U.S. Department of Energy
Office of River Protection
P.O. Box 450
Richland, Washington 99352

0061316

FEB 05 2004

04-ED-003

Mr. A. W. Conklin, Head
Air Emissions and Defense
Waste Section
State of Washington
Department of Health
P.O. Box 47827
Olympia, Washington 98504

RECEIVED
FEB 18 2004
EDMC

Dear Mr. Conklin:

RADIOACTIVE AIR EMISSIONS NOTICE OF CONSTRUCTION FOR THE SUPPLEMENTAL TREATMENT TEST AND DEMONSTRATION FACILITY

Attached for your review and approval are the "Radioactive Air Emissions Notice of Construction for the Supplemental Treatment Test and Demonstration Facility" (Attachment 1) and Hanford Site Air Operating Permit Off-Permit Change 00-05-006 (Attachment 2). The Off-Permit Change was prepared because planned activities are a new source of radioactive emissions. If you have any questions, please contact me, or your staff may contact Dennis W. Bowser, Environmental Division, (509) 373-2566.

Sincerely,

Roy J. Schepens
Manager

ED:DWB

Attachments: (2)

cc: See page 2

cc w/attachs:
E. S. Aromi, CH2M HILL
D. J. Carrell, CH2M HILL
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R. Jim, YN
J. Martell, WDOH Richland Office (2 copies)
Administrative Record
Environmental Portal, LMSI

Attachment 1
04-ED-003

Radioactive Air Emissions Notice of Construction for the Supplemental Treatment Test and Demonstration Facility

RADIOACTIVE AIR EMISSIONS NOTICE OF CONSTRUCTION FOR THE SUPPLEMENTAL TREATMENT TEST AND DEMONSTRATION FACILITY

Prepared by
CH2M HILL Hanford Group, Inc.

Date Published
December 2003

United States Department of Energy
Office of River Protection
P.O. Box 450
Richland, Washington

INTRODUCTION

This document serves as a notice of construction application, in accordance with 40 Code of Federal Regulations 61.07 and Washington Administrative Code 246-247-060, for a Research, Development, and Demonstration testing program for processing low-activity waste. The Research, Development, and Demonstration program includes onsite testing of a demonstration bulk vitrification technology for vitrifying low-activity waste in waste containers. The Demonstration Bulk Vitrification System will be located at the Test and Demonstration Facility. The low-activity waste will be transferred to the Demonstration Bulk Vitrification System from single-shell Tank 241-S-109 located in the 200 West Area of the Hanford Site. Over the duration of the Research, Development, and Demonstration program, it is expected that about 1,355,500 L (300,000 gal) of low-activity waste will be processed.

The Demonstration Bulk Vitrification System will be performed in two phases. Phase 1 will consist of treatment of one to three container loads, each incorporating up to 1135 L (300 gal) of tank waste. Simulants (i.e., materials similar in chemical composition to tank waste) will be added to the waste load along with the glass formers to create a container load (including insulating materials) of up to 54.4 m^3 (1920 ft^3). Phase 1 is designed to provide waste form performance data for the bulk vitrification technology in support of *Hanford Federal Facility Agreement and Consent Order* Milestone M-62-08. Phase 2 will consist of treatment of 47 to 49 container loads of waste totaling up to 1,355,500 L (300,000 gal) of tank waste. In Phase 2, tank waste, process additives, and process control parameters will be varied to establish optimum operating process parameters or envelopes. Waste containers from the vitrification process will remain at the Test and Demonstration Facility until transferred to a future onsite disposal facility or permitted storage facility.

The conservative potential unabated emissions from the bulk vitrification demonstration activity are estimated to result in a total effective dose equivalent to the hypothetical maximally exposed individual of approximately 7.35+01 mrem per year to the onsite receptor.

The abated emissions to the offsite receptor are estimated to result in a total effective dose equivalent to the hypothetical maximally exposed individual of approximately 1.29E-01 mrem per year. The abated dose to the offsite maximally exposed individual is slightly higher than the abated dose to the onsite maximally exposed individual as noted in Section 15.0, Table 2. This is due to the release factors and dose conversion factors used for gaseous radioactive analytes in calculating a dose when HEPA filtration selectively controls particulates in the ventilation air stream.

Activities that could potentially contribute to this dose include site preparation activities (fugitive source), waste processing operations (emission point source), and waste container storage (passive source). This dose estimate is extremely conservative for purposes of bounding Demonstration Bulk Vitrification System waste processing activities.

The total effective dose equivalent from all calendar year 2002 Hanford Site air emissions (includes point sources as well as diffuse and fugitive sources) was 0.066 mrem (DOE/RL-2003-19). The emissions resulting from the activities covered by this notice of construction application, in conjunction with other operations on the Hanford Site, will not

exceed the National Emission Standard of 10 mrem per year (40 CFR 61, Subpart H) to a member of the public.

The duration of onsite activities is expected to be one year of actual process operations and the anticipated start of site preparation activities is April/May 2004.

This application also provides notification of anticipated initial start-up, in accordance with 40 CFR 61.09(a)(1). It is requested that approval of this application will also constitute U.S. Environmental Protection Agency acceptance of the initial start-up notification. Written notification of the actual date of initial start-up, in accordance with 40 CFR 61.09(a)(2), will be provided at a later date.

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TERMS

ALARA	as low as reasonably achievable
ALARACT	ALARA control technology
ANSI	American National Standards Institute
APQ	annual possession quantity
ASME	American Society of Mechanical Engineers
BARCT	best available radionuclide control technology
CAP	Clean Air Act Assessment Package
CEMS	continuous emissions monitoring systems
CFR	*Code of Federal Regulations*
cm	centimeter
cm^2	square centimeter
cpm	counts per minute
CO	carbon monoxide
DBVS	Demonstration Bulk Vitrification System
dpm	disintegrations per minute
DOE	U.S. Department of Energy
ft	feet
ft^3	cubic feet
gal	gallons
gal/min	gallons per minute
HEPA	high-efficiency particulate air (filter)
HPS	Health Physics Society
hrs	hours
ICV®	in-container vitrification (licensed process)
IDF	Integrated Disposal Facility
ILAW	immobilized low-activity waste
kg	kilograms
L	liter
L/min	liters per minute
LAW	low-activity waste
lbs	pounds
m	meters
m^3	cubic meters
MEI	maximally exposed individual
min	minute
MPR	maximum public receptor
mrem	millirem
NOC	notice of construction
NOx	oxides of nitrogen
OGTS	Offgas Treatment System
ORP	Office of River Protection
PCM	periodic confirmatory measurement
RCRA	*Resource Conservation and Recovery Act*
RD&D	Research, Development, and Demonstration
SCR	selective catalytic reduction

SEPA	*State Environmental Policy Act of 1971*
sq	square
SOx	oxides of sulfur
SST	single-shell tank
TEDE	total effective dose equivalent
TWINS	Tank Waste Information Network System
WAC	*Washington Administrative Code*
yr	year

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	0.03937	inches
inches	2.54	centimeters	centimeters	0.393701	inches
feet	0.3048	meters	meters	3.28084	feet
yards	0.9144	meters	meters	1.0936	yards
miles (statute)	1.60934	kilometers	kilometers	0.62137	miles (statute)
Area			**Area**		
square inches	6.4516	square centimeters	square centimeters	0.155	square inches
square feet	0.09290304	square meters	square meters	10.7639	square feet
square yards	0.8361274	square meters	square meters	1.19599	square yards
square miles	2.59	square kilometers	square kilometers	0.386102	square miles
acres	0.404687	hectares	hectares	2.47104	acres
Mass (weight)			**Mass (weight)**		
ounces (avoir)	28.34952	grams	grams	0.035274	ounces (avoir)
pounds	0.45359237	kilograms	kilograms	2.204623	pounds (avoir)
tons (short)	0.9071847	tons (metric)	tons (metric)	1.1023	tons (short)
Volume			**Volume**		
ounces (U.S., liquid)	29.57353	milliliters	milliliters	0.033814	ounces (U.S., liquid)
quarts (U.S., liquid)	0.9463529	liters	liters	1.0567	quarts (U.S., liquid)
gallons (U.S., liquid)	3.7854	liters	liters	0.26417	gallons (U.S., liquid)
cubic feet	0.02831685	cubic meters	cubic meters	35.3147	cubic feet
cubic yards	0.7645549	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
Energy			**Energy**		
kilowatt hour	3,412	British thermal unit	British thermal unit	0.000293	kilowatt hour
kilowatt	0.94782	British thermal unit per second	British thermal unit per second	1.055	kilowatt
Force/Pressure			**Force/Pressure**		
pounds (force) per square inch	6.894757	kilopascals	kilopascals	0.14504	pounds per square inch

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

1.0 FACILITY IDENTIFICATION AND LOCATION

Regulatory Citation: Name and address of the facility, and location (latitude and longitude) of the emissions unit(s)

The facility is managed and operated by CH2M HILL Hanford Group, Inc., for the U.S. Department of Energy (DOE), Office of River Protection (ORP) under contract DE-AC06-99RL-14047.

A Supplemental Technology Research, Development, and Demonstration (RD&D) project for processing low-activity waste (LAW), from single-shell Tank (SST) 241-S-109 and subsequent temporary storage of vitrified waste is included under this Notice of Construction (NOC). The Demonstration Bulk Vitrification System (DBVS), a RD&D activity, will be conducted at the Hanford Site located in the southeastern part of Washington State (Figure 1). The Test and Demonstration Facility where the DBVS will be located is in the immediate vicinity west of the 241-S Tank Farm, 200 West Area of the Hanford Site (Figure 2). Location coordinates of planned Test and Demonstration Facility are shown in Table 1.

Table 1. Emission Units Coordinates

Unit	Location	Geodetic Coordinates[1]	
		Latitude	Longitude
Test and Demonstration Facility	West of the 241-S Tank Farm		
Temporary Storage Area (End Product)	West of the 241-S Tank Farm		

[1] Specific Geodetic Coordinates of Hanford tank farm locations have been purposely omitted for security purposes. Approximate location for the Test and Demonstration Facility subject to this Notice of Construction application can be seen on Figure 2.

Air emissions from waste treatment and waste packaging associated with DBVS activities will be discharged to atmosphere under active ventilation. Fugitive emissions are expected from site preparation activities. Passive emissions are expected from waste container storage.

Figure 1. Hanford Site

OFFICIAL USE ONLY

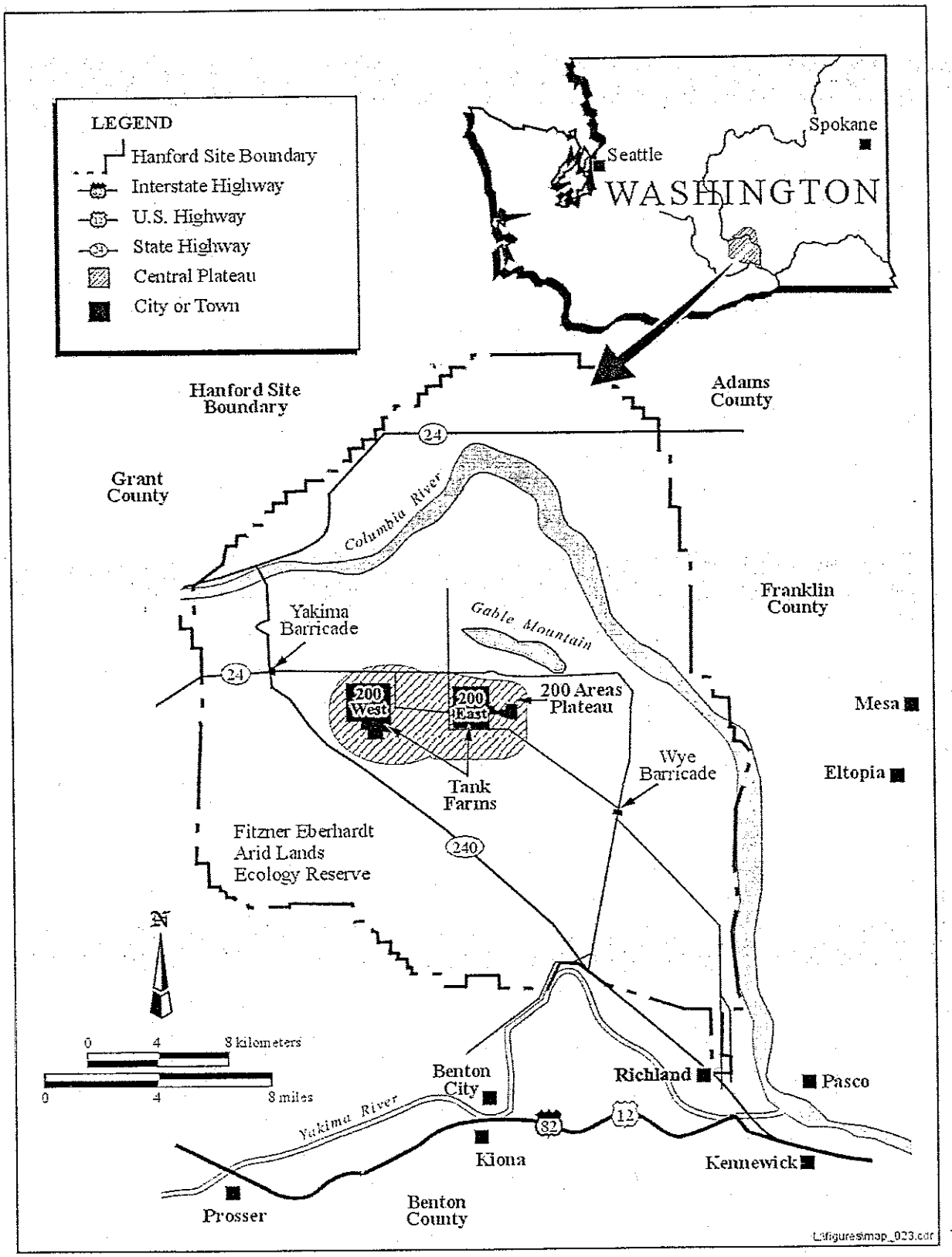
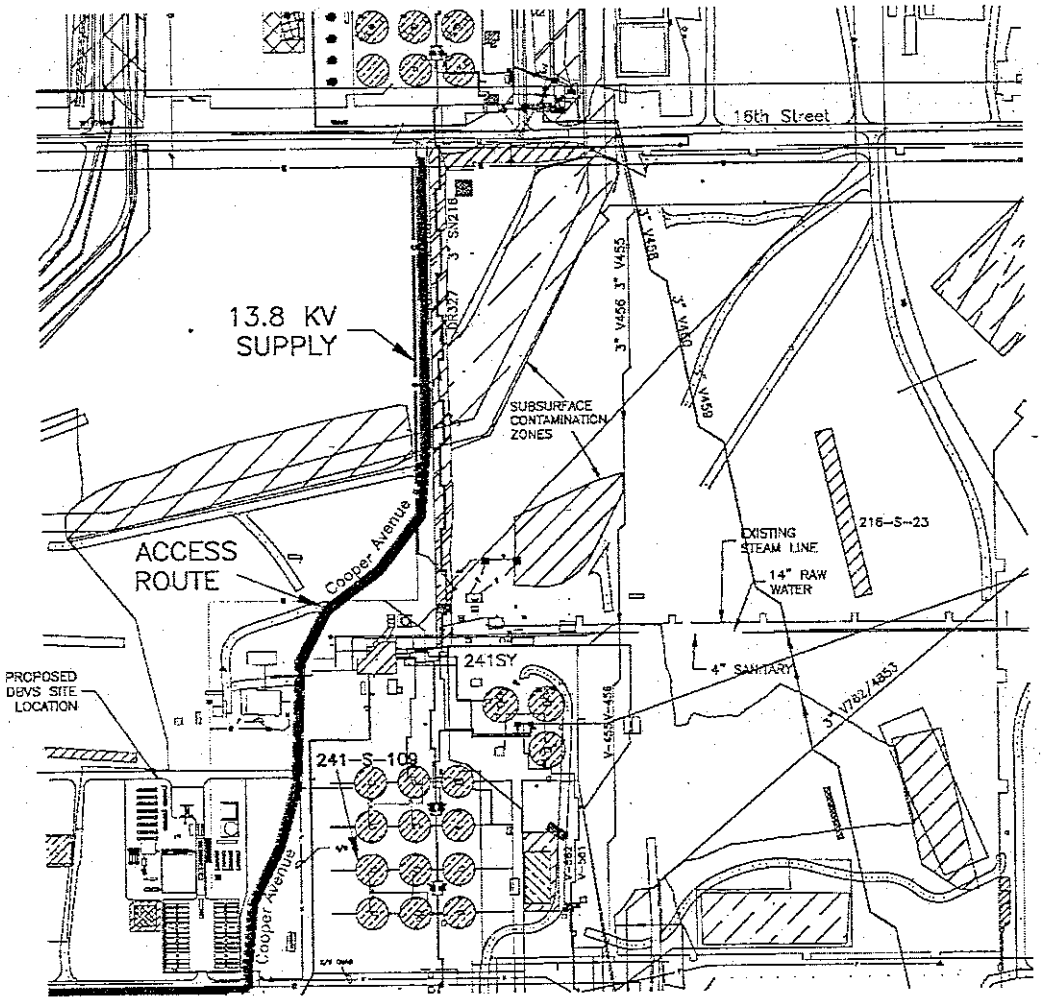


