	1.69 E-01
Te ^{125m}	s/p	8.16 E+03 / 3.28 E+01	4.13 E-02
I ¹²⁹	gas (generated)	7.41 E-03	7.41 E-03
I ¹²⁹	s (matrixed in fuel)	5.91 E+00	5.91 E-06
Cs ¹³⁴	s/p	1.69 E+04 / 6.77 E+01	8.44 E-02
Cs ¹³⁷	s/p	1.26 E+07 / 5.04 E+04	6.29 E+01
Ba ^{137m}	s/p	1.19 E+07 / 4.78 E+04	5.95 E+01
Pm ¹⁴⁷	s/p	4.89 E+05 / 1.96 E+03	2.45 E+00
Sm ¹⁵¹	s/p	1.67 E+05 / 6.72 E+02	8.39 E-01
Eu ¹⁵⁴	s/p	1.00 E+05 / 4.02 E+02	5.05 E-01
Eu ¹⁵⁵	s/p	2.12 E+04 / 8.52 E+01	1.09 E-01
U ²³⁴	s/p	8.74 E+02 / 3.51 E+00	4.39 E-03
U ²³⁵	s/p	3.40 E+01 / 1.36 E-01	1.70 E-04
U ²³⁶	s/p	1.27 E+02 / 5.08 E-01	6.34 E-04

Table 10-1. Approved Canister Storage Building Unabated Annual Emissions. (sheet 2 of 2)

Radionuclide	Physical Form s = solid (99.6%) p = particulates (0.4%)	Possession Quantity (curies)	Unabated Emissions (curies per year)
U^{238}	s/p	6.96 E+02 / 2.78 E+00	3.47 E-03
Pu^{238}	s/p	1.22 E+05 / 4.88 E+02	6.10 E-01
Pu^{239}	s/p	2.25 E+05 / 9.00 E+02	1.12 E+00
Pu^{240}	s/p	1.30 E+05 / 5.20 E+02	6.49 E-01
Pu^{241}	s/p	6.39 E+06 / 2.56 E+04	3.19 E+01
Am^{241}	s/p	3.45 E+05 / 1.39 E+03	1.73 E+00
Totals		5.29 E+07	1.03 E+03

Table 10-2. Approved Canister Storage Building Abated Annual Emissions.

Radionuclide	Unabated Emissions (curies per year)	HEPA Filter Abatement Factor	Abated Emissions (curies per year)
H ³	4.38 E+01	1	4.38 E+01
H ³	3.49 E-02	3,000	1.16 E-05
C ¹⁴	8.28 E-01	1	8.28 E-01
C ¹⁴	6.60 E-04	3,000	2.20 E-07
Co ⁶⁰	2.00 E-02	3,000	6.67 E-06
Kr ⁸⁵	7.24 E+02	1	7.24 E+02
Kr ⁸⁵	5.77 E-01	3,000	1.92 E-04
Sr ⁹⁰	4.89 E+01	3,000	1.63 E-02
Y ⁹⁰	4.89 E+01	3,000	1.63 E-02
Sb ¹²⁵	1.69 E-01	3,000	5.65 E-05
Te ^{125m}	4.13 E-02	3,000	1.38 E-05
I ¹²⁹	7.41 E-03	1	7.41 E-03
I ¹²⁹	5.91 E-06	3,000	1.97 E-09
Cs ¹³⁴	8.44 E-02	3,000	2.81 E-05
Cs ¹³⁷	6.29 E+01	3,000	2.10 E-02
Ba ^{137m}	5.95 E+01	3,000	1.98 E-02
Pm ¹⁴⁷	2.45 E+00	3,000	8.18 E-04
Sm ¹⁵¹	8.39 E-01	3,000	2.80 E-04
Eu ¹⁵⁴	5.05 E-01	3,000	1.68 E-04
Eu ¹⁵⁵	1.09 E-01	3,000	3.63 E-05
U ²³⁴	4.39 E-03	3,000	1.47 E-06
U ²³⁵	1.70 E-04	3,000	5.66 E-08
U ²³⁶	6.34 E-04	3,000	2.11 E-07
U ²³⁸	3.47 E-03	3,000	1.16 E-06
Pu ²³⁸	6.10 E-01	3,000	2.03 E-04
Pu ²³⁹	1.12 E+00	3,000	3.75 E-04
Pu ²⁴⁰	6.49 E-01	3,000	2.16 E-04
Pu ²⁴¹	3.19 E+01	3,000	1.06 E-02
Am ²⁴¹	1.73 E+00	3,000	5.76 E-04
Totals	1.03 E+03		7.69 E+02

1
2
3
4
5

This page intentionally left blank.

11.0 OFFSITE IMPACT (Requirements 8, 14 and 15)

11.1 UNABATED DOSE

The potential unabated offsite dose to a maximally exposed offsite individual (MEI) was calculated using the PC version of CAP88. The results are shown in Table 11-1. The maximum affected individual is a hypothetical individual at the Hanford site boundary approximately 10.9 miles east of the CSB. For comparative purposes, Table 11-2 compares the results of the approved NOC potential unabated offsite dose using the mainframe version of CAP88 versus the PC version of CAP88.

11.2 ABATED DOSE

The potential abated offsite dose to the MEI was calculated using the PC version of CAP88. The results are shown in Table 11-3.

1
2
3
4
5

This page intentionally left blank.

Table 11-1. Canister Storage Building Potential Unabated Offsite Dose Using
CAP88 PC Version.

