



U.S. Department of Energy

Office of River Protection

P.O. Box 450
Richland, Washington 99352

0061317

FEB 06 2004

04-ED-004

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

RECEIVED
FEB 18 2004
EDMC

Dear Mr. Wilson:

**APPROVAL OF NEW SOURCE REVIEW NOTICE OF CONSTRUCTION APPLICATION
FOR THE SUPPLEMENTAL TREATMENT TEST AND DEMONSTRATION FACILITY**

Attached for your review and approval are the "New Source Review Notice of Construction for the Supplemental Treatment Test and Demonstration Facility" (Attachment 1) and the "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 NO_x emissions that exceed the emissions threshold of two tons per year. If you have any questions, please contact me, or your staff may contact Dennis W. Bowser, Environmental Division, (509) 373-2566.

Sincerely,

For Roy J. Schepens
Manager

ED:DWB

Attachments: (2)

cc: See page 2

Mr. Michael A. Wilson
04-ED-004

-2-

FEB 06 2004

cc w/attachs:

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Attachment 1
04-ED-004

New Source Review Notice of Construction for the Supplemental
Treatment Test and Demonstration Facility

NEW SOURCE REVIEW 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

SUMMARY

The U.S. Department of Energy, Office of River Protection is proposing to conduct a Research, Development, and Demonstration bulk vitrification test program to treat mixed waste from single-shell Tank 241-S-109. The Demonstration Bulk Vitrification System (DBVS) will be located at the Test and Demonstration Facility west of the 241-S Tank Farm in the 200 West Area of the Hanford Site and 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) up to 54.4 m³ (1920 ft³). 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 by January 2005. 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. Research, Development, and Demonstration programs are authorized under the *Resource Conservation and Recovery Act of 1976*, United States Environmental Protection Agency Regulation 40 *Code of Federal Regulations* 270.65, and *Washington Administrative Code* 173-303-809.

This document evaluates the incoming waste stream of toxic air pollutants as identified in the Tank Waste Information Network System and finds that emissions of organic compounds from treatment of the waste stream would be below *Washington Administrative Code* regulations for small quantity emission rates and acceptable source impact levels would not be exceeded. Dispersion calculations of annual concentration of toxic air pollutants indicate that concentrations of these compounds at the Hanford Site boundary are within regulatory threshold limits.

In addition, this document evaluates the estimated emissions of particulate matter resulting from operations of the DBVS. Estimated emissions are below registration and reporting threshold levels of WAC 173-400-102.

Air emission calculations performed on the DBVS process result in emissions of oxides of nitrogen (NO_x) as being the criteria pollutant of concern. The DBVS requires high heat input to vitrify the waste mixture. High voltage electrical power will be applied to electrodes, vitrifying the waste mixture via resistive heating to produce an immobilized low-activity waste. Offgases from the DBVS are vented to an Offgas Treatment System.

In addition to NO_x emissions from the DBVS, a backup diesel generator rated at 1200KW (1600-hp) will contribute to NO_x emissions. The purpose of the generator is to provide backup electrical power to the DBVS melter if primary power is lost. However, diesel generator operation is anticipated primarily for testing purposes and routine maintenance.

In the event adequate electrical power is not available at the Test and Demonstration Facility, an onsite diesel-fired boiler rated at 3.4MM BTU/hr may be used for steam production to the mixer dryer. The onsite diesel-fired boiler would also contribute to NO_x emissions.

Calculated NOx emissions are expected to exceed the threshold exemption quantity of two tons/year. In accordance with WAC 173-400-100(2), this Notice of Construction application is being submitted for the installation and operation of the DBVS, a backup diesel generator rated at over 500 hp, and an onsite diesel-fired boiler. Calculated NOx emissions from the vitrification process, the backup diesel generator, and the diesel-fired boiler is approximately 8 tons of NOx per year.

NOx from the DBVS process will be controlled using selective catalytic reduction. This control technology is the most developed and widely used post-process NOx control technology. The DBVS use of selective catalytic reduction is considered the best available control technology for NOx in accordance with WAC 173-400.

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TERMS

ASIL	acceptable source impact level
CAS	Chemical Abstract Services
CEMS	Continuous Emissions Monitoring System
CFR	<i>Code of Federal Regulations</i>
cm ³	cubic centimeters
CO	carbon monoxide
cfm	cubic feet per minute
DBVS	Demonstration Bulk Vitrification System
DOE	U.S. Department of Energy
ft	feet
g	gram
HEPA	high-efficiency particulate air (filter)
HFFACO	<i>Hanford Federal Facility Agreement and Consent Order</i>
HCl	hydrochloric acid
hp	horsepower
hrs	hours
ICV [®]	in-container vitrification (licensed process)
IDF	Integrated Disposal Facility
ILAW	immobilized low-activity waste
KW	kilowatt
L	liter
LAW	low-activity waste
lbs	pounds
m	meters
m ³	cubic meter
mg	milligram
µg	micrograms
Na	Sodium
NOC	notice of construction
NOx	oxides of nitrogen
OGTS	Offgas treatment system
ORP	Office of River Protection
PM	particulate matter
PM ₁₀	particulate matter under 10 microns
ppm	parts per million
RD&D	Research, Development, and Demonstration
SCR	selective catalytic reduction
sec	second
SOx	oxides of sulfur
SQER	small quantity emission rate
SST	single-shell tank
TAP	toxic air pollutant
TWINS	Tank Waste Information Network System
VOC	volatile organic compound
WAC	<i>Washington Administrative Code</i>
WTP	Waste Treatment Plant
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 INTRODUCTION