Figure 2. Planned Site Location of the Test and Demonstration Facility

OFFICIAL USE ONLY



2.0 RESPONSIBLE MANAGER

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

Mr. Roy J. Schepens, Manager
U.S. Department of Energy
Office of River Protection
P.O. Box 450
Richland, WA 99352
(509) 376-6677

3.0 PROPOSED ACTION

Regulatory Citation: Identify the type of proposed action for which this application is submitted: (a) Construction of new emissions unit(s), (b) Modification of existing emissions unit(s); identify whether this is a significant modification; (c) Modification of existing emission unit(s), unregistered.

This NOC application is submitted in accordance with *Washington Administrative Code* (WAC) 246-247-060(1)(a) as a new NOC application for the construction, installation, and operation of a RD&D project for the DBVS. The proposed action will receive a liquid salt solution LAW waste stream from Tank 241-S-109, and the waste will be mixed with glass formers (e.g., soil) and dried prior to processing (or treating) the waste by an in-container vitrification process. The vitrification of the waste will occur in the same waste container used for disposal. After vitrification, the waste container will be moved to an onsite storage area or disposal site. The activity of waste retrieval from Tank 241-S-109 is being performed under a separate NOC. The scope of this RD&D NOC application begins at the interface between tank retrieval operations and the RD&D unit.

This NOC application describes the DBVS process and the emission controls associated with the DBVS process. Potential radioactive air emissions are expected to occur over the duration of the RD&D program as indicated in the *Resource Conservation and Recovery Act* (RCRA) RD&D Permit currently under development. Potential radioactive emissions are expected from waste processing and packaging activities. Fugitive emissions are expected from site preparation activities and temporary storage of waste containers at the Test and Demonstration Facility.

3.1 SYSTEM LAYOUT

Figure 3 shows the DBVS system layout at the Test and Demonstration Facility (west of the 241-S Tank Farm and west of Cooper Avenue). The waste receiving tanks, processing units, and ancillary equipment will either be skid- or trailer-mounted, or will be placed on concrete pad sites constructed for the DVBS. All waste tanks will have secondary containment and will be monitored for leaks. Waste piping runs between skids or trailers will be hose-in-hose or rigid piping with secondary containment. Commercial Unit support systems include such services as compressed air, instrument air, deionized water, and steam supply. Electrical services will be provided by Hanford Site utilities. Office and field trailers will be set up to accommodate the office and field staffs. Staging areas will be constructed for incoming empty waste containers, and an interim storage pad will be constructed for the vitrified waste containers awaiting shipment to the Integrated Disposal Facility (IDF) or an alternative on-site disposal unit.

The Test and Demonstration Facility (Figure 3) will be located in an area where no contaminated soil is expected. However for contingency purposes, this NOC application assumes that approximately 154 cubic meters (m^3) (5,445 cubic feet [ft^3]) of contaminated soil will be encountered.

Figure 3. Bulk Vitrification System Layout

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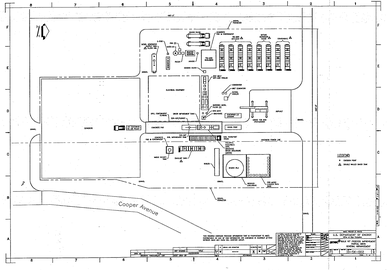


Figure 3. Bulk Vitrification System Layout

OFFICIAL USE ONLY

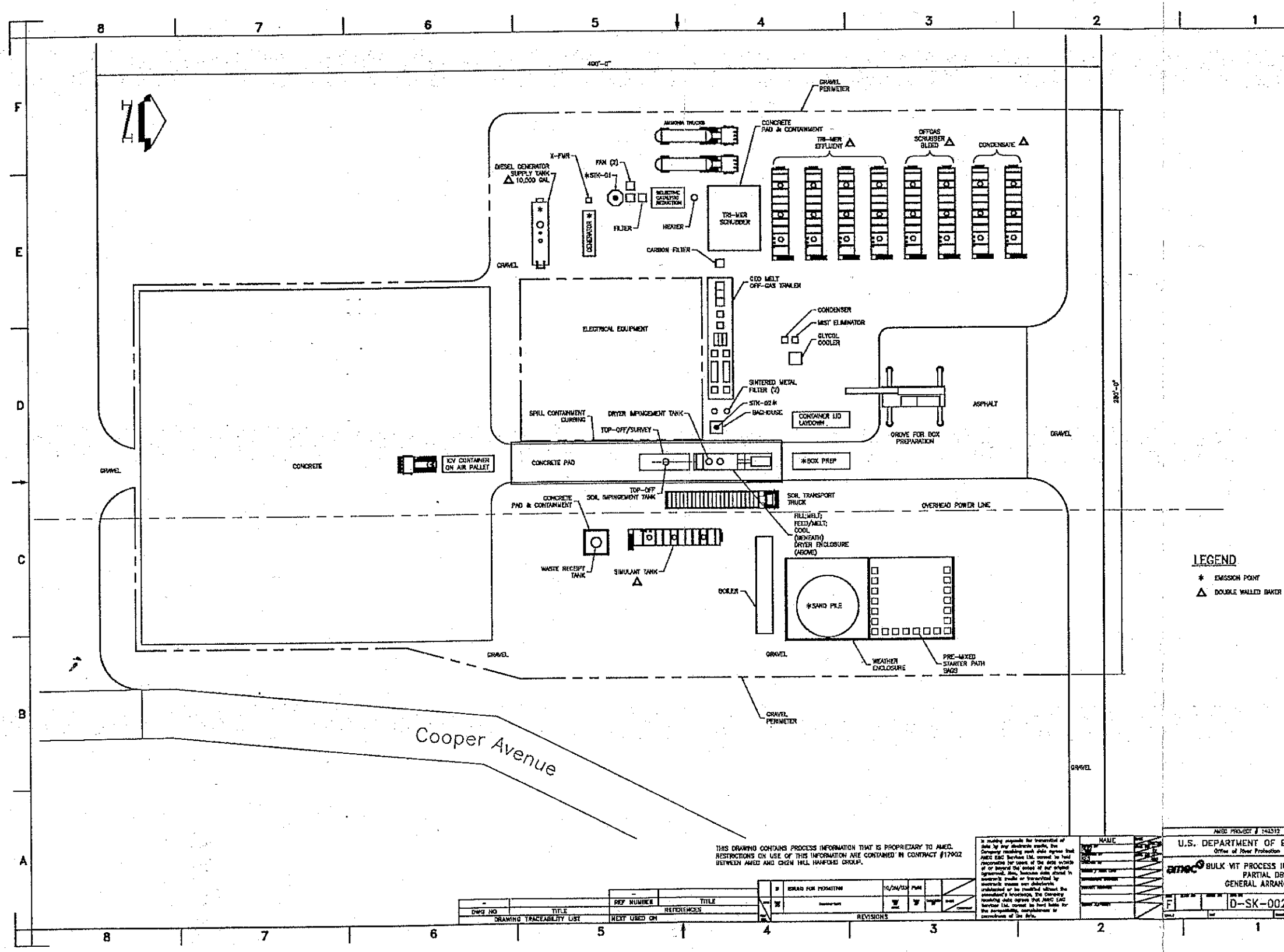
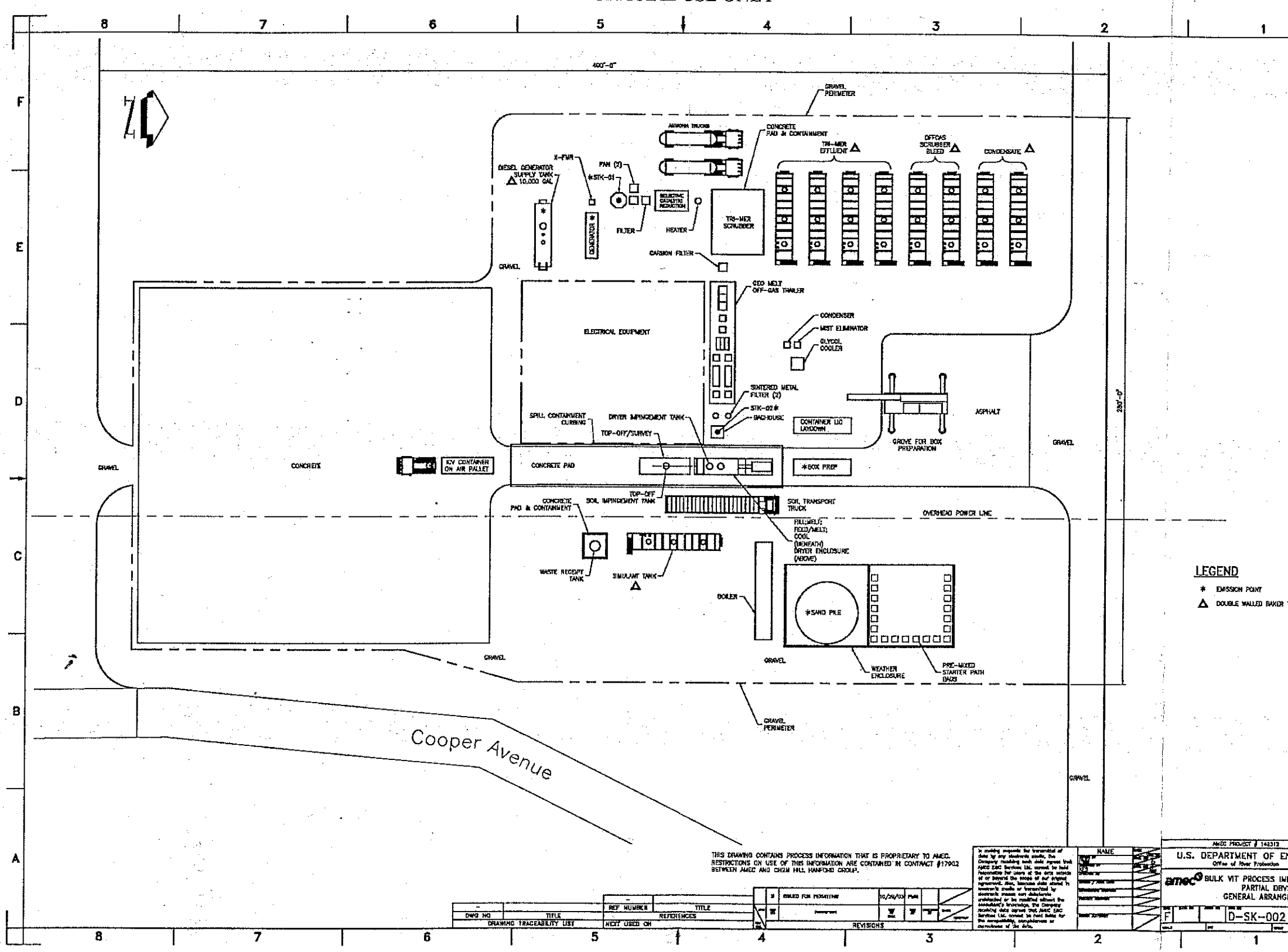


Figure 3. Bulk Vitrification System Layout

OFFICIAL USE ONLY



3.2 SYSTEM CAPACITY

The DBVS will be designed to process a 5 molar Na solution waste feed at a rate of 9 liters per minute (L/min) (2.4 gallons per minute [gal/min]). Waste feed will be from Tank 241-S-109. The radionuclide inventory annual possession quantity (APQ) is shown in Appendix A.