Radionuclide	Unabated Emissions (curies per year)	Dose Equivalent (millirem per curie)	Total Dose (millirem per year)	Percent of Total Unabated Dose
H ³	4.38 E+01	1.45 E-05	6.35 E-04	0.00
H ³	3.49 E-02	1.45 E-05	5.06 E-07	0.00
C ¹⁴	8.28 E-01	8.04 E-04	6.66 E-04	0.00
C ¹⁴	6.60 E-04	8.04 E-04	5.31 E-07	0.00
Co ⁶⁰	2.00 E-02	8.96 E-02	1.79 E-03	0.00
Kr ⁸⁵	7.24 E+02	3.20 E-08	2.32 E-05	0.00
Kr ⁸⁵	5.77 E-01	3.20 E-08	1.85 E-08	0.00
Sr ⁹⁰	4.89 E+01	6.04 E-02	2.95 E+00	8.00
Y ⁹⁰	4.89 E+01	1.32 E-04	6.46 E-03	0.00
Sb ¹²⁵	1.69 E-01	9.03 E-03	1.53 E-03	0.00
Te ^{125m}	4.13 E-02	5.97 E-04	2.47 E-05	0.00
I ¹²⁹	7.41 E-03	2.86 E-01	2.12 E-03	0.00
I ¹²⁹	5.91 E-06	2.86 E-01	1.69 E-06	0.00
Cs ¹³⁴	8.44 E-02	4.90 E-02	4.14 E-03	0.00
Cs ¹³⁷	6.29 E+01	9.29 E-02	5.84 E+00	15.80
Ba ^{137m}	5.95 E+01	0.00 E-00	0.00 +00	0.00
Pm ¹⁴⁷	2.45 E+00	6.92 E-04	1.70 E-03	0.00
Sm ¹⁵¹	8.39 E-01	4.77 E-04	4.00 E-04	0.00
Eu ¹⁵⁴	5.05 E-01	6.93 E-02	3.50 E-02	0.00
Eu ¹⁵⁵	1.09 E-01	3.07 E-03	3.35 E-04	0.00
U ²³⁴	4.39 E-03	1.93 E+00	8.47 E-03	0.00
U ²³⁵	1.70 E-04	1.83 E+00	3.11 E-04	0.00
U ²³⁵	6.34 E-04	1.83 E+00	1.16 E-03	0.00
U ²³⁸	3.47 E-03	1.72 E+00	5.97 E-03	0.00
Pu ²³⁸	6.10 E-01	4.75 E+00	2.90 E+00	7.90
Pu ²³⁹	1.12 E+00	5.12 E+00	5.73 E+00	15.50
Pu ²⁴⁰	6.49 E-01	5.12 E+00	3.32 E+00	9.00
Pu ²⁴¹	3.19 E+01	8.03 E-02	2.56 E-00	6.90
Am ²⁴¹	1.73 E+00	7.88 E+00	1.36 E+01	36.90
Total	1.03 E+03		3.69 E+01	100

Table 11-2. Comparison of CAP88 Mainframe and CAP88PC Values on Unabated Dose.

Radionuclide	Unabated Emissions (curies per year)	CAP88 Mainframe Values		CAP88PC Values	
		Dose Equivalent (millirem per curie)	Total Dose (millirem per year)	Dose Equivalent (millirem per curie)	Total Dose (millirem per year)
H ³	4.38 E+01	2.19 E-05	9.59 E-04	1.45 E-05	6.35 E-04
H ³	3.49 E-02	2.19 E-05	7.67 E-07	1.45 E-05	5.06 E-07
C ¹⁴	8.28 E-01	2.62 E-03	2.17 E-03	8.04 E-04	6.66 E-04
C ¹⁴	6.60 E-04	2.62 E-03	1.73 E-06	8.04 E-04	5.31 E-07
Co ⁶⁰	2.00 E-02	2.90 E-02	5.80 E-04	8.96 E-02	1.79 E-03
Kr ⁸⁵	7.24 E+02	4.88 E-08	3.53 E-05	3.20 E-08	2.32 E-05
Kr ⁸⁵	5.77 E-01	4.88 E-08	2.82 E-08	3.20 E-08	1.85 E-08
Sr ⁹⁰	4.89 E+01	4.38 E-02	2.14 E+00	6.04 E-02	2.95 E+00
Y ⁹⁰	4.89 E+01	3.77 E-04	1.84 E-02	1.32 E-04	6.46 E-03
Sb ¹²⁵	1.69 E-01	4.15 E-03	7.03 E-04	9.03 E-03	1.53 E-03
Te ^{125m}	4.13 E-02	included in Sb-125	n/a	5.97 E-04	2.47 E-05
I ¹²⁹	7.41 E-03	2.91 E-01	2.16 E-03	2.86 E-01	2.12 E-03
I ¹²⁹	5.91 E-06	2.91 E-01	1.72 E-06	2.86 E-01	1.69 E-06
Cs ¹³⁴	8.44 E-02	3.13 E-02	2.64 E-03	4.90 E-02	4.14 E-03
Cs ¹³⁷	6.29 E+01	2.39 E-02	1.50 E+00	9.29 E-02	5.84 E+00
Ba ^{137m}	5.95 E+01	2.39 E-02	1.42 E+00	0.00 E+00	0.00 E+00
Pm ¹⁴⁷	2.45 E+00	1.14 E-03	2.80 E-03	6.92 E-04	1.70 E-03
Sm ¹⁵¹	8.39 E-01	7.59 E-04	6.37 E-04	4.77 E-04	4.00 E-04
Eu ¹⁵⁴	5.05 E-01	1.82 E-02	9.18 E-03	6.93 E-02	3.50 E-02
Eu ¹⁵⁵	1.09 E-01	4.26 E-02	4.64 E-03	3.07 E-03	3.35 E-04
U ²³⁴	4.39 E-03	3.15 E+00	1.40 E-02	1.93 E+00	8.47 E-03
U ²³⁵	1.70 E-04	2.96 E+00	5.03 E-04	1.83 E+00	3.11 E-04
U ²³⁶	6.34 E-04	3.02 E+00	1.92 E-03	1.83 E+00	1.16 E-03
U ²³⁸	3.47 E-03	2.84 E+00	9.88 E-03	1.72 E+00	5.97 E-03
Pu ²³⁸	6.10 E-01	8.02 E+00	4.89 E+00	4.75 E+00	2.90 E+00
Pu ²³⁹	1.12 E+00	8.67 E+00	9.75 E+00	5.12 E+00	5.73 E+00
Pu ²⁴⁰	6.49 E-01	8.66 E+00	5.62 E+00	5.12 E+00	3.32 E+00
Pu ²⁴¹	3.19 E+01	1.38 E-01	4.41 E+00	8.03 E-02	2.56 E+00
Am ²⁴¹	1.73 E+00	1.31 E+01	2.26 E+01	7.88 E+00	1.36 E+01
Total	1.03 E+03		5.24 E+01		3.69 E+01

Table 11-3. Canister Storage Building Potential Abated Offsite Dose Using
CAP88 PC Version.