This document serves as the New Source Review Notification of Construction (NOC) for the Research, Development, and Demonstration (RD&D) test program to treat mixed waste from single-shell Tank (SST) 241-S-109. The Demonstration Bulk Vitrification System (DBVS) is to be located at the Test and Demonstration Facility west of the 241-S Tank Farm in the 200 West Area of the Hanford Site. The RD&D program will evaluate the performance of the bulk vitrification of low-activity waste (LAW) in waste containers as a supplemental treatment technology supporting the Hanford Waste Treatment Plant (WTP) now under construction. The DBVS will be designed, constructed, and operated in two phases and will be a RD&D permitted activity under *Washington Administrative Code* (WAC) 173-303-809 and 40 *Code of Federal Regulations* (CFR) 270.65. This permit has a duration of one operating year (i.e., 365 days of actual waste processing) but can be extended for up to two additional one-year operating permit terms.

This NOC is submitted in accordance with WAC 173-400. Table 1 provides details on the location of Tank 241-S-109 and the approximate coordinates of areas where waste processing equipment will be located that are the subject of this notification.

Table 1. Emission Unit Covered by the
New Source Review Notice of Construction

Unit	Location	Geodetic Coordinates	
		Latitude	Longitude
Demonstration Bulk Vitrification System Process <ul style="list-style-type: none"> • Backup diesel generator • Diesel-fired boiler 	West of the 241-S Tank Farm, 200 West Area	*	*

* Specific Geodetic Coordinates of Hanford tank farm location has been purposely omitted for security purposes. Approximate location for DBVS subject to this NSR Notice of Construction can be seen on Figure 2.

The proposed action will receive a liquid salt solution waste stream from Tank 241-S-109. The waste will be mixed with glass formers (e.g., soil) and dried prior to processing (or treating) the retrieved waste by an in-container vitrification (ICV[®]) 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. Retrieval of waste from Tank 241-S-109 is being performed under a separate NOC. The scope of this NOC begins at the interface between tank retrieval operations and the DBVS waste receipt tank(s). The DBVS will be designed to process a 5 molar sodium (Na) solution waste feed at a rate of 9 L/min (2.4 gal/min).

The incoming DBVS waste stream will be mixed with glass forming additives (e.g., soil and graphite) and dried before being discharged to a waste container for vitrification by electrode resistive heating. Filled waste containers will be transferred to a temporary storage area within the Test and Demonstration Facility for the duration of the RD&D demonstration. The stored

containers will ultimately be transferred to and disposed of in the future Integrated Disposal Facility (IDF) or another permitted onsite facility in the 200 Area of the Hanford Site.

2.0 SCOPE

The scope of this document is to analyze the toxic air pollutant (TAP) data for Tank 241-S-109 as reported in the Tank Waste Information Network System (TWINS) and to calculate, using the maximum reported TAP concentration value, an offsite concentration based on a stack discharge flow rate. The calculated results are then compared to WAC 173-400 and 173-460 regulations for small quantity emission rate (SQER) and acceptable source impact level (ASIL) thresholds, respectively.

Also analyzed is the emission of criteria pollutants from the DBVS process created by electrode resistive heating, the expected emissions from the 1200 kilowatt (KW) (1600 horsepower [hp]) diesel generator, and a diesel-fired boiler. The criteria pollutant of concern is primarily NO_x. Emissions of particulate matter (PM) and particulate matter under 10 microns (PM₁₀) from off-loading soil storage piles, mixer/dryer operations, waste container filling, and melter operations are also calculated in addition to volatile organic compound (VOC) emissions.

3.0 BACKGROUND INFORMATION

The U.S. Department of Energy (DOE), Office of River Protection (ORP) and CH2M HILL Hanford Group, Inc. (CH2M HILL) have created aggressive initiatives to accelerate the closure of tank farms with SSTs containing mixed radioactive and dangerous waste at the Hanford Site. To meet the *Hanford Federal Facilities Agreement and Consent Order* (HFFACO) (Ecology et al. 1989) requirement for completing SST retrieval by 2018 and tank waste treatment by 2028 (Milestones 45-00 and 62-00), ORP is evaluating the supplemental treatment technology to support Waste Treatment Plant throughput to meet HFFACO milestones. An RD&D project using a DBVS as a supplemental technology to immobilize low-activity waste (LAW) from SST 241-S-109 is planned to provide data for waste form qualification and performance assessment in response to Milestones M-62-08 and M-62-11.

The RD&D project will evaluate the DBVS process as a suitable immobilization process. The DBVS will be used to evaluate the ability to produce immobilized LAW (ILAW) that is equivalent to or better than the WTP ILAW; the compatibility of the technology with actual tank waste; the safety, efficiency, and potential cost-effectiveness; and the feasibility for scale-up to full-scale application.

4.0 LOCATION

Tank 241-S-109 is located on the DOE Hanford Site, 241-S Tank Farm in the 200 West Area, Richland, Washington (Figure 1). The Test and Demonstration Facility will be located west of the 241-S Tank Farm (Figure 2). The DBVS is operated and managed by CH2M HILL for ORP under contract DE-AC06-99RL-14047.