3.3 EQUIPMENT DESCRIPTION

3.3.1 Waste Receipt Tanks

The DBVS will receive incoming LAW from Tank 241-S-109 into the waste receipt tank(s). The purpose of the waste receipt tanks is for process feed, storage, and sampling. The waste feed tanks will be constructed of a corrosion resistant material. The tank capacities for the DBVS waste receipt are 3,780 L (1,000 gal) for Phase 1 of the test program consisting of initial system shakedown and production of one to three containers of treated waste. There will be 47 to 49 waste containers produced from four 68,140-liters (L) (18,000 gallons [gal]) tanks in Phase 2 for a total of 50 containers for both phases. Waste feed to the waste feed receipt tanks will occur on a semi-continuous basis.

3.3.2 Bulk Vitrification System

The primary technology to be used for the DBVS is an in-container vitrification (ICV®) process that involves the batch treatment of waste in a refractory-lined steel waste container. The purpose of the DBVS, under the RD&D testing program, is to fully demonstrate the bulk vitrification process on LAW.

The container will be lined with refractory sand and graphite electrodes will be placed in the container prior to addition of the waste mixture. A tight-fitting cover using a refractory gasket seal material will be bolted on the container.

The liquid salt-solution LAW received at the DBVS will be mixed with appropriate glass formers (primarily clean soil). Excess water will be removed from the mixture in a mixer/dryer using indirect steam heating. The mixture will be transported by vacuum transfer to a waste container. Airflow from the container filling operation is exhausted through a vent port in the waste container to an Offgas Treatment System (OGTS). High voltage electric power will be applied to the electrodes, vitrifying the waste mixture via resistive heating. After vitrification, the remaining space will be filled with sand or soil while the container is under active ventilation to the OGTS. After cool down, the waste containers will be under ambient cooling air conditions and passively vented to atmosphere through a high-efficiency particulate air (HEPA) filter.

Offgases from the DBVS waste processing system, including waste receipt tanks and the waste container packaging, will be routed to an OGTS for removal of particulate and gaseous pollutants. The system will consist of wet gas scrubbing, an oxides of nitrogen (NOx) removal system for gaseous emissions control, and HEPA filters for radioactive particulate matter removal.

3.3.3 End Product Container

The container receiving the immobilized LAW end product from the DBVS is expected to be approximately 7.3 meters (m) (24 feet [ft]) long, 3.0 m (10 ft) high, and 2.4 m (8 ft) wide. The carbon steel disposal containers are designed to provide full remote filling and capping and will be suitable for 50 years of burial while maintaining intact retrieval capability. The vitrified waste material (i.e., immobilized low-activity waste [ILAW]) will be cooled prior to being tested and transferred to the onsite storage area.

3.3.4 Waste Container Storage

Filled waste containers will be moved to a storage area until transferred to the future Integrated Disposal Facility (IDF) or alternative onsite disposal unit. The storage area is anticipated to be a concrete pad that will accommodate up to 50 waste containers from the Phase 1 and Phase 2 vitrification process. Each waste container being stored will have NucFil[1] HEPA filter (or equivalent) installed.

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

4.0 STATE ENVIRONMENTAL POLICY ACT OF 1971

Regulatory Citation: If this project is subject to the requirements of the State Environmental Policy Act of 1971 (SEPA) contained in Chapter 197-11 WAC, provide the name of the agency contact person and their telephone number.

The proposed action is categorically exempt from the requirements of the *State Environmental Policy Act* (SEPA) under 197-11 WAC, "SEPA Rules, Section 197-11-845, Department of Social and Health Services."

However, for informational purposes, a SEPA Checklist is being prepared supporting the submittal of a RCRA RD&D permit application currently under development.

5.0 CHEMICAL AND PHYSICAL PROCESSES

Regulatory Citation: Describe the chemical and physical processes upstream of the emission unit(s).

5.1 CHEMICAL AND PHYSICAL PROCESSES

The process used for the DBVS is ICV® as shown in the process flow diagram (Figure 4). The liquid salt-solution received at the DBVS will be mixed with appropriate glass formers and excess water will be removed from the mixture. The mixture will be transported and distributed into a refractory-lined waste container, where electrodes, penetrating the waste mixture, will vitrify the waste via resistive heating.

After completion of the vitrification process, soil and sand will be added to sufficiently fill the void container volume. The waste and waste container will undergo cooling, sampling, and external decontamination as required. The waste container with final vitrified waste will be allowed to cool, and will be stored at the Test and Demonstration Facility awaiting transfer to an approved storage facility or transferred to an approved onsite low-level burial ground.

The DBVS RD&D program will be operated in two phases. The Phase 1 DBVS will consist of treatment of approximately one to three container loads, each incorporating up to 1135 L (300 gal) of tank waste. Simulants (i.e., materials similar in chemical composition to tank waste) will be added to the waste load along with the glass formers to create a container load (including insulation materials) up to 54.4 m^3 (1920 ft^3). Phase 1 is designed to provide waste form performance data for the bulk vitrification technology to support Hanford Federal Facility Agreement and Consent Order Milestone M-62-08 by January 2005. The containers will be stored at the Test and Demonstration Facility and ultimately be transferred to the IDF or another permitted disposal facility.

The goal of Phase 2 is to optimize the DBVS performance and operation for full-scale use. Phase 2 will consist of treatment of 47 to 49 container loads of waste totaling up to 1,355,500 L (300,000 gal) of tank waste. Tank waste, process additives, and process control parameters will be varied to establish optimum operating process parameters or envelopes. It is anticipated that one container load of material will be vitrified weekly over one operating year. Phase 2 includes additional waste storage capacity, increased process additive storage and handling capacity, and testing to determine optimum OGTS.

Figure 4. Phase 2 Process Flow Diagram (2 pages)

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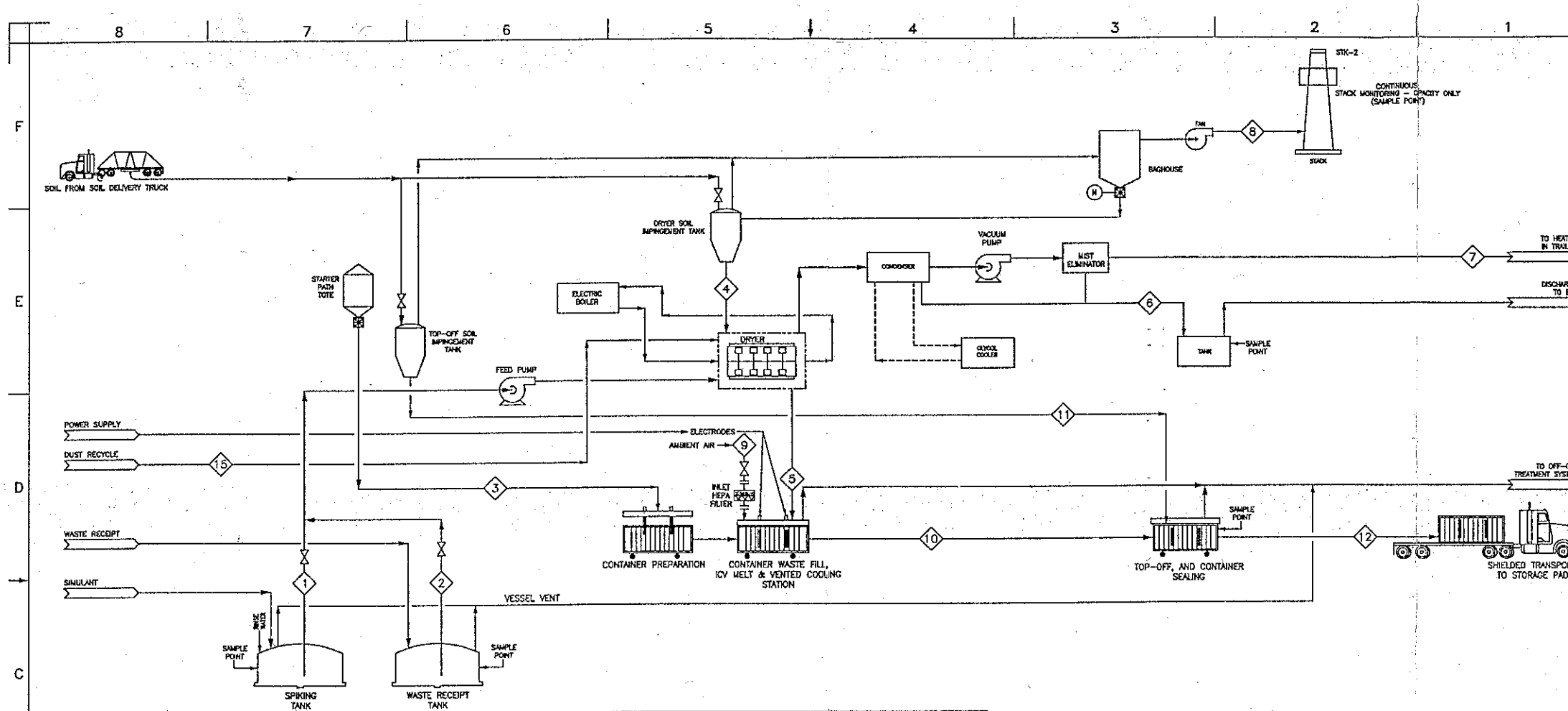

STREAM No.		1	2	3	4	5	6	7	8	9	10	11	12	15
STREAM NAME	UNITS	SPIKING FLOW	WASTE RECEIPT	STARTER PATH	SOIL	ICV FEED	DRYER CONDENSATE	DRYER OFF GAS	STACK DISCHARGE	AMBIENT AIR	HOT ICV PRODUCT	TOP UP SOIL	COOLED ICV PRODUCT	DUST RECYCLE
FLOW TYPE (Batch or Continuous, TR units)		B(GPM)	B(GPM)	B(kg/min)	B(m3/min)	B(kg/hr)	Cont.	Cont.	Cont.	Cont.	Batch (Container/Week)	Batch(kg/hr)	Batch (Container/Week)	Cont.
PHASE		LIQUID	LIQUID	SOLID	SOLID	SOLID	LIQUID	GAS	GAS	GAS	SOLID	SOLID	SOLID	SOLID
DESIGN MASS FLOWRATE	kg/hr	0.0	704	13	433	639	500	301	1003	78	460	110	477	2.3
VOLUMETRIC FLOW RATE (LIQ/GAS)	GPM/CFM	0.00	2.40				2.2	150	500	39				
TRANSFER RATE	as shown	0	75	100	1	581					1	Variable	1	
CYCLE TIME	hr	Variable	Variable	Variable	7.9	7.9					168	1	168	
SpG		1.29	1.29	1.49	2.23	2.02	0.993	0.001	0.001	0.001	2.52	2.60	2.74	2.32
PRESSURE (delta P from ATMOS)	In. H2O							-67	2	0				
TEMPERATURE	°C	28	28	25	25	28	28	25	25	25	1500	25	50	300
H2O Liquid	kg/hr	0	470	0	43.3	12.8	500	0	0	0	0	0	0	0
Na	kg/hr	0	63	0	8.5	71.5	0	0	0	0	71.2	0	0	0.34
SO2 GAS	ppmV	0	0	0	0	0	0	0	0	0	0	0	0	0
NOx GAS	ppmV	0	0	0	0	0	0	0	0	0	0	0	0	0
HCl GAS	ppmV	0	0	0	0	0	0	0	0	0	0	0	0	0
^{137}Cs	Ci/hr	0	3.35E+00	0	0	3.38E+00	0	0	0	0	3.35E+00	0	3.34E+00	3.39E-02
^{99}Tc	Ci/hr	0	2.58E-02	0	0	2.71E-02	0	0	0	0	2.56E-02	0	2.57E-02	1.36E-03
TRU	Ci/hr	0	1.98E-03	0	0	1.98E-03	0	0	0	0	1.96E-03	0	1.97E-03	1.99E-07
^{129}I	Ci/hr	0	4.56E-05	0	0	4.51E-05	4.51E-05	0	0	0	4.49E-06	0	4.47E-06	4.06E-05

GENERAL NOTES:

1. SINGLE TRAIN FACILITY THROUGHPUT: PROCESS FEED IS MODELLED BASED ON A DESIGN FEED OF 2.4 GPM. A TOTAL OPERATING EFFICIENCY OF 70% SHOULD BE APPLIED TO ACHIEVE A 1.87 GPM PRODUCTION RATE WITH A 20.0 WT% Na2O GLASS LOADING IN THE GLASS PRODUC
2. VALVES ARE SHOWN TO INDICATE PROCESS INTENT.
3. FEED DATA BASED ON SECTIONS 3.1.2.1.1.1 AND 3.1.2.1.1.2 IN RPP-17403 REV 0.
4. RADIONUCLIDE CONTENT WAS BASED ON TABLE 3-3 IN SECTION 3.1.2.1.1.3 OF RPP-17403 REV 0.
5. NO EQUIPMENT FOR SOIL ADDITIVES ARE INCLUDED.