Radionuclide	Abated Emissions (curies per year)	Dose Equivalent (millirem per curie)	Total Dose (millirem per year)	Percent of Total Unabated Dose
H ³	4.38 E+01	1.45 E-05	6.35 E-04	4.00
H ³	1.16 E-05	1.45 E-05	1.68 E-10	0.00
C ¹⁴	8.28 E-01	8.04 E-04	6.66 E-04	4.20
C ¹⁴	2.20 E-07	8.04 E-04	1.77 E-10	0.00
Co ⁶⁰	6.67 E-06	8.96 E-02	5.98 E-07	0.00
Kr ⁸⁵	7.24 E+02	3.20 E-08	2.32 E-05	0.00
Kr ⁸⁵	1.92 E-04	3.20 E-08	6.14 E-12	0.00
Sr ⁹⁰	1.63 E-02	6.04 E-02	9.85 E-04	6.30
Y ⁹⁰	1.63 E-02	1.32 E-04	2.15 E-06	0.00
Sb ¹²⁵	5.65 E-05	9.03 E-03	5.10 E-07	0.00
Te ^{125m}	1.38 E-05	5.97 E-04	8.24 E-09	0.00
I ¹²⁹	7.41 E-03	2.86 E-01	2.12 E-03	13.50
I ¹²⁹	1.97 E-09	2.86 E-01	5.63 E-10	0.00
Cs ¹³⁴	2.81 E-05	4.90 E-02	1.38 E-06	0.00
Cs ¹³⁷	2.10 E-02	9.29 E-02	1.95 E-03	12.40
Ba ^{137m}	1.98 E-02	0.00 E+00	0.00 E+00	0.00
Pm ¹⁴⁷	8.18 E-04	6.92 E-04	5.66 E-07	0.00
Sm ¹⁵¹	2.80 E-04	4.77 E-04	1.34 E-07	0.00
Eu ¹⁵⁴	1.68 E-04	6.93 E-02	1.16 E-05	0.00
Eu ¹⁵⁵	3.63 E-05	3.07 E-03	1.11 E-07	0.00
U ²³⁴	1.47 E-06	1.93 E+00	2.84 E-06	0.00
U ²³⁵	5.66 E-08	1.83 E+00	1.04 E-07	0.00
U ²³⁶	2.11 E-07	1.83 E+00	3.86 E-07	0.00
U ²³⁸	1.16 E-06	1.72 E+00	2.00 E-06	0.00
Pu ²³⁸	2.03 E-04	4.75 E+00	9.64 E-04	6.10
Pu ²³⁹	3.75 E-04	5.12 E+00	1.92 E-03	12.20
Pu ²⁴⁰	2.16 E-04	5.12 E+00	1.11 E-03	7.10
Pu ²⁴¹	1.06 E-02	8.03 E-02	8.51 E-04	5.40
Am ²⁴¹	5.76 E-04	7.88 E+00	4.54 E-03	28.80
Total	7.69 E+02		1.58 E-02	100

1
2
3
4
5

This page intentionally left blank.

12.0 FACILITY LIFETIME (Requirement 17)

Construction activities for the CSB began in January of 1996 commensurate with previously approved NOCs.

The building foundation has a design lifetime of 75 years. The superstructure and operating systems within have a design life of 40 years, which can be extended with maintenance and upgrades as required.

1
2
3
4
5

This page intentionally left blank.

13.0 TECHNOLOGY STANDARDS (Requirement 18)

The following technology standards are applicable to the CSB design, construction, and operation.

- ASME/ANSI AG-1, code on nuclear air and gas treatment. The requirements listed in ASME AG-1, pertaining to the stack monitoring system, also are addressed in ASME N509, ASME N510, and ANSI N13.1. Furthermore, the same or more stringent requirements are addressed; therefore, ASME N509, ASME N510, and ANSI N13.1 will be used in place of ASME AG-1.
- ASME/ANSI N509, nuclear power plant air cleaning units and components. This standard addresses the design, construction and testing of air cleaning systems. The CSB ventilation system will meet the requirements of this standard.
- ASME/ANSI N510, testing of nuclear air treatment systems. This standard addresses requirements for the field testing of air cleaning systems. The CSB ventilation system will meet the requirements of this standard.
- ANSI/ASME NQA-1 and NQA-2, quality assurance program requirements for nuclear facility applications. The design and operation of the CSB will be in conformance with 10 CFR 830.120. The implementation plan to these codified quality assurance requirements describe in detail which portions of the same standard are applicable and carried forward into design and operation.
- ANSI/ASME N13.1, guide to sampling airborne radioactive materials in nuclear facilities. The implementation plan to these codified quality assurance requirements describe in detail which portions of the same standard are applicable and carried forward into design and operation.

1
2
3
4
5

This page intentionally left blank.

14.0 ACCIDENT SCENARIOS

1
2
3
4 There are no postulated accidents with a probability of occurrence of
5 1 in 100 during the lifetime of the CSB that would cause an uncontrolled
6 release to the environment (WHC-SD-SNF-RPT-004).

1
2
3
4
5

This page intentionally left blank.