5.0 WASTE PROCESSING SYSTEM

5.1 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 transfer line (HIHTL) or rigid piping with secondary containment. Commercial unit support systems include 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 a storage pad will be constructed for the vitrified waste containers.

The following sections contain additional information on DBVS activities to be conducted under this NOC application.

5.2 WASTE RETRIEVAL

The DBVS will receive a liquid salt solution waste stream from Tank 241-S-109 waste retrieval operations. Permitting of the waste retrieval activities up to the unit interface is outside the scope of this NOC application and is included in a separate NOC. Information on waste retrieval is provided solely to describe the interfaces between the Waste Retrieval System (WRS) activities and the DBVS.

The waste will be transferred from the waste retrieval operations using over-ground, double-contained piping to the DBVS. The waste composition received by the DBVS is, in general, referred to as a salt solution.

5.3 BULK VITRIFICATION SYSTEM PROCESS

In-container vitrification[®] is the process used for the DBVS 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 by vacuum transfer and distributed into a refractory-lined sealed 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 (and vitrified waste contents) will be allowed to cool and temporarily stored awaiting disposal at the IDF or an alternate approved onsite low-level burial ground or storage area.

The DBVS RD&D program will be operated in two phases. The Phase 1 DBVS 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 insulation materials) of up to 54.4 m³ (1920 ft³). Phase 1 is designed to provide waste form performance

data for the bulk vitrification technology to support *Hanford Federal Facility Agreement and Consent Order* (HFFACO) Milestone M-62-08 by January 2005. The containers will be temporarily stored at the DBVS and ultimately be transferred to the IDF or another permitted disposal or storage 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. In Phase 2 operations, additional waste storage capacity, increased process additive storage and handling capacity, and testing to determine optimum Offgas Treatment Systems (OGTS) will be evaluated.

5.3.1 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.

5.3.2 Waste Receipt

The DBVS receives LAW from Tank 241-S-109 into waste receipt 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 and storage. Up to 49 waste containers for a total of 50 containers will be produced in Phase 2. Multiple waste receipt 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 5.3.8).

5.3.3 Process Additives

The DBVS will receive soil, glass additives, container refractory sand, and other materials necessary to the 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 DBVS 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 salt cake or slurry. This waste simulant will be used for running system checkout and vitrification tests prior to treatment of actual waste and used as a filler material during Phase 1 and 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.

5.3.4 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. Emissions from the mixer/dryer will be routed to the OGTS.

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.

5.3.5 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. Actual provisions and operation of this containment have not yet been determined. The container will contain ports to obtain samples of the vitrified waste 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.

5.3.6 In-Container Vitrification

The waste mixture from the mixer/dryer will be placed into the vitrification container through ports in the sealed box lid. Simulants and glass formers will be added to fill the container. Electric power will be applied to the electrodes, vitrifying the container contents via resistive heating. Ambient air, filtered through a high-efficiency particulate air (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.

5.3.7 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.

5.3.8 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. A continuous emissions monitoring system (CEMS) will monitor emissions of radionuclides, and criteria pollutants (particulate matter, carbon monoxide (CO), oxides of nitrogen (NO_x), and oxides of sulfur (SO_x). The CEMS will be designed, installed, and operated in compliance with applicable portions of 40 CFR 60, Appendix B. 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 and storage
- Particulate emissions from process additive receipt, storage, and transfer (not including fugitive emissions from stockpiles)
- Particulate and gaseous emissions from mixer/dryer
- Particulate and gaseous emissions from waste container filling and vitrification
- Particulate emissions from waste container tophoff 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 management emissions, all system emissions will be routed to an OGTS prior to discharge to the atmosphere.

The major components of the DBVS OGTS 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)
- Packed tower scrubber (optional)
- Carbon filter
- Selective Catalytic Reduction Unit(s)
- Polishing Filter.

5.3.8.1 Process Additive Emissions Control. 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 baghouse system is returned to the appropriate additive storage area for reuse.

5.3.8.2 Mixer/Dryer Offgas Emissions Control. 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.

5.3.8.3 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 will be 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.

NOx treatment will be accomplished by use of a selective catalytic reduction (SCR) unit. More than one SCR unit may be used. 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. 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 and, upon reaching saturation, will be removed, sampled, and disposed.

5.3.8.4 Phase 2 Main Offgas Treatment System. Performance of the OGTS will be enhanced for Phase 2 to allow higher waste processing rates and to examine other NO_x 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 to allow the option of routing exhaust gases either through the SCR unit(s) or the tower scrubbers to determine the effect on both scrubbing efficiency and scrubber blowdown rates.

5.3.9 Immobilized Low-Activity Waste Storage

Packages of ILAW produced by the DBVS will be stored at the Test and Demonstration Facility until they are transferred to the IDF or another permitted onsite storage/disposal facility. The DBVS is an activity permitted under the *Resource Conservation and Recovery Act of 1976*.

6.0 METHODOLOGY OF COMPARISON CALCULATED EMISSIONS TO SQER AND ASIL THRESHOLDS

For calculation of dispersed offsite concentration of TAPs to members of the public, TAP vapor sample data from Tank 241-S-109, as reported in TWINS, was used for developing the pollutant source term. The maximum reported concentration was selected for the TAP Chemical Abstract Services (CAS) number for Tank 241-S-109 (Appendix A, Table A-1). A worst-case bounding tank pollutant source inventory was developed that contained the highest concentration of each constituent detected. Emission quantities were calculated based on the worst-case tank scenario using maximum values and represents a conservative approach. Estimated TAP emissions were reviewed against WAC 173-460-160 TAP SQERs and ASILs as shown in Appendix B.