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E	ISSUED FOR PERMITTING	01/22/04	SKB		
D	ISSUED FOR PERMITTING	01/20/04	SKB		
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DISCIPLINE ENGINEER	
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AMEC PROJECT # 142512

U.S. DEPARTMENT OF ENERG
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PFD SHEET 1 OF 2

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Figure 4. Phase 2 Process Flow Diagram (2 pages)

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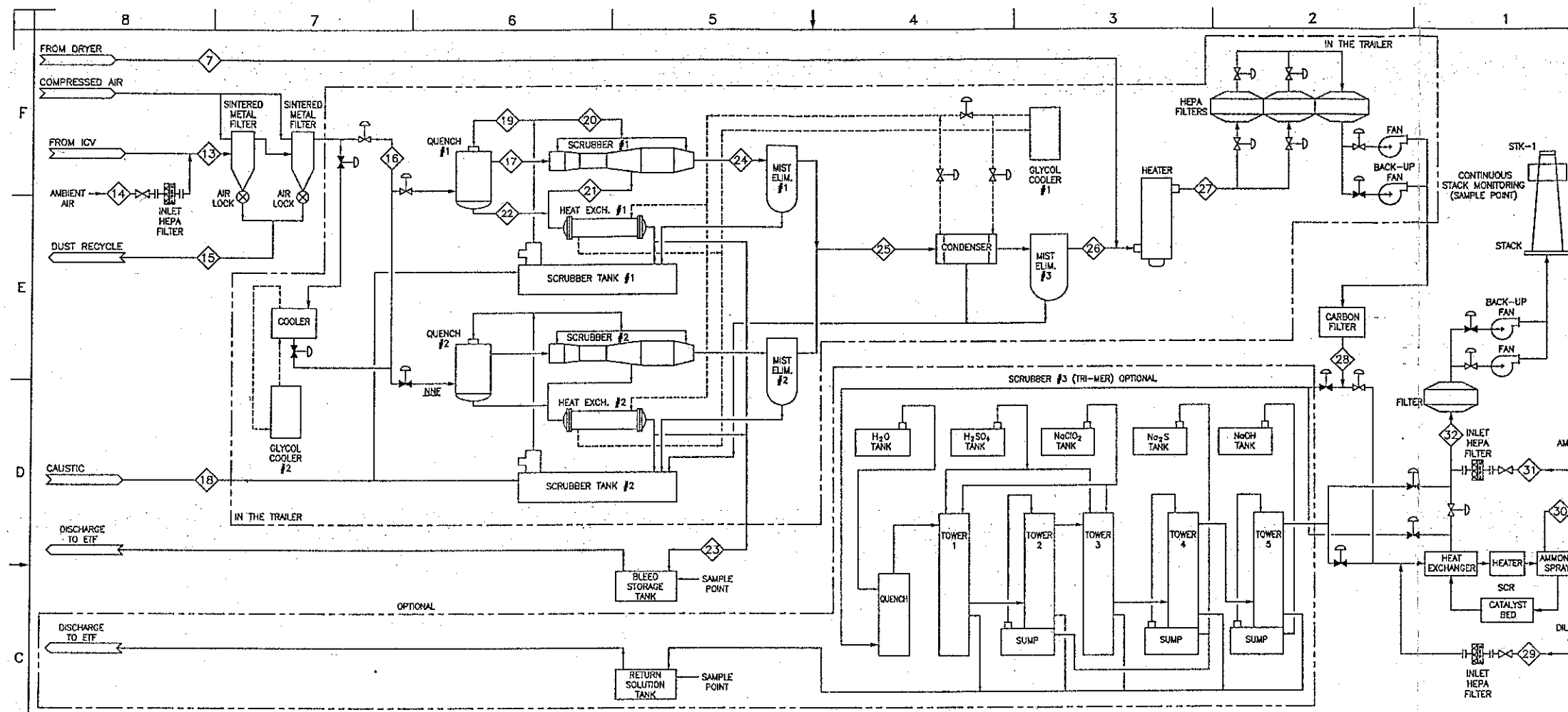

STREAM No.		7	13	14	15	16	17	18	19	20	21	22	23	24
STREAM NAME	UNITS	DRYER OFF GAS	ICV OFF GAS	AMBIENT AIR	DUST RECYCLE	FILTERED OFF GAS	QUENCHER DISCHARGE	CAUSTIC MAKE-UP	QUENCH SOLUTION	SCRUB SOLUTION	SCRUB RETURN	QUENCH RETURN	BLEED	SCRUB DISCHARGE
FLOW TYPE, (Batch or Continuous, TR units)		Cont.	Cont.	Cont.	Cont.	Cont.	Cont.	Cont.	Cont.	Cont.	Cont.	Cont.	Cont.	Cont.
PHASE		GAS	GAS	GAS	SOLID	GAS	GAS	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	GAS
DESIGN MASS FLOWRATE	kg/hr	301	1018	781	2.27	1016	1091	489	2321	4642	4690	2246	462	1013
VOLUMETRIC FLOWRATE (LIQ/GAS)	GPM/CFM	150	969	389		969	812	2	9	19	18	0.8	1.9	616
TRANSFER RATE	as shown													
CYCLE TIME	hr													
SpG		0.001	0.001	0.001	2.3	0.001	0.001	1.08	1.1	1.1	1.1	1.1	1.1	0.001
PRESSURE (delta P from ATMOS)	in. H2O	-67	-1	0		-9	-10							-60
TEMPERATURE	°C	25	300	25	300	300	54	52	41	41	50	53	40	50
H2O Liquid	kg/hr	0	0	0	0	0	0.5	440	1907	3815	3841	1818	377	0
Na	kg/hr	0	0.30	0	0.34	0	0	0	0	0	0	0	0	0
SO2 GAS	ppmV	0	604	0	0	604	160	0	0	0	0	0	0	17
NOx GAS	ppmV	0	73087	0	0	73195	58143	0	0	0	0	0	0	49043
HCl GAS	ppmV	0	58	0	0	58	15	0	0	0	0	0	0	2
^{137}Cs	Ci/hr	0	3.35E-02	0	3.35E-02	3.04E-09	1.02E-09	0	7.11E-09	1.422E-08	1.37E-08	9.14E-09	1.52E-09	1.52E-09
^{99}Tc	Ci/hr	0	1.36E-03	0	1.36E-03	1.22E-10	4.07E-11	0	2.85E-10	5.694E-10	5.50E-10	3.66E-10	6.10E-11	6.10E-11
TRU	Ci/hr	0	1.99E-07	0	1.99E-07	1.78E-14	5.95E-15	0	4.16E-14	8.319E-14	8.03E-14	5.35E-14	8.91E-15	8.92E-15
^{129}I	Ci/hr	0	4.06E-05	0	4.06E-05	3.65E-12	1.22E-12	0	8.53E-12	1.706E-11	1.64E-11	1.10E-11	1.83E-12	1.83E-12

STREAM No.	25	26	27	28	29	30	31	32
STREAM NAME	CONDENSER FEED	HEATER FEED	HEPA FEED	SCR FEED	SCR AIR	AMMONIA FEED	AMBIENT AIR	STACK DISCHARGE
FLOW TYPE, (Batch or Continuous, TR units)	Cont.	Cont.	Cont.	Cont.	Cont.	Cont.	Cont.	Cont.
PHASE	GAS	GAS	GAS	GAS	GAS	GAS	GAS	GAS
DESIGN MASS FLOWRATE	1043	1043	1344	1344	16049	21	0	17413
VOLUMETRIC FLOWRATE (LIQ/GAS)	616	616	810	810	8000		0	9747
TRANSFER RATE								
CYCLE TIME								
SpG	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
PRESSURE (delta P from ATMOS)	-62	-67	-70	-4				2
TEMPERATURE	50	50	75	75	25	25	25	50
H2O Liquid	0	0	0	0	0	0	0	0
Na	0	0	0	0	0	0	0	0
SO2 GAS	17	17	13	13	0	0	0	1.05
NOx GAS	49043	49043	38413	38413	0	0	0	37.0
HCl GAS	2	2	1	1	0	0	0	0.1
^{137}Cs	1.52E-09	1.52E-09	1.52E-09	1.52E-11	0	0	0	0
^{99}Tc	6.10E-11	6.10E-11	6.10E-11	6.10E-13	0	0	0	0
TRU	8.92E-15	8.92E-15	8.92E-15	8.92E-17	0	0	0	0
^{129}I	1.83E-12	1.83E-12	1.83E-12	1.83E-14	0	0	0	0

NOTES:

1. NOx EMISSION AT STREAM 32 WILL BE LESS THAN 1.5 lbs/hr.

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DRAWING CHECKED	
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PROJECT MANAGER	

AMEC PROJECT # 142312

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SCALE NONE | SHEET 2

5.1.1 System Capacity

The DBVS is designed to process the incoming 5 molar Na solution waste feed at a rate of 9 L/min (2.4 gal/min). However, the feed rate may be varied as one of the parameters being evaluated through this demonstration project. Under Phase 2 test conditions, it is anticipated that up to 22,700 L (6,000 gal) of tank waste could be included in each container.

5.1.2 Waste Receipt

The DBVS receives LAW from Tank 241-S-109 into tanks for process feed, storage, and sampling. The tank capacities for the DBVS waste receipt are 3,780 L (1,000 gal) for Phase 1 of the test program consisting of initial system shakedown and production of up to three containers of treated waste. In Phase 1, the liquid salt-solution received will be stored in a 3,780-L (1,000-gal) tank because the total amount of waste included in the initial batch(es) to be treated will be minimal. At the completion of Phase 1, the 3,780-L (1,000-gal) storage tank will be retained at the site and used for storage of process additives such as simulated waste materials during Phase 2. In Phase 2, up to four 68,140 L (18,000 gal) tanks will be used for waste receipt. There will be 47 to 49 waste containers produced in Phase 2. Multiple tanks will allow one or more tanks to be used for waste feed to the DBVS while the other tanks are being filled and sampled.

Each waste receipt tank is sized to accommodate the incoming waste stream. All waste receipt tanks will be double-shell construction with double-contained waste transfer lines having leak detection capability. Waste tanks will be vented through the OGTS (Section 5.1.8).

5.1.3 Process Additives

The DBVS will receive soil, glass additives, container refractory sand, and other materials necessary to the vitrification process or as processing aids. Soil will be used to form the matrix for the vitrification process and to add an additional layer of clean material on the vitrified mass in the container. Vitrification aids, such as graphite, boron, and zirconium, may be used. Graphite will be placed in the vitrification container to help initiate the soil/waste melting process. Boron and zirconium will be used in small quantities to increase glass performance (waste retention). A castable refractory, sand, and refractory insulating board will be used as insulators.

There will be a period of DBVS system testing using a "waste simulant" consisting of a nonhazardous saltcake or slurry. This waste simulant will be used for running system checkout and vitrification tests prior to treatment of actual waste during Phase 1 and used as a "filler material" during Phase 1 and as a spiking material in Phase 2. Because the majority of simulant will be used in Phase 1, a temporary 68,140 L (18,000 gal) double-shell portable tank will be used for simulant storage during system testing. This portable tank may be used as a waste receipt tank during Phase 2. As noted earlier, the 3,780 L (1,000 gal) tank used for waste receipt in Phase 1 may be used for simulant storage in Phase 2.

5.1.4 Waste Feed Preparation

Waste feed material will be transferred from Tank 241-S-109 to the waste receipt tanks at the DBVS site. Prior to starting the vitrification process, the waste feed material will be mixed with additives and dried to approximately two percent (2%) moisture content. The mixer/dryer will be heated by steam from an onsite boiler. Appropriate additives will be conveyed or transferred to the unit. The dry material transfer systems will be equipped with weigh stations to control the amount of material being added to the mixer/dryer.

The mixer/dryer design capacity is 10,000 L (2,640 gal) and the nominal cycle time is between six and eight hours. During the mixing/drying cycle, the unit will be operated under vacuum to promote the release of moisture from the material being processed until required dryness is achieved.

5.1.5 Vitrification Container Preparation

The typical waste container for the vitrification process is expected to be a steel box approximately 3.0 m high (10 ft), 2.4 m wide (8 ft), and 7.3 m long (24 ft). Containers will comply with the waste acceptance criteria for the receiving permitted storage or disposal facility. Prior to waste distribution, the box will be lined with insulating board, sand, and a layer of castable refractory. The castable refractory will face the waste material. A layer of melt-initiating graphite and soil will be placed over the castable refractory in the bottom of the container.

A steel lid with attached electrodes will be sealed onto the box prior to waste deposition using bolted flanges and a refractory gasket. The lid contains several ports for waste material addition, electrode connections, venting, sampling, and introduction of post-vitrification materials. All connections will be mechanically sealed to the box lid. In addition, waste transfer connections will be equipped with shutoff valves to prevent spillage of material as the chute is attached to and removed from the port. To minimize potential contamination to workers and the environment, each connection point will be equipped with secondary containment and spilled material recovery provisions during material transfer, melting, and cooldown. The container will contain ports for sampling the vitrified waste to obtain samples for analyses. The waste container filling/vitrification station will be equipped with shielding, as required.

The container-filling operation is performed under negative pressure and exhausted out the vent port to the OGTS.

5.1.6 In-Container Vitrification

The waste mixture from the mixer/dryer will be placed into the vitrification container through ports in the sealed box lid. Electric power will be applied to the electrodes, vitrifying the container contents via resistive heating. Ambient air, filtered through a HEPA filter, is injected to cool the vitrification offgases and provide thermal protection for HEPA filters in the OGTS. Vitrification offgases are vented under negative pressure to the OGTS. During the vitrification process, the depth of material will typically decrease due to consolidation in melting.

Both "bottom-up" and "top-down" melting may be conducted during testing. Top-down melting is conducted by applying power to the electrodes only after all waste materials and process additives have been placed in the container. Bottom-up melting begins melting with a shallow layer of material in the container and continues as more material is added until the desired depth of melt is obtained.