15.0 REFERENCES

- 1
2
3
4 EPA, 1996, *U.S. Environmental Protection Agency Clean Air Act Notice of*
5 *Construction for the Hanford Spent Nuclear Fuel Canister Storage*
6 *Building, Project W-379*, DOE/RL-96-PCA-127, February 14, 1996, Notice of
7 Construction for the Spent Nuclear Fuel Canister Storage Building,
8 Project W-379.
9
10 EPA, 1996a, Letter, A. Frankel, Environmental Protection Agency to
11 J.E. Rasmussen, U.S. Department of Energy, Richland Operations Office, no
12 subject, March 5, 1996.
13
14 HNF-1527, *Estimates of Particulate Mass in Multi-Canister Overpacks*, Numatec
15 Hanford Corporation, Richland, Washington.
16
17 HNF-SD-SNF-TI-009, *105-K Basin Material Design Basis Feed Description for*
18 *Spent Nuclear Fuel Project Facilities*, Rev. 1, 11-06-97.
19
20 PNL-10816, *Generic Air Sampler Probe Test*, Pacific Northwest Laboratory,
21 Richland, Washington.
22
23 WDOH, 1992, Letter, AIR-92-107, A.W. Conklin, Washington State Department of
24 Health, to J.D. Bauer, U.S. Department of Energy, Richland Operations
25 Office, no subject, October 5, 1992.
26
27 WDOH, 1996, *Notice of Construction for State of Washington Department of*
28 *Health Phase 2 Spent Nuclear Fuel Canister Storage Building, Project*
29 *W-379*, DOE/RL-96-SFD-251, Washington State Department of Health, Olympia,
30 Washington, as amended by DOE/RL-96-EAP-130, December 12, 1996,
31 Submission of Supplemental Information and Revisions to the Spent Nuclear
32 Fuel Canister Storage Building Phase 2 Notice of Construction,
33 DOE/RL-SD-195.
34
35 WDOH, 1996a, Letter, AIR 96-1203, A.W. Conklin, Washington State Department of
36 Health, to J.E. Rasmussen, U.S. Department of Energy, Richland Operations
37 Office, no subject, December 16, 1996.
38
39 WHC-EP-0498, *Unit Dose Calculation Methods and Summary of Facility Effluent*
40 *Monitoring Plan Determinations*, Westinghouse Hanford Company, Richland,
41 Washington.
42
43 WHC-SD-SNF-RPT-004, *Canister Storage Building Safety Analysis Report-Phase 3:*
44 *Safety Analysis Documentation Supporting CSB Construction*, Rev. 7B,
45 Westinghouse Hanford Company, Richland, Washington.
46
47
48

1
2
3
4
5

This page intentionally left blank.

APPENDIX A

DISCUSSION OF BEST AVAILABLE RADIONUCLIDE CONTROL TECHNOLOGY (Requirement 16)

1
2
3
4
5

This page intentionally left blank.

APPENDIX A

DISCUSSION OF BEST AVAILABLE RADIONUCLIDE CONTROL TECHNOLOGY (Requirement 16)

Requirement 16 of WAC 246-247-060 is not applicable because BARCT emission equipment will be used. The BARCT is defined by WAC 246-247-039 as follows:

"Technology that will result in a radionuclide emission limitation based on the maximum degree of reduction for radionuclides from any proposed newly constructed or significantly modified emission units that the licensing authority determines is achievable on a case-by-case basis. A BARCT compliance demonstration must consider energy, environmental, and economic impacts, and other costs through examination of production processes, and available methods, systems and techniques for control of radionuclide emissions. A BARCT compliance demonstration is the conclusion of an evaluative process that results in the selection of the most effective control technology from all known feasible alternatives. In no event shall application BARCT result in emissions of radionuclides that could exceed the applicable standards of WAC 246-247-040. Control technology that meets BARCT requirements also meets ALARACT requirements."

As stated in WAC 246-247-120, only those radionuclides comprising more than 10 percent of the unabated dose need to be evaluated. Nearly all of the dose is due to particulate radionuclides. The Washington State Department of Health has provided guidance that testable HEPA filters generally are considered BARCT for particulate emissions (WDOH 1992).

It is proposed, pursuant to the quoted citation, that the ventilation systems described in Section 8.0, and the systems described in Section 9.0 be approved as BARCT for the proposed activities at the Canister Storage Building.

1
2
3
4
5

This page intentionally left blank.

APPENDIX B

1
2
3
4

DERIVATION OF PARTICULATE FRACTION OF SPENT NUCLEAR FUEL POSSESSION QUANTITY

1
2
3
4
5

This page intentionally left blank.

APPENDIX B

DERIVATION OF PARTICULATE FRACTION OF SPENT NUCLEAR FUEL POSSESSION QUANTITY

The following information provides a bounding estimate of that portion of the SNF annual possession quantity in an MCO which could exist in a particulate state and is for environmental permitting purposes only.

The 105-K Basin Corrosion Program Report, WHC-EP-0877 documents estimates of the total fuel corrosion at 4,300 kg of uranium oxide (U_{O_2}) in the 105-K East Basin. The 105-K West canister water sampling accounted for a maximum of 3,800 curies of cesium-137 released from fuel in the 105-K West Basin (Data Analysis, K West Basin Canister Liquid and Gas Samples, Gamma Energy Analysis and Mass Spectrometry Data, WHC-SD-SNF-ANAL-007). The 3,800 curies cesium-137 corresponds to approximately 800 kg of U_{O_2} . The total mass of fuel oxide in the 105 K Basins is therefore estimated at 5,100 kg. The MCO fuel inventory which is estimated to be oxide particulate is described in the following steps:

Process Step: MCO Loading

SNF assemblies contained in canisters in the 105-K East and 105-K West Basins are coated with particulate oxidation products (canister sludge) as the result of a reaction of the metallic uranium with the water. The SNF assemblies will be washed to remove as much of this canister sludge as possible before the fuel is loaded into MCO baskets. It is estimated that (for purposes of estimating emissions) approximately 6.75 kilograms (kg) of canister sludge per MCO may still adhere to the SNF after the washing process.

- a. The total mass of fuel oxide potentially available for carry-over into the MCOs during SNF loading is estimated to be approximately 5,100 kg based on measurements of the amount of cesium-137 in the basins that has been released from the SNF by oxidation.
- b. The following assumptions are made:
 - All of the fuel oxide still resides in the canisters as canister sludge
 - The SNF washing process will remove half of the adhering canister sludge, the other half will be transferred to the MCOs as residual sludge
 - Basin floor sludge will not be carried over with the SNF into the MCOs because, unlike the canister sludge, it is physically separate from the canisters.
- c. The 2,550 kg of canister sludge that cannot be washed off the fuel will then be transferred to the 400 MCOs, for an average MCO content of 6.4 kg of sludge. (5,100 kg x one half/400 MCOs = 6.4 kg/MCO).
- d. It was estimated earlier, from a different basis, that each MCO could contain an average of 6.75 kg of canister sludge. The value of

6.75 kg was retained for this NOC because 6.75 kg is the value in the NOC that was submitted to EPA Region 10 and because it is more conservative than the 6.4 kg provided by the current estimate.