Assumptions made in calculating emission quantities include:

- A maximum concentration of an organic constituent was selected for a worst-case inventory.

Basis: Selecting the maximum value of each identified organic constituent from vapor space data would provide a worst-case tank scenario. Emission calculations would, therefore, be based on a worst-case concentration and would provide a bounding calculation of emissions to the environment.

- The exhauster flow rate is 283 m³/min (10,000 cfm).

Basis: The exhauster has a designed flowrate of 10,000 cfm

- The OGTS will operate 24 hours per day for 365 days per year for a total of 8,760 hours.

Basis: This is very conservative but does represent the maximum run time for emissions calculations.

- The unit concentration factors from industrial source complex dispersion modeling were used for ground level releases for 24-hour average and annual average releases from the 200 West Area.

24-hour average concentration factor was 3.46 (200 West Area) $\mu\text{g}/\text{cm}^3/\text{g}/\text{sec}$; annual average was 0.0585 (200 West Area) $\mu\text{g}/\text{cm}^3/\text{g}/\text{sec}$.

Basis: These unit concentration factors are used by the tank farm contractor on the Hanford Site for air concentrations at site boundaries. Source: Memorandum to J.S. Hill from P.D. Rittman, "Unit Concentration Factors from ISC3," September 27, 1996 (DSI 1996).

- Organic chemicals in the waste stream received and treated at the DBVS contain the same concentrations as reported in TWINS for Tank 241-S-109

Basis: The waste stream is transferred directly from Tank 241-S-109 to the waste receipt tanks. It is reasonable to assume that the organic chemicals in the waste stream are similar.

6.1 CALCULATION RESULTS FOR TAPS

The Appendix B, Table B-1 worksheet shows the comparison of calculated concentration of TAPs to SQER and ASIL thresholds under active ventilation. Columns A through E list the chemical name, CAS number, TAP Class, SQER, and ASIL respectively, and are from WAC 173-460-080, -150, and -160. Column F is the maximum reported value (from column H of Appendix A) in mg/m^3 for the CAS number. Column G is the calculated result for pounds per hour (lbs/hr) discharged. Column H is the result for pounds per year (lbs/yr)(8,760 hrs/yr multiplied by lbs/hr from Column H). Column I is the result of a comparison of Column G lbs/hour or Column H lbs/year to the Column D SQER value noting either the calculated result is at or below the SQER. Column J is the result of a conversion from Column H lbs/yr to $\mu\text{g}/\text{m}^3$. Column K is the result of a comparison between Column J and Column E noting if the calculated value is below the ASIL threshold.

No sampling is required for nonradioactive air emissions because all contaminant emissions are below their respective SQERs or below their ASILs. Organic vapor analyzers, or other similar instruments for detecting fugitive organic emissions as part of the Hanford Industrial Hygiene program to monitor worker exposure, will be used to monitor for VOCs.

Although calculated TAPs are below SQER and ASIL thresholds, the DBVS use of SCR unit(s) in addition to an up-stream scrubber system is considered the best available control technology (T-BACT) for toxic air pollutants

6.2 CALCULATION RESULTS FOR PM/PM₁₀

Appendix C-1 is the calculation result of particulate matter (PM) and particulate matter under 10 microns (PM₁₀) from off loading the soil at the site. Appendix C-2 is the calculation result of particulate emissions from the soil storage pile at the site. Appendix C-3 is the calculation result of particulates from the mixer/dryer. Appendix C-4 is the calculation result of particulates from

the waste container fill station. Appendix C-5 is the calculation result of particulates from the melter. Appendix C-6 is a summary of the PM/PM₁₀ calculated emissions from all sources. Results show PM and PM₁₀ emissions for the DBVS are well within regulatory threshold limits of WAC 173-400-110(5)(d).

6.3 CALCULATION RESULTS FOR CRITERIA POLLUTANTS

Appendix D, Table D-1 shows the calculation results for the backup diesel generator run time and NOx emissions in tons/yr. Appendix D, Table D-2 shows the calculation results of NOx emissions from the diesel boilers. Appendix D, Table D-3 shows the calculation result of VOC emissions from the diesel tank storage. Appendix D, Table D-4 shows the calculation result of hydrochloric acid (HCl) emissions exiting the scrubber. Appendix D, Table D-5 shows the calculation result of NOx emissions from Phase 1 and Phase 2 DBVS activities. Phase 1 results in a total NOx emitted during the cycle as 0.08 tons/month. Phase 2 shows total monthly NOx emissions of 0.33 tons/month based on 4 cycles per month.

6.3.1 Explanation of NOx Emission Calculations

NOx emissions from waste vitrification were calculated using the vendor mass balance and NOx concentration data to calculate uncontrolled and controlled emission rates and scrubbing efficiency. Additional sources of NOx emissions are the 1200 KW (1600-hp) backup diesel generator, and the potential use of a 3.4 MM BTU/hr diesel-fired boiler. Assuming a 1200 KW (1600-hp) diesel engine and an 80% total system efficiency, generator NOx emissions were calculated assuming one 4-hr test monthly and one 8-hr system usage every three months. For Phases 1 and 2, the corresponding total operating hours are 20 and 80, respectively (Appendix D-1).