5.1.7 Post-Vitrification Container Handling

After vitrification has been completed, the container connection to the OGTS will be maintained. Clean fill materials will be added to fill cavities around the electrodes and cover the top of the vitrified mass to minimize headspace in the container.

Sampling of the vitrified waste, radiation surveying, and external decontamination, as necessary, can be conducted anytime after initial cooling has been completed. Sampling of the melt will be conducted as required by a coring process through a port in the side of the container

Temporary storage for up to 50 treated waste containers will be located at the Test and Demonstration Facility. At the completion of DBVS activities, waste containers will be transported to the IDF or to another permitted storage or disposal facility.

5.1.8 Offgas Treatment System

Emissions may consist of either fugitive (i.e., bulk process additive loading and transfer) or point (i.e., stack) sources. Hazardous or radioactive emissions will not be released through fugitive sources, as those sources will be limited to nonhazardous and nonradioactive materials.

Point sources may emit both nonradioactive and radioactive emissions. For radioactive emissions, the design of the gaseous and particulate effluent monitoring system will comply with ANSI/HPS N13.1, *Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities.*

Offgas treatment for DBVS operations will include the following:

- Particulate and gaseous emissions from waste receipt
- Particulate emissions from process additive receipt, storage, and transfer (not including fugitive emissions from stockpiles)
- Particulate and gaseous emissions from mixer/dryer (dedicated partial system)
- Particulate and gaseous emissions from waste container filling and vitrification
- Particulate emissions from waste container topoff after vitrification.

All offgas system connections to treatment equipment and the waste container tops will be sealed and the offgas ducting maintained under negative pressure. With the exception of process additive emissions control, all system emissions will be routed to an OGTS prior to discharge to the atmosphere.

5.1.8.1 Process Additive Emissions. Particulate emissions from offloading and transfer of process additives will be controlled by dedicated baghouse and vent systems. A covered hopper

with a sealed pneumatic conveying system will be used to transfer soil to the mixer/dryer soil holding tank or silos. Particulate matter collected at the baghouses is returned to the appropriate additive storage area for reuse.

5.1.8.2 Mixer/Dryer Offgas Emissions. The mixer/dryer emissions will be partially treated for moisture removal using a glycol-cooled condenser and mist eliminator prior to being routed to the OGTS downstream of the chemical/venturi scrubber. Water condensed in the condenser and removed in the mist eliminator will be routed to a storage tank for sampling and subsequent treatment or disposal.

5.1.8.3 Phase 1 Main Offgas Treatment System. The Phase 1 OGTS will consist of two sintered metal filters in series, a glycol-cooled condenser, a quench section, an atomizing chemical scrubber/venturi scrubber, and mist eliminator system. Condensed liquids are drained into the condenser exhaust duct. Two quench/scrubber/mist eliminator systems will be installed in parallel, with one in service and the other on standby. Dilute sodium hydroxide will be injected in the atomizing scrubber section to reduce hydrogen chloride and other acid gas emissions. Based on expected or measured emission levels of pollutants such as hydrogen fluoride, both systems may be used simultaneously to provide additional scrubbing capabilities. Scrubber system offgases will pass through an additional condenser and mist eliminator, with drainage from those units routed to the scrubber recycle tanks. An offgas heater, parallel HEPA filters (in series), and a carbon filter will follow the mist eliminator.

5.1.8.4 Phase 2 Main Offgas Treatment System. Abatement performance of the OGTS will be enhanced for Phase 2 to allow higher waste processing rates and to examine other NOx treatment methods. A larger selective catalytic reduction (SCR) unit may be used or an additional unit added in series based on the analysis of Phase 1 emissions data. A packed tower scrubber may be used to allow the option of routing exhaust gases either through the SCR unit(s) or the tower scrubber to determine the effect on both scrubbing efficiency and scrubber blowdown rates.

5.2 SITE ACTIVITIES

Site preparation activities include:

- Performance of site preparation work such as site grubbing, grading, excavating, backfilling, utility installation, fence installation, and construction of storage pads
- Installation of construction office trailers, field trailers, and change trailers
- Positioning and erection of DBVS processing equipment and support equipment
- Connection of site utilities (e.g., electrical, water, and sewer)
- Teardown and removal of equipment
- Site restoration.

6.0 ABATEMENT TECHNOLOGY

Regulatory Citation: Describe the existing and proposed (as applicable) abatement technology. Describe the basis for the proposed system. Include expected efficiency of each control device, and the annual volumetric flow rate in meters^3/sec for the emissions unit(s).

During waste transfer into the waste receipt tanks the DBVS exhauster will be in operation. The exhauster is designed to operate at flow rates up to 283 cu m (10,000 cu ft) /min. The major components of the DBVS exhauster are as follows:

- Sintered metal filters
- Glycol cooled condenser (mixer/dryer offgases and scrubber exhaust gases)
- Mist eliminators
- Wet gas scrubbers (2 units in parallel, one in use at a time)
- Heater
- HEPA filters (2 HEPA filters in series)
- Carbon filter
- Packed tower scrubber (optional)
- Selective Catalytic Reduction Unit(s)
- Polishing Filter.

DBVS components listed for nonradioactive emissions control are included and described for system completeness. This equipment is not to be considered radioactive abatement control equipment.

6.1 PHASE 1 MAIN OFFGAS TREATMENT SYSTEM

The Phase 1 OGTS will consist of two sintered metal filters in series, a glycol-cooled condenser, a quench section, an atomizing chemical scrubber/venturi scrubber, and mist eliminator system. Condensed liquids are drained into the condenser exhaust duct. Two quench/scrubber/mist eliminator systems will be installed in parallel, with one in service and the other on standby. Dilute sodium hydroxide will be injected in to the atomizing scrubber section to reduce hydrogen chloride and other acid gas emissions. Based on expected or measured emission levels of pollutants such as hydrogen fluoride, both systems may be used simultaneously to provide additional scrubbing capabilities. Scrubber system offgases will pass through an additional condenser and mist eliminator, with drainage from those units routed to the scrubber recycle tanks. Water vapor is removed and a heater raises the air temperature and dew point prior to reaching the HEPA filters. An offgas heater, parallel HEPA filters (in series), and a carbon filter will follow the mist eliminator.

NOx treatment will be accomplished by use of a SCR unit. More than one SCR unit and an optional packed tower scrubber may be used. From the SCR unit(s), offgases will be routed

through a polishing filter before being discharged through the exhaust stack equipped with sample ports and monitoring equipment.

Dust collected from the sintered metal filters will be recycled to the mixer/dryer, except for the final dust batch, which will be vitrified and sent to the IDF or another permitted disposal facility. Blowdown from the scrubber recycle tank will be sampled and routed to the permitted Effluent Treatment Facility or other permitted facility. Carbon filters will be modular units and, upon reaching saturation, will be removed, sampled, and disposed.

Each HEPA filter section will have injection ports and sampling ports for independent aerosol testing. The stack will include an effluent monitoring system that is alarmed in the event high radioactive particulate levels are detected. The stack monitoring system includes a shrouded nozzle design for sampling and vacuum pumps to provide sampling ability.

6.1.1 Sintered Metal Filter – Abatement

Airflow from the mixer/dryer passes through a glycol-cooled condenser and mist eliminator to reduce airflow moisture before reaching the sintered metal filter. Dust collected from the sintered metal filters will be recycled to the mixer/dryer, except for the final dust batch, which will be vitrified and sent to the IDF or another permitted disposal facility. Blowdown from the scrubber recycle tank will be sampled and routed to the permitted Effluent Treatment Facility or other permitted facility.

6.1.2 HEPA Filter – Abatement

During OGTS operations, airflow will be heated before passing through two HEPA filters in series. As low as reasonably achievable (ALARA) concepts will be applied to allow for less frequent change out of the HEPA filters, thereby reducing exposure to personnel to radiological materials.

The HEPA filters are expected to meet the requirements of ASME AG-1, Section FC, and will be tested annually to requirements of ASME N510. The HEPA filters will be nuclear grade throwaway extended-media dry-type in a rigid case having minimum particle collection efficiency of 99.97 % for 0.3-micrometer median diameter. The frame will be corrosion resistant for the air stream design conditions. Each filter will have gelatinous or elastomer seal gasket material. HEPA filter testing will confirm that any airborne radionuclide particles are captured to the level of efficiency of 99.95 %.

HEPA filters are located within an existing trailer unit as discussed in Section 18.0. As noted in Section 18.0, HEPA filter abatement equipment requirements will be reviewed with the Washington State Department of Health as to the applicability of ASME AG-1.

6.1.3 Carbon Filter – Abatement

Airflow leaving the trailer unit containing the in-series HEPAs is routed to a carbon filter. The purpose of the carbon filter is to capture any remaining organics before entering the tower scrubbers. Upon reaching saturation, the carbon filters will be removed, sampled, and disposed.

6.1.4 Selective Catalytic Reduction – Abatement

A SCR unit will be placed downstream of the carbon filter. The purpose of this unit is for NOx removal. NOx treatment will be accomplished by use of a SCR unit. More than one SCR unit may be used. From the SCR unit(s), offgases will be routed through a polishing filter before being discharged through the exhaust stack.

6.1.5 Polishing Filter – Abatement

A polishing filter will be placed downstream of the SCR unit(s) for the purpose of being a final filter prior to being exhausted to the atmosphere. The intent of the polishing filter is to capture radioactive particles, which may be dislodged from the SCR process (expected to be minimal). There has been no credit taken for this HEPA as abatement control equipment.

6.2 PHASE 2 MAIN OFFGAS TREATMENT SYSTEM – ABATEMENT

Performance of the OGTS will be enhanced for Phase 2 to allow higher waste processing rates and to examine other NOx treatment methods. A larger SCR unit may be used or an additional unit added in series based on the analysis of Phase 1 emissions data. A packed tower scrubber may be used in addition to or with the SCR unit(s) to determine the effect on both scrubbing efficiency and scrubber blowdown rates. DBVS processing operations will be performed under active ventilation. For calculation of unabated and abated emissions from the RD&D project activities, the radionuclide inventory based on the volume of waste processed through the DBVS is presented in Appendix C. Calculations are also included in Appendix C.

6.3 SOIL EXCAVATION ABATEMENT

Because of the possibility of encountering previously undetected subsurface contamination, all work will be performed in accordance with appropriate radiological controls and the River Protection Project as low as reasonably achievable program. These requirements are implemented through fieldwork packages and associated radiological work permits.

Should contaminated soil be encountered, soil excavation activities will be performed in accordance with as low as reasonably achievable control technology (ALARACT) Demonstration 5, *Demonstration for Soil Excavation (Using Hand Tools)*, and will follow the radiological controls specified in that ALARACT (HNF-4327). Soil excavation activities may also be performed in this non-contaminated area using heavy equipment (backhoe, front-end loader, etc.).

6.4 WASTE CONTAINER STORAGE ABATEMENT

A waste container concrete storage pad will accommodate up to 50 waste containers from the Phase 1 and Phase 2 vitrification process. Waste containers being stored will have NucFil HEPA filter (or equivalent) installed which are considered Best Available Radionuclide Control Technology (BARCT) (Conklin 1992) and ALARACT. No decontamination factor credit is taken for the HEPA filter in estimating the potential dose from storage of the waste containers. The HEPA-type NucFil filters are not testable once installed. However, the manufacturer certifies a 99.97% removal efficiency at a flow range of 1.0E-06 to 3.0E-06 m^3/sec.

7.0 DRAWING OF CONTROLS

Regulatory Citation: Provide conceptual drawings showing all applicable control technology components from the point of entry of radionuclides into the vapor space to release to the environment.

Figure 4 (2 pages) shows the air pathway and abatement controls (e.g., offgas unit with sintered metal filters, glycol cooled condenser, mist eliminators, wet gas scrubbers, heater, HEPA filters in series, carbon filter, tower scrubber, selective catalytic reduction unit, and polishing filter).

8.0 RADIONUCLIDES OF CONCERN

Regulatory Citation: Identify 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.

The radionuclide estimated to contribute greater than ten percent of the unabated potential-to-emit total effective dose equivalent (TEDE) to the onsite maximally exposed individual (MEI) from operation of RD&D process equipment is calculated to be Cesium-137 as shown in Appendix C. The contribution of this radionuclide is derived by application of the Clean Air Act Assessment Package (CAP)-88PC dose conversion factors (HNF-3602) used for the Hanford Site and the radionuclide inventory as shown in Appendix A.

9.0 EFFLUENT MONITORING SYSTEM

Regulatory Citation: 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 with detail sufficient to demonstrate compliance with the applicable requirements.

The potential unabated total onsite dose to the MEI for all associated activities for the RD&D activities is calculated to be 7.35E+01 millirem (mrem)/yr (Table 2). As required by 40 CFR 61, Subpart H, continuous monitoring during exhauster operations will be performed to verify emissions. Radionuclide contributions to the onsite unabated dose are shown in Appendix C. However, the largest contributors to the unabated dose is Cesium-137 (99%).

The active ventilation system will sample and monitor emissions continuously. Emissions will be sampled for those radionuclides contributing greater than 0.1 mrem/yr potential-to-emit TEDE to the MEI using a record sample collection system. The collection system includes a filter holder to collect the record sample. The record sampler will operate continuously during operations. Sample collection results will be analyzed by a Hanford Site laboratory.

For passive ventilation, periodic confirmatory measurement (PCM) will be performed on the HEPA breather vents. PCM will be conducted annually by verifying the levels of smearable contamination on the outside of the screen covering the outlet of the vent. If a screen covering does not exist, smearable contamination is to be checked on the inside of the duct downstream of the HEPA filter. Confirmation of levels below 10,000 disintegrations (dpm)/min per 100 square centimeters (cm^2) beta/gamma and 200 dpm/min per 100 cm^2 alpha will be used to verify low emissions. Any detection above these levels will be reported if the cause was due to an airborne emission. The radiological survey report(s) will be the record for PCM.