- e. The 6.75 kg of sludge per MCO (5.95 kg expressed as uranium) is 0.11 percent of the total uranium content of the MCOs (5,250 kg)
 $(5.95 \text{ kg} / 5,250 \text{ kg} \times 100) = 0.11 \text{ percent}.$

Process Step: Cold Vacuum Drying

- a. It is estimated that during the CVD process, an additional 0.72 kg of fuel oxide per MCO will be produced. This estimate is based on knowledge of the rate of reaction between uranium and water as a function of temperature and an estimate of the temperature and time duration of transportation and cold vacuum drying.
- b. The average MCO particulate content at the end of CVD will thus be 6.75 kg plus 0.72 kg = 7.47 kg (6.58 kg expressed as uranium).

Process Step: Transportation to CSB

- a. It is estimated that during transportation from the basins to the CVDF, an additional 2 kg of fuel oxide per MCO will be produced. Again, this estimate is based on knowledge of the oxidation conditions and kinetics.
- b. The average MCO particulate content when the MCO reaches the CSB for staging will thus be 6.75 kg + 0.72 kg + 2.0 kg = 9.47 kg (8.34 kg expressed as uranium).
- c. The 9.47 kg of particulate is thus $8.34 \text{ kg} / 5,250 \text{ kg per MCO} \times 100 = 0.15 \text{ percent}$ of the MCO uranium content.

Process Step: Storage At CSB Prior to Being Sealed

- a. It is estimated that an additional 14.3 kg per MCO of fuel oxide will be formed during staging of the MCOs at the CSB by the same uranium oxidation process described above.
- b. Thus at the end of staging, the average MCO particulate content will be 6.75 kg + 0.72 kg + 2.0 kg + 14.3 kg = 23.8 kg (21.0 kg expressed as uranium).
- c. The 23.8 kg of particulate is thus $21.0 \text{ kg} / 5,250 \text{ kg per MCO} \times 100 = 0.4 \text{ percent}$ of the MCO uranium content.

The rest of the uncorroded fuel (99.6 percent) is an intact metallic solid.

The possession quantity listed in Table 7-1 results from the entire quantity of SNF from the 105 K-East and 105-K West Basins when it is transferred to the CSB.

1 Gases matrixed in the fuel alloy will be released as free gases when the
2 matrix that bounds them undergoes a physical change such as corrosion.
3 Gaseous radionuclides are matrixed into the solid fuel metal. Small amounts
4 of gases are released due to the water-uranium corrosion on the surface of the
5 fuel and absorbed in residual sludge remaining on the fuel when it is moved to
6 the CSB. It is assumed that all of the gaseous constituents that are
7 generated by corrosion are released.

1
2
3
4
5

This page intentionally left blank.

APPENDIX C

INPUT PARAMETERS AND PROGRAM OUTPUT FOR CAP88PC

1
2
3
4
5

- 1 Information contained in this appendix was provided by Pacific Northwest
- 2 National Laboratory, Richland, Washington.

CAP88PC Dose Factors for Canister Storage Building

May 21, 1998

Introduction

CAP88PC (Parks 1992) runs were produced to support the notice of construction (NOC) prepared for submission to the Washington State Department of Health. These runs produce dose factors, annual effective dose equivalent, on a per unit activity released (Ci/y) from the Canister Storage Building (CSB) in the 200 E Area of the Hanford Site in southeastern Washington. These runs were requested to fully document all the input parameters as shown in Attachment 1.

Methods

For all analyses, default parameters from the CAP88PC code were used except where stack-specific and MEI-specific parameters were used, as shown in Table 1. Separate sets of runs were produced for each of the facilities. Site-specific fourteen-year meteorological data were used with data from 200 E representing the CSB.

Attachment 2 shows a sample synopsis files, describing all the input parameters for the CSB release location. The radionuclides included in this analysis are shown in Table 2. Because of CAP88PC limits the number of radionuclides that can be analyzed in a run, the list was divided into three runs. Most input chosen were EPA default CAP88PC values except for the Hanford-specific data: the stack dimension parameters, locations and distances of the maximally exposed individual (MEI), and the meteorological data (Attachment 3). Momentum plume rise was used in the analysis. All food was assumed to be locally produced at the MEI location.

Table 1 Stack parameters used in CAP88PC analysis.

Facility	Stack Height (ft, (m))	Diameter (")	Radius (m)	Flow rate	units	Exit Velocity (m/s)	MEI Location
CSB	75 (22.5)	28	0.35	9000	cfm	10.54063	17460 m E

Results

Table 2 presents the dose factors resulting from a unit Ci release of a radionuclide. These dose factors may be multiplied by the release amount in Ci/y to calculate the expected potential dose to the MEI at the Hanford Site boundary.

The flow rate from the CSB facility was an estimate, and an additional analysis was performed to determine the difference in the dose factors if the flow was changed by +/- 25%. Two sets of sample radionuclides were run with adjusted exit velocity values. All other parameters were unchanged. The lower flow value was more conservative for gases and particulates. The difference in the dose factors from +/- 25% CSB flow rate is shown in Table 3 for the sample radionuclides. While there is some difference, the overall flow resulting dose factor does not change by more than a few percent. The 9000 cfm flow rate was used to model the CSB for the unit release dose factors shown in Table 2.

Documentation of Hanford Environmental Dose Overview Panel is included in Attachment 4. K. Rhoads reviewed all input and results.