The boiler was assumed to be operated on a continuous basis, but with an equipment availability of 80%, resulting in 7,008 operating hours per year or 584 operating/hours per month. A 12-month total NOx emission quantity has been calculated for the initial year of operation, including Phase 1 operations, system changeover, and the start of Phase 2 operations. Emissions from generator testing/operation and boiler operation are included in this calculation (Appendix D-2).

Finally, the total NOx emissions from the 12-month Phase 2 operating period were calculated. This calculation covers the 12-month period of highest NOx emissions and serves as a "worst-case" 12-month total. Generator and boiler emissions are also included in this calculation, (Appendices D-5 and D-6). Cumulative 12-month total NOx emissions for Phase 2 operations were calculated to be 7.94 tons or about 8 tons.

6.3.2 Control of NOx Emissions

Criteria pollutants are regulated under WAC 173-400-110. In accordance with WAC 173-400, General Regulations For Air Pollution Sources, the permit applicant is to install and operate best available control technology (BACT). NOx from post-process operations is controlled by a scrubber system and selective catalytic reduction unit (Figure 4). The SCR technology is the most developed and widely used post-process NOx control technology with ammonia being the

most commonly used reagent (EPA 2000). The DBVS use of SCR in addition to an up-stream scrubber system is considered BACT for criteria pollutants.

7.0 REFERENCES

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WAC 173-400, "General Regulations for Air Pollution Sources," *Washington Administrative Code*, as amended.

WAC 173-460, "Controls for New Sources of Toxic Air Pollutants," *Washington Administrative Code*, as amended.

APPENDIX A
MAXIMUM REPORTED POLLUTANT FOR TANK 241-S-109

Table A-1. Maximum Reported Toxic Air Pollutants (TAP) for Tank 241-S-109

Column A	B	C	D	E	F	G	H	I
Toxic Air Pollutant	Molecular Weight	CAS #	TAP CLASS	SQER (A lbs/yr, B lbs/hr)	ASIL (ug/m ³)	Maximum Reported (ppbv)	Maximum Reported (mg/m ³)	S109 ppmv Max Value (a)
Ammonia	17.0306	7664-41-7	B	2.00	100	4.79E+04	H=G*B/24/1000 3.4E+01	4.79E+01

Note: Ammonia (reported as 47.9 ppmv) has been converted to ppbv

Conversions:

47.9 ppmv *1000ppbv/ppmv = 47900 ppbv

47900 ppbv*molecular weight/24/1000 = 34 mg/m³

Source: Tank Waste Inventory Network System (TWINS), <http://twinsweb.pnl.gov>, August 2003

APPENDIX B
EMISSION CALCULATIONS FOR
ACTIVE VENTILATION OF TANK 241-S-109

APPENDIX C
EMISSION CALCULATIONS FOR PARTICULATE MATTER

Table C-1. Emission Calculations for PM/PM₁₀ — Off-Loading Soil

Emission Factors from AP-42 11.19.1, Table 11.19.1-1	
Source	Factor PM (lb/ton)
Soil handling, transfer, and storage with wet scrubber ¹	0.0013
Assumed control efficiency for wet scrubber for PM	95%
Soil handling, transfer, and storage (uncontrolled)	0.026
Assume all PM is PM ₁₀	
Assumed PM & PM ₁₀ control efficiency for baghouse	99%
Assumed mass flow rate to each pit	1350 lb/hr
Assumed mass flow rate to baghouse	0.015 lb/hr

Emissions from Soil			Emission Rate - uncontrolled (lb/hr)			Calculation
P&ID #	Process	Unit ID	Mass flow rate (lb/hr)	PM	PM ₁₀	
A-SK-003	Soil Reception Pit	SRP-01 ¹	1350	0.018	0.018	Emission factor X mass flow rate/2000
	Soil Reception Pit	SRP-02 ¹	1350	0.018	0.018	Emission factor X mass flow rate/2000
	Dryer Soil Impingement Tank	SIT-01 ²	952	0.012	0.012	Emission factor X mass flow rate/2000
	Top-Off Soil Impingement Tank		220	0.003	0.003	Emission factor X mass flow rate/2000
	Baghouse		0.015	1.5E-04	1.5E-04	Mass flow rate X (100% - baghouse efficiency)

SRP-01 and 02 emissions are fugitive - they only occur in Phase II
 SIT-01 and Top-Off Soil Impingement Tank emissions to baghouse
 Baghouse emissions to Stack 2

Notes

1. Choke feed into hopper
2. One of three impingement tanks (SIT-01) active at a time

Table C-2. Emission Calculations for PM/PM₁₀ — Soil Storage Pile

AP-42 Emission Factors from AP-42 Chapter 13.2.4

k 0.35 Dimensionless particle size multiplier for <10 micrometers diameter
 U 12.4 Mean wind speed, meters/sec
 M 3 Material moisture content, percent by weight

Emission Factor 2.07E-03 lb/ton
 Calculation k X 0.0032 X ((U/5)^{1.3} / (M/2)^{1.4})

Emission Point Description	Stockpile Weight ¹ (tons)	Annual Operation (hrs/yr)	Maximum Daily PM ₁₀ Emission Rate (lb/hr)	Annual Avg. PM ₁₀ Emission Rate (ton/year)	
Soil Storage Pile	35	8760	0.0724	0.3170	Stockpile Weight X Emission Factor; Annual = lb/hr X Annual operation / 2000

Notes:

1. Approximate weight needed for vitrification of one (1) containerload of waste. Assume one containerload dumped into the storage pile per hour.