The quality and detection limits of these analyses are controlled via the current revisions of the following documents:

- HNF-EP-0528, *NESHAP Quality Assurance Project Plan for Radioactive Air Emissions*
- HNF-EP-0835, *Statement of Work for Services Provided by the Waste Sampling and Characterization Facility for the Environmental Compliance Program during Calendar Yr 2003*
- RPP-QAPP-004, *Quality Assurance Program Plan for Tank Farm Contractor Radioactive Air Emissions.*

10.0 ANNUAL POSSESSION QUANTITY

Regulatory Citation: Indicate the annual possession quantity for each radionuclide.

The DBVS ICV® process involves a high heat treatment (vitrification) of the waste with resultant offgas stream. Due to this process, the annual possession quantity (APQ) is determined based on the inventory expected to be processed through the DBVS and not from a typical tank activity where emissions are being exhausted. The inventory of saltcake-solids and saltcake-liquids in Tank 241-S-109 serve as the origin in the development of the APQ. A maximum of 1,355,500 L (300,000 gal) of saltcake from Tank 241-S-109 will enter the DBVS inventory in accordance with the RCRA RD&D permit. Sludge inventory in Tank 241-S-109 will not be processed through the DBVS. The curie content of the 46 analytes as listed in Tank Waste Information Network System is based on 300,000 gallons of saltcake. The APQ for the DBVS facility inventory is indicated in Appendix A. Appendix B shows the methodology for deriving the APQ for soil excavations.

11.0 PHYSICAL FORM

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

Each radionuclide in the tank inventory to be processed through the DBVS is listed in Appendix A. This tank waste inventory consists of gases, liquids, and solids. Excavation of soils is expected to result in particulate solids.

12.0 RELEASE FORM

Regulatory Citation: 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.

The radionuclides in the tank inventory listed in Appendix A are assumed to be released as particulates, except for Tritium, Carbon-14, Ruthenium-106, and Iodine-129, which are assumed to be released as gases. HEPA filters are assumed to not serve as an effective abatement control for gases.

13.0 RELEASE RATES

Regulatory Citation:

a. *New emission unit(s): Give predicted release rates without any emission control equipment (the potential-to-emit) and with the proposed control equipment using the efficiencies described in subsection 6 of this section.*

b. *Modified emission unit(s): Give predicted release rates without any emissions control equipment (the potential-to-emit) and with the existing and proposed control equipment using the efficiencies described in subsection 6 of this section. Provide the latest year's emission data or emissions estimates.*

Abated emissions from passive and diffuse sources were reported in DOE/RL-2003-19, *Radionuclide Air Emissions Report for the Hanford Site, Calendar Yr 2002.* Reported emissions include Tank 241-S-109.

The TEDE from all calendar yr 2002 Hanford Site air emissions (point sources and diffuse and fugitive sources) was 0.066 mrem (DOE/RL-2003-19).

13.1 DBVS PROCESSING

This Notice of Construction uses release rates based on 40 CFR 61, Appendix D release factors for particulates (i.e., 1E-03) and gases (i.e., 1E+00) for tritium, carbon-14, ruthenium-106, and iodine-129. The release factors for particulates and gasses were used in dose calculations under active ventilation for all analytes except for cesium-137 and technetium-99. If a particulate release factor of 1E-03 were used for cesium-137 and technetium-99 in accordance with 40 CFR 61, Appendix D, radioactive emissions of these analytes would be underestimated because of the thermal treatment (bulk vitrification) process. Based on test results from the bulk vitrification vendor, a more conservative release factor for cesium-137 of 1E-02 is used for active ventilation calculations. For technetium-99, a more conservative release factor of 5E-02 is used for active ventilation. Therefore, these release factors represent a more conservative, bounding analysis. These release factors will only be used for this RD&D activity. Release factors for eventual full-scale operation of the DBVS will be based on test data collected from Phase 1 and 2 test activities.

13.2 SOIL EXCAVATION

It is assumed that contaminated soil may be encountered in the Test and Demonstration Facility. Dose calculations for soil excavation assume 500,000 dpm/cm^2 beta-gamma and 200 dpm/cm^2 alpha readings. If net contamination exceeds these values, field work is stopped and other contamination controls will be implemented per ALARACT 5 (HNF-4327). The values are then "converted" to 50,000 counts per minute (cpm)/probe area beta-gamma and 20 cpm/probe area alpha. In the absence of surface survey data of the Test and Demonstration Facility location, this conversion is done in order estimate emissions (HNF-2418). These do not represent limits but reflect implementation guidelines of ALARACT 5 (HNF-4327) for hand digging. The calculated results are considered very conservative. An assumption was made that the average

soil density was 1590 kg/m^3 (98 lbs/ft^3). Release rate calculations for soil excavation are shown in Appendix D.

13.3 VENTED WASTE CONTAINER STORAGE

The release form of the radionuclides from waste container storage is particulate solid. Although a negligible fraction of gaseous radionuclides could be encountered during the storage phase, it is assumed to be insignificant with no anticipated change to the estimated curies.

Once the waste containers have been filled, up to 50 waste containers will be stored at the Test and Demonstration Facility until moved to an onsite disposal facility.

The waste container contents from the DBVS will be a vitrified solid mass. A release factor of 1.0E-06 in accordance with 40 CFR 61, Appendix D is used to calculate unabated and abated dose to the maximally exposed individual. No credit has been taken in the Appendix E calculations as a decontamination factor for the NucFil filter.

14.0 LOCATION OF THE MAXIMALLY EXPOSED INDIVIDUAL

Regulatory Citation: Identify the MEI by distances and direction from the emission unit(s). The MEI is determined by considering distance, wind rose data, presence of vegetable gardens, and meat or milk producing animals at unrestricted areas surrounding the emission unit.

The MEI is determined using CAP-88PC dispersion factors that are derived for and used on the Hanford Site. These dispersion factors are published in HNF-3602, Revision 1, *Calculating Potential-to-Emit Releases and Doses for FEMPs* [Facility Environmental Monitoring Plans] *and NOCs*. Dispersion values used for RD&D activities are from Table 4-10 in HNF-3602 for the 200 West Area. Because the DBVS exhaust stack does not exceed 40 m, an effective release height of <40 m was selected from Table 4-10 in HNF-3602.

Table 4-10 in HNF-3602, Revision 1, also provides values to use for the offsite maximum public receptor (MPR) and the onsite MPR. Values from both the offsite MPR and the onsite MPR were used to determine a maximum dose to the MPR. For the 200 West Area, the calculated results show that the maximum unabated dose of 7.35E+01 mrem/yr is to the onsite MPR located 18,310 m (12 mi) east-southeast of 241-S Tank Farm at the Laser Interferometer Gravitational Wave Observatory. Table 4-2 in HNF-3602, Revision 1, was used to determine the distance and location to the onsite MPR.

15.0 TOTAL EFFECTIVE DOSE EQUIVALENT TO THE MAXIMALLY EXPOSED INDIVIDUAL

Regulatory Citation: calculate the TEDE to the MEI using an approved procedure (see WAC 246-247-085). 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 emission controls (the potential-to-emit) using release rates from subsection 13 of this section. Provide all input data used in the calculations.

The TEDE to the onsite MEI resulted in calculated unabated emissions of approximately 7.35E+01 mrem/yr and abated emissions of approximately 5.50E-02 mrem/yr as shown in Table 2.

Table 2. Summary – TEDE to the MEI

Activity	Unabated Dose		Abated Dose	
	mrem/yr		mrem/yr	
	Onsite	Offsite	Onsite	Offsite
Active Ventilation	7.35E+01	4.60E+01	5.21E-02	1.27E-01
Soil Excavation	1.54E-03	1.14E-03	1.54E-03	1.14E-03
Vented Container Storage	1.35E-03	7.91E-04	1.35E-03	7.91E-04
TOTAL	**7.35E+01**	**4.60E+01**	**5.50E-02**	**1.29E-01**

The unabated and abated dose calculations are based on the release rate discussion in Section 13.0, Release Rates. Unabated and abated dose calculations are included in Appendices C, D, and E.

16.0 COST FACTOR

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

Pursuant to WAC 246-247-110, Appendix A (16), cost factors for construction, operation, and maintenance of proposed technology requirements are not required, as the Washington State Department of Health has provided guidance in a letter to DOE, that HEPA filters are generally considered BARCT for particulate emissions (Conklin 1992). Because the key radionuclides of concern are particulates, it is proposed that the controls described in Section 6.0 be accepted as BARCT. Compliance with the substantive BARCT technology standards is described in Section 18.0.

17.0 DURATION OR LIFETIME

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

Field activities to support site preparation activities and equipment installation are currently scheduled to begin March 2004. Phase 1 waste processing activities are currently scheduled to start October 2004 and be completed no later than December 2004. Phase 2 waste processing activities are currently scheduled to start several months after Phase 1 completion and be completed no later than September 2006. The activity start and completion dates may vary dependent upon Hanford Site planning.

18.0 STANDARDS

Regulatory Citation: "Indicate which of the following control technology standards have been considered and will be complied within the design and operation of the emission unit(s) described in this application: . . . ."

Latest versions of standards American Society of Mechanical Engineers (ASME) AG-1, ASME N509, ASME N510, ASME NQA-1, 40 CFR 60, Appendix A Methods 1, 1A, 2, 2A, 2C, 2D, 4, 5, and 17, and ANSI/HPS N13.1. With respect to compliance with ASME AG-1 standards, recent discussions with WDOH regarding the applicability of ASME AG-1 for this OGTS exhauster will be followed.

The OGTS ventilation system being proposed consists of an exhauster unit as shown in Figure 4. Page 2 of Figure 4 depicts some abatement equipment located within a dashed-line. The dashed-line represents the boundary of existing abatement equipment located within an existing trailer unit that is planned for use for the DBVS project. This OGTS equipment within the trailer was fabricated about 1984 prior to the effective date of current ASME N509 (1989), ASME N510 (1989), and ASME AG-1 (1997) standards. The trailer mounted abatement equipment will be reviewed with the Washington State Department of Health as to the applicability of current standard ASME AG 1.

Abatement control equipment external to the trailer will be procured new to support the DBVS activities as discussed in Section 3.0 and will be designed, installed, and tested in accordance with the compliance standards as noted in Table 3. The DBVS sampling and monitoring design will be per the requirements of ANSI/HPS N13.1-1999 using a shrouded nozzle design to extract air samples.

Table 3 summarizes the compliance of newly procured DBVS emissions abatement control equipment with the listed technology standards for tank waste contents to be processed having a potential to emit greater than 0.1 mrem/yr TEDE to the MEI as discussed in Section 13. Existing emissions control equipment located within the trailer unit will be reviewed with Washington Department of Health for Table 3 compliance requirements.

The design of the HEPA breather filters must meet, as applicable and to the extent justified by a cost/benefit evaluation, the technology standards listed under WAC 246-247-110(18). Table 4 summarizes the compliance of emissions control equipment listed with technology standards for new DBVS breather filters.

Table 3. Emissions Control Standards for New DBVS Abatement Control Equipment

Standard	Does Design Comply?	Notes
ASME AG-1	Yes	HEPA filter housing will be designed to meet ASME AG-1.
ASME N509	Yes	Filters, moisture separators (or demisters or mist eliminators), air heaters, filter housings, dampers, fans, and ductwork will be designed to meet ASME N509. Also, filter housings are purchased to meet requirements in AG-1 for single filter, side access housings. Injection ports will be designed and installed between HEPA filter banks for testing purposes.
ASME N510	Yes	Visual inspection of offgas system, leak tightness testing of housing and ducts, and HEPA filter bank testing will be performed per the requirements of ASME N510. Filters are testable per ASME N510 and the housing will contain testing devices that meet requirements under ASME AG-1.
ASME NQA-1	Yes	Component fabrication will be performed under an approved ASME NQA-1 program.
ANSI/HPS N13.1	Yes	Sampling and monitoring of releases from the exhaust stack will be designed, fabricated, and operated to meet ANSI/HPS N13.1-1999. A shrouded nozzle will be used for sampling the airflow.
40 CFR 60, Appendix A Test Methods: 1, 1A, 2, 2A, 2C, 2D, 4	NA	These methods are for extracting samples from the airflow. Sampling and monitoring will be per ANS/HPSI N13.1
40 CFR 60, Appendix A Test Methods: 5, 17	NA	These methods are for sampling system designs. Periodic confirmatory measurements will be taken via smears in lieu of a sampling system.

Table 4. Emissions Control Standards for New DBVS Breather Filters

Standard	Does Design Comply?	Notes
ASME AG-1	Yes	HEPA filter housing will be designed to meet ASME AG-1.
ASME N509	Yes	Filter and housing design will meet ASME N509.
ASME N510	Yes	Filters are testable per ASME N510 and the housing will contain testing devices that meet requirements under ASME AG-1.
ASME NQA-1	Yes	Component fabrication will be performed under an approved ASME NQA-1 program.
ANSI/HPS N13.1	NA	ANSI/HPS N13.1 monitoring and sampling system is not required for breather vents. Periodic confirmatory measurement will be taken via smears on the filter screen
40 CFR 60, Appendix A Test Methods: 1, 1A, 2, 2A, 2C, 2D, 4	NA	Filter testing required for air flow related to ASME N510. Other methods are not required because emission collection and measurement is not required.
40 CFR 60, Appendix A Test Methods: 5,17	NA	These methods are for sampling system designs. Periodic confirmatory measurement will be taken via smears in lieu of a sampling system.

19.0 REFERENCES

40 CFR 60, "Standards for Performance of New Stationary Sources," *Code of Federal Regulations*, as amended.

40 CFR 61, "National Emission Standards for Hazardous Air Pollutant," *Code of Federal Regulations*, as amended.

ANSI/HPS N13.1, 1999, *Sampling and Monitoring Releases of Airborne Radioactive Substances from Stacks and Ducts of Nuclear Facilities*, American National Standards Institute, New York, New York.