Table 2. CAP88PC Unit Ci Dose Factors for Canister Storage Building and 100 K Basins Using 14-year Meteorological Data

CSB		CSB	
MEI Location	17460 m E	MEI Location	17460 m E
Radionuclide	(mrem/y per Ci/y)	Radionuclide	(mrem/y per Ci/y)
H-3	1.45E-05	TE-125M	5.97E-04
C-14	8.04E-04	TE-127M	1.73E-03
FE-55	1.96E-04	TE-129	9.55E-07
CO-60	8.96E-02	TE-129M	1.28E-03
NI-59	1.67E-04	I-129	2.86E-01
NI-63	1.84E-04	CS-134	4.90E-02
SE-79	*	CS-135	3.61E-03
KR-85	3.20E-08	CS-137/BA-137M	9.29E-02**
SR-89	8.77E-04	CE-141	3.69E-04
SR-90	6.04E-02	CE-144	7.52E-03
Y-90	1.32E-04	PR-143	2.64E-04
Y-91	1.45E-03	PR-144	7.43E-08
ZR-93	8.32E-04	PR-144M	1.20E-09
ZR-95	1.56E-03	PM-147	6.92E-04
NB-93M	1.95E-03	PM-148	2.94E-04
NB-95	2.06E-03	PM-148M	3.24E-03
NB-95M	7.02E-05	SM-151	4.77E-04
TC-99	1.27E-02	EU-152	8.59E-02
RU-103	7.53E-04	EU-154	6.93E-02
RU-106	9.79E-03	EU-155	3.07E-03
RH-103M	3.95E-08	GD-153	*
RH-106	0.00E+00	TB-160	2.61E-03
PD-107	2.36E-04	U-234	1.93E+00
AG-110	0.00E+00	U-235	1.83E+00
AG-110M	1.83E-02	U-236	1.83E+00
CD-113M*	0.00E+00	U-238	1.72E+00
CD-115M	1.90E-03	NP-237	7.20E+00
IN-113M	1.68E-06	PU-238	4.75E+00
SN-113	1.85E-03	PU-239	5.12E+00
SN-119M	*	PU-240	5.12E+00
SN-121M*	*	PU-241	8.03E-02
SN-123	1.73E-05	PU-242	4.87E+00
SN-126	3.32E-02	AM-241	7.88E+00
SB-124	3.37E-03	AM-242	7.57E-04
SB-125	9.03E-03	AM-242M	7.60E+00
SB-126	1.20E-03	AM-243	7.88E+00
SB-126M	9.62E-07	CM-242	2.56E-01
TE-123M	*	CM-244	4.16E+00
TE-127	5.17E-06		

* Radionuclide or dose factors not included in CAP88PC. It is possible to substitute another, more conservative unit dose factor for these radionuclides based on their mode of radioactive decay. (e.g., SR-90 for β/γ emitters and PU-239 for α emitters)

** Dose from Ba-137m in equilibrium added to dose from Cs-137

Table 3. Dose factors (mrem/y per Ci/y) based on CSB flow rate +/- 25%

CSB	9000 cfm (10.5 m/s)	+25% (13.1 m/s)	-25% (7.9 m/s)
H-3	1.45E-05	1.42E-05	1.48E-05
PU-239	5.04E+00	4.96E+00	5.12E+00
I-129	2.81E-01	2.91E-01	2.70E-01

Reference:

Parks, BS 1992. User's Guide for CAP88-PC Version 1.0. U. S. Environmental Protection Agency, Las Vegas NV.

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Individual Assessment
May 21, 1998 11:33 am

Facility: H- Ru Canister storage building
Address: 200 E Area
Hanford Site
City: Richland
State: WA Zip: 99352

Effective Dose Equivalent
(mrem/year)

1.84E-01

At This Location: 17460 Meters East

Source Category:
Source Type: Stack
Emission Year:

Comments: 14 year jfd Unit Dose factor calculation

Dataset Name: CSB2 1
Dataset Date: May 21, 1998 11:32 am
Wind File: WNDFILES\HS200E10.WND

C A U T I O N !

The Following DEFAULT VALUES Have Been Changed By The User.

These changes CANNOT BE USED to demonstrate compliance
per 40 CFR 61.93(a) unless specifically approved by EPA.

Direction Single Location - Individual Calculation

Changed From: 0
To: 13

Distance Single Location - Individual Calculation

Changed From: 0
To: 1

May 21, 1998 11:33 am
SYNOPSIS

Page 1

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 17460 Meters East
Lifetime Fatal Cancer Risk: 4.41E-06

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Dose Equivalent (mrem/y)
GONADS	1.11E-01
BREAST	1.00E-01
R MAR	3.90E-01
LUNGS	1.67E-01
THYROID	1.54E-01
ENDOST	7.79E-01
RMNDR	1.53E-01
EFFEC	1.84E-01

May 21, 1998 11:33 am
SYNOPSIS

Page 2

RADIONUCLIDE EMISSIONS DURING THE YEAR

Nuclide	Class	Size	Source #1 Ci/y	TOTAL Ci/y
H-3	*	0.00	1.0E+00	1.0E+00
C-14	*	0.00	1.0E+00	1.0E+00
FE-55	W	1.00	1.0E+00	1.0E+00
CO-60	Y	1.00	1.0E+00	1.0E+00
NI-59	W	1.00	1.0E+00	1.0E+00
NI-63	W	1.00	1.0E+00	1.0E+00
SE-79		0.00	1.0E+00	1.0E+00
KR-85	*	0.00	1.0E+00	1.0E+00
SR-89	D	1.00	1.0E+00	1.0E+00
SR-90	D	1.00	1.0E+00	1.0E+00
Y-90	Y	1.00	1.0E+00	1.0E+00
Y-91	Y	1.00	1.0E+00	1.0E+00
ZR-93	W	1.00	1.0E+00	1.0E+00
ZR-95	W	1.00	1.0E+00	1.0E+00
NB-93M	Y	1.00	1.0E+00	1.0E+00
NB-95	Y	1.00	1.0E+00	1.0E+00
NB-95M	Y	1.00	1.0E+00	1.0E+00
TC-99	W	1.00	1.0E+00	1.0E+00
RU-103	Y	1.00	1.0E+00	1.0E+00
RU-106	Y	1.00	1.0E+00	1.0E+00