Table C-3. Emission Calculations for PM/PM₁₀ — Mixer/Dryer

Emission Factors from AP-42 11.7, Table 11.7-1

Source	Factor PM (lb/ton)
Dryer	2.3
Assume all PM is PM ₁₀	
Assumed efficiency of F-03	99%

Mass flow rate of waste to dryer	704 kg/hr	1548.8 lb/hr
Mass flow rate of soil to dryer	423 kg/hr	930.6 lb/hr
Mass flow rate of recycled dust to dryer	2.3 kg/hr	5.1 lb/hr
	1129.3 kg/hr	2484.46 lb/hr

Emissions from Dryer

P&ID #		Emission Rate - uncontrolled (lb/hr)			
P&ID #	Process	Unit ID	Mass flow rate (lb/hr)	PM	PM ₁₀
A-SK-003	Dryer	DRY-01	2484.46	2.86	2.86

Calculation:
Emission factor X mass flow rate/2000

Table C-4. Emission Calculations for PM/PM₁₀ — Waste Container Fill Station

For emissions from DRY-01 and from Refractory Sand in ICV Container Waste Fill Station
and for emissions from Container Top-off Station

Emission Factors from AP-42 11.19.1, Table 11.19.1-1

Source	Factor PM (lb/ton)
Sand handling, transfer, and storage with wet scrubber	0.0013
Assumed control efficiency for wet scrubber for PM	95%
Sand handling, transfer, and storage (uncontrolled)	0.026
Assume all PM is PM ₁₀	

For emissions from ICV Melt Station

Emission factor from AP-42 11.15, Table 11.15-1, Melting Furnace Container, Uncontrolled	1.4 lb/ton
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Emissions from ICV P&ID #	Process	Mass flow rate (lb/hr)	Emission Rate - uncontrolled (lb/hr)		Calculation
			PM	PM ₁₀	
A-SK-003	ICV Container Waste Fill Station ¹	1435	0.019	0.019	Emission factor X mass flow rate/2000
	ICV Melt Station ²	1435	1.005	1.005	Emission factor X mass flow rate/2000
	Container Top-off Station ³	220	0.003	0.003	Emission factor X mass flow rate/2000
	TOTAL ⁴		1.026	1.026	

Notes

1. Mass flow from DRY-01 - mass flow to F-03; Revised 1/23/04 per Dwg A-SK-003F (stream 3 + stream 5)
2. Same mass flow rate as ICV Container Waste Fill Station
3. Assume soil filled over 1 hr to 8 ft wide x 24 feet long x 7.5 feet deep and soil is 75 lb/ft³; Revised 1/23/04 per Dwg A-SK-003F (stream 3 + stream 5)
4. All emissions to treatment system - sintered metal filter

Table C-5. Emission Calculations for PM/PM₁₀ — Melter

Process	Emission Rate - uncontrolled (lb/hr)		Emission Rate - controlled (lb/hr)		Calculation
	PM	PM ₁₀	PM	PM ₁₀	
A-SK-004 ICV (all)	1.03	1.03	1.15E-08	1.15E-08	mass flow rate X [(1-control efficiency) for all components in use] mass flow rate X [(1-control efficiency) for all components in use]
Dryer	2.86	2.86	1.43E-04	1.43E-04	
TOTAL	3.88	3.88	1.43E-04	1.43E-04	

Treatment System Component Efficiencies ³			Stream Filtered ²	
Component	Efficiency	Notes	ICV (all)	Dryer
Sintered metal filter PM/PM ₁₀ removal efficiency	99.50%		X	
Quench PM/PM ₁₀ removal efficiency	10.00%		X	
Scrubber PM/PM ₁₀ removal efficiency	95.00%		X	
HEPA Filter PM/PM ₁₀ removal efficiency	99.95%		X	X
Carbon Filter PM/PM ₁₀ removal efficiency	0.00%		X	X
Packed Tower PM/PM ₁₀ removal efficiency	0.00%	Not Used		
SCR PM/PM ₁₀ removal efficiency	0.00%		X	X
Polishing Filter PM/PM ₁₀ removal efficiency	90.00%		X	X

Notes:

1. All PM emisissions are assumed to be PM₁₀
2. From Dwg A-SK-004F
3. From Table 4-2, RD&D permit application
4. System emissions to Stack 1

Table C-6. Emission Calculations for PM/PM₁₀ — Summary

Exhaust points	Total PM (lb/hr)	Total PM ₁₀ (lb/hr)
Stack 1 - Bulk Vitrification Process (App C-5)	0.0001	0.0001
Stack 2 - Soil Offloading (App C-1)	0.0002	0.0002
Fugitive - Soil Storage Pile (App C-2)	0.0724	0.0724
TOTAL	0.07266	0.07266

APPENDIX D
EMISSION CALCULATIONS FOR CRITERIA POLLUTANTS

**Table D-1. Emission Calculations — Criteria Pollutants
Diesel Generator Run-Time**

Pollutant	lb/hp-hr	lb/MMBTU
NOx	3.10E-02	4.41
CO	6.68E-03	0.95
SOx	2.05E-03	0.29
PM/PM ₁₀	2.20E-03	0.31
VOC	2.47E-03	0.35