ASME AG-1, 1997, *Code on Nuclear Air and Gas Treatment*, American Society of Mechanical Engineers, New York, New York.

ASME NQA-1, *Quality Assurance Program Requirements for Nuclear Facilities*, American Society of Mechanical Engineers, New York, New York.

ASME N509, 1989, *Nuclear Power Plant Air Cleaning Units and Components*, American Society of Mechanical Engineers, New York, New York.

ASME N510, 1989, *Testing of Nuclear Air Treatment Systems*, American National Society of Mechanical Engineers, New York, New York.

Conklin, A. W., 1992, "Air 92-107" (Letter WDOH to J. D. Bauer, U.S. Department of Energy, Richland Operations Office, October 5), Washington Department of Health, Olympia, Washington.

DOE/RL-2001-57, 2003, *Radioactive Air Emissions Notice of Construction for Transuranic Waste Retrieval Project*, Rev. 2, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-2003-19, 2003, *Radionuclide Air Emissions Report for the Hanford Site, Calendar Year 2002*, U.S. Department of Energy Richland Operations Office, Richland, Washington.

Ecology, EPA, and DOE, 1989, *Hanford Federal Facility Agreement and Consent Order*, as amended, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington.

HNF-2418, 1998, *Soil Contamination Standards for Protection of Personnel*, Fluor Hanford, Inc., Richland, Washington.

HNF-3602, 2002, *Calculating Potential-to-Emit Release and Dose for FEMP and NOCs*, Rev. 1, Fluor Hanford, Inc., Richland, Washington.

HNF-4327, 2002, *Control of Airborne Radioactive Emissions for Frequently Performed TWRS Work Activities (ALARACT Demonstrations)*, Rev. 1A, CH2M HILL Hanford, Inc., Richland, Washington.

HNF-EP-0528, 2001, *NESHAP Quality Assurance Project Plan for Radioactive Air Emissions*, Rev 4, Fluor Hanford Group, Inc., Richland, Washington.

HNF-EP-0835, 2003, *Statement of Work for Services Provided by the Waste Sampling and Characterization Facility for the Environmental Compliance Program during Calendar Year 2003*, Fluor Hanford Group, Inc., Richland, Washington.

RPP-QAPP-004, *Quality Assurance Program Plan for Tank Farm Contractor Radioactive Air Emissions*, CH2M HILL Hanford Group, Inc., Richland, Washington.

TWINS, Tank Waste Information Network System, available on the Internet at http://twinsweb.pnl.gov.

WAC 197-11-845, State Environmental Policy Act, "SEPA Rules, Department of Social and Health Services," *Washington Administration Code*, as amended.

WAC 246-247, "Radiation Protection – Air Emissions," *Washington Administrative Code*, as amended.

APPENDIX A

ANNUAL POSSESSION QUANTITY FOR DEMONSTRATION BULK VITRIFICATION SYSTEM INVENTORY

Table A-1. Demonstration Bulk Vitrification System (DBVS) Inventory (2 Pages)

Analyte Name	Analyte	DBVS Inventory (Ci)
Tritium	3H	1.09E+02
Carbon-14	14C	3.76E+01
Nickel-59	59Ni	4.20E+00
Cobalt-60	60Co	2.10E+01
Nickel-63	63Ni	3.89E+02
Selenium-79	79Se	5.02E-01
Strontium-90	90Sr	8.70E+03
Yttrium-90	90Y	8.70E+03
Niobium-93 metastable	93mNb	1.80E+01
Zirconium-93	93Zr	2.46E+01
Technetium-99	99Tc	1.80E+02
Ruthenium-106	106Ru	7.24E-05
Cadmium-113 metastable	113mCd	8.88E+01
Antimony-125	125Sb	3.98E+01
Tin-126	126Sn	3.04E+00
Iodine-129	129I	3.47E-01
Cesium-134	134Cs	2.09E-01
Cesium-137	137Cs	2.36E+04
Barium-137 metastable	137mBa	2.23E+04
Samarium-151	151Sm	1.68E+04
Europium-152	152Eu	3.96E+00
Europium-154	154Eu	9.65E+01
Europium-155	155Eu	7.95E+01
Radium-226	226Ra	2.25E-04
Actinium-227	227Ac	1.40E-03
Radium-228	228Ra	6.78E-02
Thorium-229	229Th	1.77E-03
Protactinium-231	231Pa	6.25E-03
Thorium-232	232Th	6.60E-03
Uranium-232	232U	1.03E-02
Uranium-233	233U	4.21E-02
Uranium-234	234U	3.73E-02

Table A-1. Demonstration Bulk Vitrification System (DBVS) Inventory (2 Pages)

Analyte Name	Analyte	DBVS Inventory (Ci)
Uranium-235	235U	1.56E-03
Uranium-236	236U	9.91E-04
Neptunium-237	237Np	6.69E-01
Plutonium-238	238Pu	1.48E-01
Uranium-238	238U	3.54E-02
Plutonium-239	239Pu	7.26E+00
Plutonium-240	240Pu	1.11E+00
Americium-241	241Am	4.82E+00
Plutonium-241	241Pu	6.91E+00
Curium-242	242Cm	9.18E-03
Plutonium-242	242Pu	4.90E-05
Americium-243	243Am	1.37E-04
Curium-243	243Cm	7.16E-04
Curium-244	244Cm	7.16E-03

APPENDIX B

ANNUAL POSSESSION QUANTITY FOR SOIL EXCAVATION

Table B-1. Soil Excavation Inventory for Demonstration Bulk Vitrification System at the Test and Demonstration Facility

Area Disturbed	3	Acres (2 inch depth Average - 25% of the area disturbed)
Maximum Soil Excavated	5445	Cubic feet
Soil Density	98	Pounds/Cubic Feet
Total Mass of Soil (TMS)	2.42E+08	Grams
Max Alpha Reading (MA)	20	Counts Per Minute (CPM)(c)
Max Beta/Gamma Reading (MB)	50,000	CPM (c)
Assumed Isotope	**Conversion Factor (pCi/gram)/cpm (a)**	**Possession Quantity Ci (b)**
	Column B	Column C
		C=B*TMS* MB(for Beta/Gamma)/1E12 MA (for Alpha)/1E12
Sr-90	0.35	4.24E+00
Am-141	14.20	6.87E-02
TOTAL		**4.30E+00**

Notes:

(a) HNF-2418, *Soil Contamination Standards for Protection of Personnel*, March 1998, P.D. Rittmann Tables 1 and 4 based on 500 mrem/yr

(b) Weight of Soil * Field Instrument Reading* Conversion Factor

(c) Per ALARACT 5: 200dpm/cm2 probe area alpha and 500,000dpm/cm2 probe area beta-gamma is converted to 20 cpm and 50,000 cpm; dpm=cpm*correction factor (10)

APPENDIX C

DOSE CALCULATIONS FOR ACTIVE VENTILATION

Table C-1. Demonstration Bulk Vitrification System (DBVS) Active Ventilation

# of HEPAs	1	
HEPA Efficiency	99.95%	
DF Factor (gases)	1	(For: 3H,14C,106Ru,129I)
DF Factor (solids)	2000	(1/1-efficiency = 1/1-.9995= 2.0E+03)

Column		A	B	C	D	E	F	G	H	I	J	K
ANALYTE NAME	ANALYTE	Facility Inventory (Ci)	Release Fraction	Unabated Release (Ci)	Conversion Factor - 200W Offsite MPR (mrem/Ci)	Offsite Unabated Dose (mrem/yr)	Offsite Abated Dose (mrem/yr)	Conversion Factor - 200W Onsite MPR (mrem/Ci)	Onsite Unabated Dose (mrem/yr)	Onsite Abated Dose (mrem/yr)	Contribution to Onsite Unabated Dose %	Contribution to Offsite Abated Dose %
				C=A*B		E=C*D	F=E/Decon Factor		H=C*G	I=H/Decon Factor	J=H\Sum of H	K=F\Sum of F
Tritium	3H	1.09E+02	1.00E+00	1.09E+02	2.50E-05	2.73E-03	2.73E-03	1.10E-05	1.20E-03	1.20E-03	0.00%	2.14%
Carbon-14	14C	3.76E+01	1.00E+00	3.76E+01	2.00E-03	7.52E-02	7.52E-02	3.00E-04	1.13E-02	1.13E-02	0.02%	59.09%
Nickel-59	59Ni	4.20E+00	1.00E-03	4.20E-03	2.40E-04	1.01E-06	5.04E-10	3.30E-04	1.39E-06	6.93E-10	0.00%	0.00%
Cobalt-60	60Co	2.10E+01	1.00E-03	2.10E-02	1.90E-01	3.99E-03	2.00E-06	3.40E-01	7.14E-03	3.57E-06	0.01%	0.00%
Nickel-63	63Ni	3.89E+02	1.00E-03	3.89E-01	2.00E-04	7.78E-05	3.89E-08	7.80E-05	3.03E-05	1.52E-08	0.00%	0.00%
Selenium-79	79Se	5.02E-01	1.00E-03	5.02E-04	1.00E-01	5.02E-05	2.51E-08	1.60E-01	8.03E-05	4.02E-08	0.00%	0.00%
Strontium-90	90Sr	8.70E+03	1.00E-03	8.70E+00	8.80E-02	7.66E-01	3.83E-04	1.10E-02	9.57E-02	4.79E-05	0.13%	0.30%
Yttrium-90	90Y	8.70E+03	1.00E-03	8.70E+00	2.60E-04	2.26E-03	1.13E-06	2.90E-04	2.52E-03	1.26E-06	0.00%	0.00%
Niobium-93 metastat	93mNb	1.80E+01	1.00E-03	1.80E-02	1.60E-03	2.88E-05	1.44E-08	1.30E-03	2.34E-05	1.17E-08	0.00%	0.00%
Zirconium-93	93Zr	2.46E+01	1.00E-03	2.46E-02	9.90E-04	2.44E-05	1.22E-08	1.50E-03	3.69E-05	1.85E-08	0.00%	0.00%
Technetium-99	99Tc	1.80E+02	5.00E-02	9.00E+00	1.80E-02	1.62E-01	8.10E-05	1.80E-03	1.62E-02	8.10E-06	0.02%	0.06%
Ruthenium-106	106Ru	7.24E-05	1.00E+00	7.24E-05	1.60E-02	1.16E-06	1.16E-06	2.20E-02	1.59E-06	1.59E-06	0.00%	0.00%
Cadmium-113 metas	113mCd	8.88E+01	1.00E-03	8.88E-02	1.00E-01	8.88E-03	4.44E-06	1.60E-01	1.42E-02	7.10E-06	0.02%	0.00%
Antimony-125	125Sb	3.98E+01	1.00E-03	3.98E-02	2.10E-02	8.36E-04	4.18E-07	3.70E-02	1.47E-03	7.36E-07	0.00%	0.00%
Tin-126	126Sn	3.04E+00	1.00E-03	3.04E-03	3.70E-02	1.12E-04	5.62E-08	4.60E-02	1.40E-04	6.99E-08	0.00%	0.00%
Iodine-129	129I	3.47E-01	1.00E+00	3.47E-01	7.60E-02	2.64E-02	2.64E-02	8.10E-03	2.81E-03	2.81E-03	0.00%	20.72%
Cesium-134	134Cs	2.09E-01	1.00E-03	2.09E-04	7.80E-02	1.63E-05	8.15E-09	1.00E-01	2.09E-05	1.05E-08	0.00%	0.00%
Cesium-137	137Cs	2.36E+04	1.00E-02	2.36E+02	1.90E-01	4.48E+01	2.24E-02	3.10E-01	7.32E+01	3.66E-02	99.47%	17.62%
Barium-137 metastat	137mBa	2.23E+04	1.00E-03	2.23E+01	8.60E-14	1.92E-12	9.59E-16	1.70E-12	3.79E-11	1.90E-14	0.00%	0.00%
Samarium-151	151Sm	1.68E+04	1.00E-03	1.68E+01	5.80E-04	9.74E-03	4.87E-06	9.50E-04	1.60E-02	7.98E-06	0.02%	0.00%
Europium-152	152Eu	3.96E+00	1.00E-03	3.96E-03	1.90E-01	7.52E-04	3.76E-07	3.40E-01	1.35E-03	6.73E-07	0.00%	0.00%
Europium-154	154Eu	9.65E+01	1.00E-03	9.65E-02	1.50E-01	1.45E-02	7.24E-06	2.80E-01	2.70E-02	1.35E-05	0.04%	0.01%
Europium-155	155Eu	7.95E+01	1.00E-03	7.95E-02	6.30E-03	5.01E-04	2.50E-07	1.10E-02	8.75E-04	4.37E-07	0.00%	0.00%
Radium-226	226Ra	2.25E-04	1.00E-03	2.25E-07	3.60E-01	8.10E-08	4.05E-11	2.90E-01	6.53E-08	3.26E-11	0.00%	0.00%
Actinium-227	227Ac	1.40E-03	1.00E-03	1.40E-06	1.10E+01	1.54E-05	7.70E-09	2.00E+01	2.80E-05	1.40E-08	0.00%	0.00%
Radium-228	228Ra	6.78E-02	1.00E-03	6.78E-05	1.50E-01	1.02E-05	5.09E-09	7.90E-02	5.36E-06	2.68E-09	0.00%	0.00%
Thorium-229	229Th	1.77E-03	1.00E-03	1.77E-06	1.20E+01	2.12E-05	1.06E-08	2.20E+01	3.89E-05	1.95E-08	0.00%	0.00%
Protactinium-231	231Pa	6.25E-03	1.00E-03	6.25E-06	8.90E+00	5.56E-05	2.78E-08	1.50E+01	9.38E-05	4.69E-08	0.00%	0.00%
Thorium-232	232Th	6.60E-03	1.00E-03	6.60E-06	7.20E+00	4.75E-05	2.38E-08	1.30E+01	8.58E-05	4.29E-08	0.00%	0.00%
Uranium-232	232U	1.03E-02	1.00E-03	1.03E-05	8.60E+00	8.86E-05	4.43E-08	1.50E+01	1.55E-04	7.73E-08	0.00%	0.00%
Uranium-233	233U	4.21E-02	1.00E-03	4.21E-05	2.40E+00	1.01E-04	5.05E-08	4.20E+00	1.77E-04	8.84E-08	0.00%	0.00%
Uranium-234	234U	3.73E-02	1.00E-03	3.73E-05	2.40E+00	8.95E-05	4.48E-08	4.20E+00	1.57E-04	7.83E-08	0.00%	0.00%
Uranium-235	235U	1.56E-03	1.00E-03	1.56E-06	2.30E+00	3.59E-06	1.79E-09	4.00E+00	6.24E-06	3.12E-09	0.00%	0.00%
Uranium-236	236U	9.91E-04	1.00E-03	9.91E-07	2.30E+00	2.28E-06	1.14E-09	3.90E+00	3.86E-06	1.93E-09	0.00%	0.00%