(The following radionuclides were extracted from separate synopsis files, and are shown here for completeness)

RH-103M	Y	1.00	1.0E+00	1.0E+00
RH-106	Y	1.00	1.0E+00	1.0E+00
PD-107	Y	1.00	1.0E+00	1.0E+00
AG-110	Y	1.00	1.0E+00	1.0E+00
AG-110M	Y	1.00	1.0E+00	1.0E+00
CD-113M		0.00	1.0E+00	1.0E+00
CD-115M	Y	1.00	1.0E+00	1.0E+00
IN-113M	W	1.00	1.0E+00	1.0E+00
SN-113	W	1.00	1.0E+00	1.0E+00
SN-123		0.00	1.0E+00	1.0E+00
SN-126	W	1.00	1.0E+00	1.0E+00
SB-124	W	1.00	1.0E+00	1.0E+00
SB-125	W	1.00	1.0E+00	1.0E+00
SB-126	W	1.00	1.0E+00	1.0E+00
SB-126M	W	1.00	1.0E+00	1.0E+00
TE-127	W	1.00	1.0E+00	1.0E+00
TE-125M	W	1.00	1.0E+00	1.0E+00
TE-127M	W	1.00	1.0E+00	1.0E+00
TE-129	W	1.00	1.0E+00	1.0E+00
TE-129M	W	1.00	1.0E+00	1.0E+00
I-129	D	1.00	1.0E+00	1.0E+00

CS-134	D	1.00	1.0E+00	1.0E+00
CS-135	D	1.00	1.0E+00	1.0E+00
CS-137	D	1.00	1.0E+00	1.0E+00
BA-137M	D	1.00	0.0E+00	0.0E+00
BA-137M	D	1.00	1.0E+00	1.0E+00
CE-141	Y	1.00	1.0E+00	1.0E+00
CE-144	Y	1.00	1.0E+00	1.0E+00
PR-143	Y	1.00	1.0E+00	1.0E+00
PR-144	Y	1.00	1.0E+00	1.0E+00
PR-144M	Y	1.00	1.0E+00	1.0E+00
PM-147	Y	1.00	1.0E+00	1.0E+00
PM-148	Y	1.00	1.0E+00	1.0E+00
PM-148M	Y	1.00	1.0E+00	1.0E+00
SM-151	W	1.00	1.0E+00	1.0E+00
EU-152	W	1.00	1.0E+00	1.0E+00
EU-154	W	1.00	1.0E+00	1.0E+00
EU-155	W	1.00	1.0E+00	1.0E+00
TB-160	W	1.00	1.0E+00	1.0E+00
U-234	Y	1.00	1.0E+00	1.0E+00
U-235	Y	1.00	1.0E+00	1.0E+00
U-236	Y	1.00	1.0E+00	1.0E+00
U-238	Y	1.00	1.0E+00	1.0E+00
TH-234	Y	1.00	0.0E+00	0.0E+00
PA-234	Y	1.00	0.0E+00	0.0E+00
U-234	Y	1.00	0.0E+00	0.0E+00
TH-230	Y	1.00	0.0E+00	0.0E+00
RA-226	W	1.00	0.0E+00	0.0E+00
RN-222	*	0.00	0.0E+00	0.0E+00
PO-218	W	1.00	0.0E+00	0.0E+00
PB-214	D	1.00	0.0E+00	0.0E+00
BI-214	W	1.00	0.0E+00	0.0E+00
PO-214	W	1.00	0.0E+00	0.0E+00
PB-210	D	1.00	0.0E+00	0.0E+00
BI-210	W	1.00	0.0E+00	0.0E+00
PO-210	W	1.00	0.0E+00	0.0E+00
NP-237	W	1.00	1.0E+00	1.0E+00
PU-238	Y	1.00	1.0E+00	1.0E+00
PU-239	Y	1.00	1.0E+00	1.0E+00
PU-240	Y	1.00	1.0E+00	1.0E+00
PU-241	Y	1.00	1.0E+00	1.0E+00
PU-242	Y	1.00	1.0E+00	1.0E+00
AM-241	W	1.00	1.0E+00	1.0E+00
AM-242	W	1.00	1.0E+00	1.0E+00
AM-242M	W	1.00	1.0E+00	1.0E+00
AM-243	W	1.00	1.0E+00	1.0E+00
CM-242	W	1.00	1.0E+00	1.0E+00
CM-244	W	1.00	1.0E+00	1.0E+00

SITE INFORMATION

Temperature: 12 degrees C
 Precipitation: 16 cm/y
 Mixing Height: 1000 m

May 21, 1998 11:33 am
SYNOPSIS

Page 3

SOURCE INFORMATION

Source Number: 1

Stack Height (m): 22.50
Diameter (m): 0.70

Plume Rise
Momentum (m/s): 1.05E+01
(Exit Velocity)

AGRICULTURAL DATA

	<u>Vegetable</u>	<u>Milk</u>	<u>Meat</u>
Fraction Home Produced:	1.000	1.000	1.000
Fraction From Assessment Area:	0.000	0.000	0.000
Fraction Imported:	0.000	0.000	0.000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