Generator Size 1,200 KW
 Efficiency 75%
 Engine Size 1,600 HP

Operating Hours - Phase 1

4 hrs/month testing
 3 month operation
 8 hrs/startup
 1 startup for Phase 1
 20 hrs

	Monthly Test 4 hrs	Start 8 hrs	TOTAL (tons/yr)
NOx (tons)	0.099	0.198	0.496
CO (tons)	0.021	0.043	0.107
SOx (tons)	0.007	0.013	0.033
PM/PM ₁₀ (tons)	0.007	0.014	0.035
VOC (tons)	0.008	0.016	0.040

Operating Hours - Phase 2

4 hrs/month testing
 12 month operation
 8 hrs/startup
 4 startups for Phase 2
 80 hrs

Total Annual Hours	Monthly Test 4 hrs	Start 8 hrs	TOTAL (tons/yr)
NOx (tons)	0.099	0.198	1.984
CO (tons)	0.021	0.043	0.428
SOx (tons)	0.007	0.013	0.131
PM/PM ₁₀ (tons)	0.007	0.014	0.141
VOC (tons)	0.008	0.016	0.158

**Table D-2. Emission Calculation – Criteria Pollutants
Boiler Process Emissions**

Emission factors			
Pollutant	lb/1000 gal		
NOx	20.00		
CO	5.00		
Total SOx	0.72	Sulfur content =	0.5%
PM/PM ₁₀	2.00		
VOC	0.34		
Methane	0.22		
Boiler duty rating	1 MW		
	3,413,000 BTU/hr		
Fuel oil heating value	135,000 BTU/gal		
System efficiency	90%		
Fuel consumption	28.1 gal/hr	Boiler duty rating / Fuel oil heating value / System efficiency	
Operating schedule	7,008 hrs/yr		
	584 hrs/month		

Emissions

	lb/hr		tons/month	tons/yr
NOx	0.562	Emission factor X volumetric flow rate/1000	0.16	1.97
CO	0.140	Emission factor X volumetric flow rate/1000	0.04	0.49
SOx	0.020	Emission factor X volumetric flow rate/1000	0.01	0.07
PM/PM ₁₀	0.056	Emission factor X volumetric flow rate/1000	0.02	0.20
VOC	0.010	Emission factor X volumetric flow rate/1000	0.003	0.03
Methane	0.006	Emission factor X volumetric flow rate/1000	0.002	0.02

Table D-3. Emission Calculations — Volatile Organic Compounds

Utilizing method of calculation of emissions stated in AP-42 Document 7.0 *Liquid Storage Tanks*.

Generator Fuel Storage Tank

Diameter	5 ft			Standing Storage Loss		Working Loss	
Length Tnk	15 ft	TLA	512.4954 Deg. R	Ls	0.526624 lb/yr	Lw	0.325 lb/yr
De	9.774528 ft	DTv	15.81228 Deg. R	Vv	187.5949	Q	238.0952 bbl/yr
Height VS	2.5 ft	DPv	0.002599 psi	Wv	0.000248	Kn	30.16667 If Turnovers > 36
MW	130 lb/lbmol	DPb	0 psi	Ke	0.03103	Kn	1 If Turnovers < or = 36
Max Temp	518.57 Deg. R	Pa	14.7 psi	Ks	0.998611	Kp	1
Min Temp	503.57 Deg. R						
Taa	511.07 Deg. R			Total Loss	0.851624 lb/yr VOC		
Alpha	0.17 Paint Factor				0.000426 tons/yr VOC		
Tb	511.09 Deg. R						
I	1053 BTU/ft ² /day						
Pva	0.0105 psi						
R	10.731 psi ft ³ /lbmol Deg R.						
DTa	15 Dg. F & R						
B	8223.25 Deg. R						
Annual TP	10,000 Gal/Yr						
# Turnover	1 Turnover/Yr						

Boiler Fuel Storage Tank

Assume one month's fuel consumption in storage

Hourly fuel consumption	28.1 gal/hr
Operating hours/month	584 hrs
Fuel storage requirement	16,405 gal
	20,000 gal tank

Diameter	10 ft			Standing Storage Loss		Working Loss	
Height	35 ft	TLA	512.4954 Deg. R	Ls	46.87464 lb/yr	Lw	7.8 lb/yr
De	35 ft	DTv	15.81228 Deg. R	Vv	16836.96	Q	5714.286 bbl/yr
Height VS	17.5 ft	DPv	0.002599 psi	Wv	0.000248	Kn	2.666667 If Turnovers > 36
MW	130 lb/lbmol	DPb	0 psi	Ke	0.03103	Kn	1 If Turnovers < or = 36
Max Temp	518.57 Deg. R	Pa	14.7 psi	Ks	0.990355	Kp	1
Min Temp	503.57 Deg. R						
Taa	511.07 Deg. R			Total Loss	54.67464 lb/yr VOC		
Alpha	0.17 Paint Factor				0.027337 tons/yr VOC		
Tb	511.09 Deg. R						
I	1053 BTU/ft ² /day						
Pva	0.0105 psi						
R	10.731 psi ft ³ /lbmol Deg R.						
DTa	15 Dg. F & R						
B	8223.25 Deg. R						
Annual TP	240,000 Gal/Yr						
# Turnover	12 Turnover/Yr						

Notes: Assumed a vertical tank with a diameter of 10 feet and a height of 35 feet.