Table C-1. Demonstration Bulk Vitrification System (DBVS) Active Ventilation (continued)

Column		A	B	C	D	E	F	G	H	I	J	K
ANALYTE NAME	ANALYTE	Facility Inventory (Ci)	Release Fraction	Unabated Release (Ci)	Conversion Factor - 200W Offsite MPR (mrem/Ci)	Offsite Unabated Dose (mrem/yr)	Offsite Abated Dose (mrem/yr)	Conversion Factor - 200W Onsite MPR (mrem/Ci)	Onsite Unabated Dose (mrem/yr)	Onsite Abated Dose (mrem/yr)	Contribution to Onsite Unabated Dose %	Contribution to Offsite Abated Dose %
				C=A*B		E=C*D	F=E/Decon Factor		H=C*G	I=H/Decon Factor	J=H\Sum of H	K=F\Sum of F
Neptunium-237	237Np	6.69E-01	1.00E-03	6.69E-04	8.90E+00	5.95E-03	2.98E-06	1.60E+01	1.07E-02	5.35E-06	0.01%	0.00%
Plutonium-238	238Pu	1.48E-01	1.00E-03	1.48E-04	5.90E+00	8.73E-04	4.37E-07	1.00E+01	1.48E-03	7.40E-07	0.00%	0.00%
Uranium-238	238U	3.54E-02	1.00E-03	3.54E-05	2.10E+00	7.43E-05	3.72E-08	3.70E+00	1.31E-04	6.55E-08	0.00%	0.00%
Plutonium-239	239Pu	7.26E+00	1.00E-03	7.26E-03	6.40E+00	4.65E-02	2.32E-05	1.10E+01	7.99E-02	3.99E-05	0.11%	0.02%
Plutonium-240	240Pu	1.11E+00	1.00E-03	1.11E-03	6.40E+00	7.10E-03	3.55E-06	1.10E+01	1.22E-02	6.11E-06	0.02%	0.00%
Americium-241	241Am	4.82E+00	1.00E-03	4.82E-03	9.80E+00	4.72E-02	2.36E-05	1.70E+01	8.19E-02	4.10E-05	0.11%	0.02%
Plutonium-241	241Pu	6.91E+00	1.00E-03	6.91E-03	1.00E-01	6.91E-04	3.46E-07	1.60E-01	1.11E-03	5.53E-07	0.00%	0.00%
Curium-242	242Cm	9.18E-03	1.00E-03	9.18E-06	3.20E-01	2.94E-06	1.47E-09	5.70E-01	5.23E-06	2.62E-09	0.00%	0.00%
Plutonium-242	242Pu	4.90E-05	1.00E-03	4.90E-08	6.10E+00	2.99E-07	1.49E-10	1.00E+01	4.90E-07	2.45E-10	0.00%	0.00%
Americium-243	243Am	1.37E-04	1.00E-03	1.37E-07	9.80E+00	1.34E-06	6.71E-10	1.70E+01	2.33E-06	1.16E-09	0.00%	0.00%
Curium-243	243Cm	7.16E-04	1.00E-03	7.16E-07	6.60E+00	4.73E-06	2.36E-09	1.20E+01	8.59E-06	4.30E-09	0.00%	0.00%
Curium-244	244Cm	7.16E-03	1.00E-03	7.16E-06	5.20E+00	3.72E-05	1.86E-08	9.00E+00	6.44E-05	3.22E-08	0.00%	0.00%
					Totals	**4.60E+01**	**1.27E-01**		**7.35E+01**	**5.21E-02**	100.00%	100.00%
						Offsite	Offsite		Onsite	Onsite		

APPENDIX D

DOSE CALCULATIONS FOR SOIL EXCAVATION

Table D-1. Potential Unabated Emissions and Dose for Soil Excavation Activities (Hand Digging) for 200 West, 241-S-109

Area Disturbed	3	Acres (2 inch depth average - 25% of the area disturbed)
Maximum Soil Excavated	5445	Cubic feet
Soil Density	98	Pounds/Cubic Feet
Total Mass of Soil (TMS)	2.42E+08	Grams
Max Alpha Reading (MA)	20	Counts Per Minute (CPM) (e)
Max Beta/Gamma Reading (MB)	50,000	CPM (e)
Release Fraction (RF)	1.00E-03	

Assumed Isotope	Conversion Factor (pCi/gram)/cpm (a)	Possession Quantity Ci (b)	Unabated Release Ci	Offsite Annual Dose Factor mrem/Ci (c)	Onsite Annual Dose Factor mrem/Ci (c)	Unabated & Abated Dose mrem/yr (d)	Unabated & Abated Dose mrem/yr (d)	% Unabated Dose
				Offsite MPR	Onsite MPR	Offsite MPR	Onsite MPR	Offsite MPR
Column	B	C	D=C*RF	E	F	G=D*E	H=D*F	I=G/sumG
		C=B*TMS* MB(for Beta/Gamma)/1 E12 MA (for Alpha)/1E12						
Sr-90	0.35	4.24E+00	4.24E-03	1.10E-01	8.80E-02	4.66E-04	3.73E-04	40.89%
Am-141	14.20	6.87E-02	6.87E-05	9.80E+00	1.70E+01	6.74E-04	1.17E-03	59.11%
TOTAL		**4.30E+00**	**4.30E-03**			**1.14E-03**	**1.54E-03**	100.00%

Notes:

(a) HNF-2418, *Soil Contamination Standards for Protection of Personnel*, March 1998, P.D. Rittmann. Tables 1 and 4 based on 500 mrem/yr

(b) Weight of Soil * Field Instrument Reading* Conversion Factor

(c) HNF-3602, Rev 1, *Calculating Potential-to-Emit Releases and Doses for FEMPs and NOCs.*

(d) Unabated and abated values are the same because there is no emission control equipment during soil excavation

(e) per ALARACT 5: 200 dpm/cm^2 probe area alpha and 500,000 dpm/cm^2 probe area beta-gamma is converted to 20 cpm and 50,000 cpm; dpm=cpm*correction factor (10)

APPENDIX E

DOSE CALCULATION FOR VENTED CONTAINER DEMONSTRATION BULK VITRIFICATION SYSTEM STORAGE

Table E-1. Vented Container – DBVS Storage

VENTED CONTAINER STORAGE EMISSIONS - DBVS STORAGE PAD (200 West)

# of HEPAs (a)	2
HEPA Efficiency	99.97%
Alpha Emitter	Am-241
Beta Emitter	Cs-137
DF Factor (gas)	1

		Column		A	B	C	D	E	F	G	H	I
Analyte Name	Assumed Analyte (b)	Average Curie/ Container (Ci)	Containers/yr (c)	Estimated Inventory (Ci)	Release Fraction	Unabated Release (Ci/yr)	Conversion Factor - 200W Offsite MPR (mrem/Ci)	Offsite Unabated Dose (mrem/yr)	Offsite Abated Dose (mrem/yr)	Conversion Factor - 200W Onsite MPR (mrem/Ci)	Onsite Unabated Dose (mrem/yr)	Onsite Abated Dose (mrem/yr)
						C=A*B		E=C*D	F=E		H=C*G	I=H
Americium-241	Am-241	1.25	50	6.25E+01	1.00E-06	6.25E-05	9.80E+00	6.13E-04	6.13E-04	1.70E+01	1.06E-03	1.06E-03
Cesium-137	Cs-137	18.75	50	9.38E+02	1.00E-06	9.38E-04	1.90E-01	1.78E-04	1.78E-04	3.10E-01	2.91E-04	2.91E-04
							Totals	7.91E-04	7.91E-04		1.35E-03	1.35E-03
								Offsite	Offsite		Onsite	Onsite
											Contribution to Onsite Unabated Dose %	Contribution to Offsite Abated Dose %
											H\Sum of H	F\Sum of F
										Am-241	79%	77%
										Cs-137	21%	23%
											100.00%	100.00%

Notes:

(a) NucFil or equivalent

(b) It is assumed that Am-241 and Cs-137 are representative of the alpha and beta emitters w/average curies per container of 1.25 Ci of Am-241 and 18.75 Ci of Cs-137 (DOE-RL-2001-57, Rev 2)

(c) The DBVS Storage area has a maximum capacity of 50 waste containers

(d) Credit is not taken for HEPA filter; any potential release is in gas form

Attachment 2
04-ED-003

Hanford Site Air Operating Permit Notification of Off-Permit Change Permit Number: 00-05-006

HANFORD SITE AIR OPERATING PERMIT
Notification of Off-Permit Change

Permit Number: 00-05-006

This notification is provided to Washington State Department of Ecology, Washington State Department of Health, and the U.S. Environmental Protection Agency as notice of an off-permit change described as follows.

This change is allowed pursuant to WAC 173-401-724(1) as:

1. Change is not specifically addressed or prohibited by the permit terms and conditions
2. Change does not weaken the enforceability of the existing permit conditions
3. Change is not a Title I modification or a change subject to the acid rain requirements under Title IV of the FCAA
4. Change meets all applicable requirements and does not violate an existing permit term or condition
5. Change has complied with applicable preconstruction review requirements established pursuant to RCW 70.94.152.

Provide the following information pursuant to WAC-173-401-724(3):

Description of the change:	
Submittal of, RADIOACTIVE AIR EMISSIONS NOTICE OF CONSTRUCTION FOR THE SUPPLEMENTAL TREATMENT TEST AND DEMONSTRATION FACILITY. *This Notice of Construction application requests approval for construction and operation of a Supplemental Treatment Test and Demonstration Facility for bulk vitrification activities located in the 200 West Area of the Hanford Site. The bulk vitrification activities will process about 1,355,000 L (300,000 gal) of low-activity waste for Single-Shell Tank 241-S-109.*	
Date of Change: To be provided in the regulatory agency	
The date the approval order is issued by the Washington State Department of Health.	
Describe the emissions resulting from the change:	
Radioactive emissions that could potentially contribute to a hypothetical maximally exposed individual originate from soil excavation activities in potentially contaminated areas near the construction site (fugitive emissions), waste processing operations (point source), and waste container storage (passive emissions). Cesium-137 is the largest contributor to the Onsite unabated dose from waste processing operations. The estimated onsite abated dose to the maximally exposed individual is 5.50E-02 mrem/year.	
Describe the new applicable requirements that will apply as a result of the change: To be provided in the agency approval order.	
Conditions and limitations will be those identified in the approved order when issued by the Washington State Department of Health	
For Hanford Use Only:	
AOP Change Control Number:	Date Submitted:

U.S. Department of Energy
Office of River Protection
P.O. Box 450
Richland, Washington 99352

0061331

JAN 2 9 2004

04-ED-010

Mr. Michael A. Wilson, Program Manager
Nuclear Waste Program
State of Washington
Department of Ecology
1315 W. Fourth Avenue
Kennewick, Washington 99336

RECEIVED
FEB 1 9 2004
EDMC

Dear Mr. Wilson:

SUBMITTAL OF PERMIT DESIGN PACKAGE NO. HIGH-LEVEL WASTE (HLW) -038 FOR THE WASTE TREATMENT AND IMMOBILIZATION PLANT

Reference: WA7890008967, "Dangerous Waste Portion of the Hanford Facility Resource Conservation and Recovery Act Permit for the Treatment, Storage, and Disposal of Dangerous Waste, Chapter 10 and Attachment 51, 'Waste Treatment and Immobilization Plant.'"

This letter transmits Permit Design Package HLW-038, Revision 0"RLD and HCP Double Wall Pipe for HLW Facility El. -21 ft.," (Attachment 1) for the State of Washington Department of Ecology (Ecology) approval.

The attached HLW vitrification facility permit package provides the information necessary for Ecology to confirm that the structures, equipment, and processes described in the permit package will comply with the reference. This information will allow Ecology to permit the installation of tank system ancillary equipment for the HLW vitrification facility at elevation -21 ft.

A description of the permit design package (Attachment 2) and signed certification statements (Attachment 3) are also provided.

Due to the potential sensitivity of the attached engineering information, Ecology is requested to place the data for public review in the standard information repositories, but not provide electronic dissemination of the information.

JAN 2 9 2004

If you have any questions, please contact me, or your staff may contact Lori A. Huffman, Environmental Division, (509) 376-0104.

Sincerely,

Roy J. Schepens
Manager

ED:LAH

Attachments: (3)

cc w/attachs:
B. G. Erlandson, BNI
J. P. Henschel, BNI
J. Cox, CTUIR
S. Harris, CTUIR
S. L. Dahl, Ecology
K. Elsethagen, Ecology
J. L. Hensley, Ecology
S. J. Skurla, Ecology (22)
S. A. Thompson, FHI
P. Sobotta, NPT
J. B. Hebdon, RL (w/o attach)
A. C. McKarns, RL
R. Jim, YN
Administrative Record
Environmental Portal, LMSI