17,460

Joint Frequency Data for 200 E Area,

10 m Stack Height, 14-year Average

```

0.00000
.035 .050 .056 .043 .036 .028 .032 .039 .043 .049 .122 .203 .112 .074 .047
.029
2.03 2.17 1.95 1.80 1.56 1.51 1.78 2.09 1.92 1.98 3.19 3.29 3.13 4.12 3.14 2.27
1.90 2.13 1.86 1.62 1.46 1.34 1.38 1.71 1.80 1.83 2.65 2.82 2.63 3.38 3.39 2.12
2.08 2.09 1.99 1.47 1.39 1.29 1.45 1.73 1.66 1.72 2.46 2.78 2.53 3.29 2.64 2.16
1.87 1.92 1.74 1.46 1.33 1.19 1.30 1.51 1.49 1.59 2.47 3.15 2.57 3.10 2.72 2.00
1.76 1.85 1.68 1.38 1.24 1.12 1.23 1.53 1.52 1.48 2.45 3.39 2.82 2.44 2.22 1.83
1.66 1.73 1.51 1.28 1.15 1.12 1.08 1.26 1.27 1.38 2.00 2.66 2.39 1.94 1.54 1.47
1.53 1.68 1.48 1.16 1.14 1.04 .96 1.00 1.04 1.24 1.83 2.69 2.42 2.17 1.49 1.32
3.12 3.01 2.65 2.42 2.15 2.16 2.95 3.17 2.82 2.84 5.22 5.05 5.00 6.08 4.95 3.65
2.89 3.02 2.62 2.24 2.09 1.86 2.18 2.79 2.70 2.64 4.43 4.60 4.53 5.47 5.35 3.61
3.22 3.06 2.65 2.06 1.99 1.78 2.29 2.61 2.51 2.52 4.10 4.42 4.09 5.58 4.91 3.44
3.12 2.96 2.54 2.11 1.92 1.66 2.04 2.58 2.38 2.45 4.24 4.97 4.43 5.54 5.55 4.02
2.87 2.82 2.47 1.95 1.75 1.47 2.17 3.03 2.64 2.24 3.96 4.85 4.01 4.15 4.37 3.64
2.53 2.51 2.14 1.76 1.54 1.51 1.43 2.13 1.99 2.00 2.79 3.45 3.22 2.82 2.26 2.14
2.24 2.52 2.03 1.50 1.48 1.28 1.09 1.18 1.28 1.74 2.62 3.49 3.18 3.02 2.13 1.82
.0977 .0431 .0374 .2126 .2672 .2414 .1006
.1111 .0417 .0377 .2401 .2540 .2103 .1052
.1533 .0624 .0606 .2941 .2086 .1515 .0695
.2014 .0741 .0602 .3056 .1921 .1134 .0532
.2161 .0831 .0637 .3352 .1690 .0914 .0416
.2465 .0845 .0775 .3380 .1408 .0810 .0317
.2539 .0805 .0743 .3529 .1486 .0619 .0279
.2690 .1041 .0711 .3376 .1447 .0584 .0152
.2401 .0956 .0746 .3427 .1585 .0676 .0210
.1967 .0820 .0717 .3361 .1783 .1004 .0348
.1404 .0509 .0501 .3120 .2652 .1338 .0476
.0512 .0222 .0192 .2368 .3732 .2083 .0891
.0661 .0223 .0214 .1716 .3494 .2565 .1126
.1531 .0434 .0366 .2195 .2859 .1816 .0799
.1498 .0506 .0380 .2658 .2743 .1603 .0612
.1058 .0444 .0307 .2423 .2901 .2082 .0785
200 EAST AREA (Station 6) - 10 M - Pasquill A - G (1983 - 1996 Average)
Converted 8/14/97 KR, Created 6/10/97 KWB (Hoitink & Burk, 1997, PNNL-11471)
Windspeed Classes (m/s): .89 2.65 4.7 7.15 9.8 12.7 15.6 19.0

```

DISTRIBUTION

OFFSITE

A. W. Conklin, Head
Department of Health
Division of Radiation Protection
7171 Cleanwater Lane, Bldg. 5
P. O. Box 47827
Olympia, Washington 98504-7827

E. R. Skinnerland
Section Manager
Washington State Department of Ecology
1315 West Fourth Avenue
Kennewick, Washington 99336-6018

S. M. Alexander
Perimeter Section
Washington State Department of Ecology
1315 West Fourth Avenue
Kennewick, Washington 99336-6018

A. J. Frankel, Director
Office of Air Quality
U.S. Environmental Protection Agency
Region 10
Mail Stop AT-082
1200 Sixth Avenue
Seattle, Washington 98101

J. Wilkinson
Confederated Tribes of the Umatilla
Indian Reservation
P. O. Box 638
Pendleton, Oregon 97801

D. Powauke
Nez Perce Tribe
P. O. Box 305
Lapwai, Idaho 80540

R. Jim, Manager
Environmental Restoration/
Waste Management Program
Confederated Tribes and Bands
of the Yakama Nation
P. O. Box 151
Toppenish, Washington 98948

DISTRIBUTION (cont)

ONSITE

MSIN

U.S. Department of Energy
Richland Operations Office

C. A. Ayoub (3)	S7-41
G. M. Bell	A4-52
G. E. Bishop	S7-41
R. E. Bley	A5-18
J. M. Escamillo	S7-41
R. M. Hiegel	S7-41
R. G. Holt	S7-41
R. L. Long	S7-41
P. G. Loscoe	S7-41
G. Z. Morgan	S7-41
H. M. Rodriguez (7)	A5-15
K. M. Schierman	S7-41
E. D. Sellers	S7-41
Reading Room	H2-53

Duke Engineering & Services Hanford, Inc.

G. D. Bazinet	S8-06
A. S. Daughtridge (2)	R3-86
R. G. Gant (3)	X3-79
P. G. Huntley	X3-72
D. P. Kimball	X3-71
P. G. LeRoy	R3-11
C. A. Thompson (3)	R3-86
J. E. Turnbaugh	X3-79
D. J. Watson (3)	X3-79
PGL File/LB	R3-11
SNF Project Files	R3-11

Fluor Daniel Hanford, Inc.

J. A. Bates	H6-36
E. W. Gerber	R3-11
J. L. Jacobson	B3-70
E. S. McGinley	H8-68
K. A. Peterson	H6-36
L. K. Trent	H8-67
N. H. Williams	R3-11
B. D. Williamson	B3-15

DISTRIBUTION (cont)

ONSITE

MSIN

Hanford Technical Library

K1-11

Numatec Hanford Corporation

G. P. Chevrier

R3-86

Waste Management Federal Services of Hanford, Inc.

E. M. Greager

H6-36

L. D. Kamberg

H6-26

J. J. Luke

H6-25

Air Operating Permit File

H6-25

Lockheed Martin Services, Inc.

Central Files

B1-07

DPC

H6-08

EDMC (2)

H6-08