Table D-4. Emission Calculations — Hydrochloric Acid Exiting Scrubber

Scrubber Inlet (Stream 16)

PPM of HCl to scrubber	58 ppm	
Flowrate of stream to scrubber	969 acfm @	300 deg C
	29,859 scfh	572 deg F
Density of HCl	0.1024 lb/cu ft	
Mass flow rate of HCl to scrubber	10.64 lb/hr	

Scrubber Outlet (Stream 24)

PPM of HCl exiting scrubber	2 ppm	
Flowrate of stream exiting scrubber	616 acfm @	50 deg C
Flowrate of stream to scrubber	33,658 scfh	122 deg F
Density of HCl	0.1024 lb/cu ft	
Mass flow rate of HCl exiting scrubber	0.41 lb/hr	
Scrubber HCl efficiency	96.11%	

Notes: Data from Dwg A-SK-004F, dated 1/23/04

**Table D-5. Emission Calculations — NOx (Page 1 of 2)
Phase 1 and Phase 2 Treatment — 12-Month Total**

Scrubber Inlet (Stream 16)			
From PFD A-SK-001, -002			
PPM of NOx to scrubber from SMFs	73,186 ppm		
Flowrate of stream to scrubber	1,016 kg/hr		
	970 acfm @		300 deg C
	29,890 scfh		572 deg F
NO conversion factor (ppm to ug/m ³)	1,230		
Mass flow rate of NOx to scrubber	167.8 lb/hr		
Mass flow rate = ppm NOx X conversion factor X volumetric flow rate X unit conversions			
Units	= ppm X (ug/m ³)/ppm X ft ³ /hr X m ³ /ft ³ X lb/ug		
	= lb/hr		
Scrubber Outlet (Stream 24)			
PPM of NOx at scrubber outlet	49,077 ppm		
Flowrate of stream at scrubber outlet	1,042 kg/hr		
	616 acfm @		50 deg C
	33,658 scfh		122 deg F
NO conversion factor (ppm to ug/m ³)	1,230		
Mass flow rate of NOx at scrubber outlet	126.7 lb/hr		
Scrubber NOx efficiency	24.5%		
SCR Inlet (Stream 28)			
PPM of NOx to SCR	38,434 ppm		
Flowrate of stream to SCR	1,343 kg/hr		
	809 acfm @		75 deg C
	41,031 scfh		167 deg F
NO conversion factor (ppm to ug/m ³)	1,230		
Mass flow rate of NOx to SCR	121.0 lb/hr		
Stack Exhaust (Stream 32)			
PPM of NOx exiting stack	37 ppm		
Flowrate of stream to stack	17,413 kg/hr		
	9,747 acfm @		60 deg C
	516,591 scfh		140 deg F
NO conversion factor (ppm to ug/m ³)	1,230		
Mass flow rate of NOx to stack	1.5 lb/hr		
SCRr NOx efficiency	98.8%		
Total NOx removal efficiency	99.1%		
Phase 1 NOx Emissions			
Melt cycle duration	168 hrs		
Total NOx emitted during cycle	166 lb		
	0.08 tons		
Cycles/Month	1		
Total number of cycles including simulant testing	3		
Total NOx emitted monthly	0.08 tons/month		
Phase 2 NOx Emissions			
Total NOx emitted during cycle	166 lb		
	0.08 tons		
Cycles/Month	4		
Total NOx emitted	0.33 tons/month		

**Table D-5. Emission Calculations — NOx (Page 2 of 2)
Phase 1 and Phase 2 Treatment — 12-Month Total**

1st 12-Month Total (Including Backup Generator and Boiler)

Date		NOx emissions (tons)	NOx emissions (cumulative tons)
	(including generator test)	Oct-04 0.35	0.35
	(including generator test)	Nov-04 0.35	0.69
	(including generator test and start)	Dec-04 0.54	1.24
		Jan-05	
		Feb-05	system changeover for Phase 2
		Mar-05	operations
	(including generator test)	Apr-05 0.60	1.83
	(including generator test)	May-05 0.60	2.43
	(including generator test and start)	Jun-05 0.79	3.22
	(including generator test)	Jul-05 0.60	3.82
	(including generator test)	Aug-05 0.60	4.41
	(including generator test and start)	Sep-05 0.79	5.20

12-Month Total for Phase 2 Operations (Including Backup Generator and Boiler)

Date		NOx emissions (tons)	NOx emissions (cumulative tons)
	(including generator test)	Apr-05 0.60	0.60
	(including generator test)	May-05 0.60	1.19
	(including generator test and start)	Jun-05 0.79	1.98
	(including generator test)	Jul-05 0.60	2.58
	(including generator test)	Aug-05 0.60	3.17
	(including generator test and start)	Sep-05 0.79	3.97
	(including generator test)	Oct-05 0.60	4.56
	(including generator test)	Nov-05 0.60	5.16
	(including generator test and start)	Dec-05 0.79	5.95
	(including generator test)	Jan-06 0.60	6.55
	(including generator test)	Feb-06 0.60	7.14
	(including generator test and start)	Mar-06 0.79	7.94

Attachment 2

04-ED-004

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:	
<i>Submittal of APPROVAL OF NEW SOURCE REVIEW NOTICE OF CONSTRUCTION APPLICATION 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 along with a backup diesel generator and diesel-fired boiler, will emit NOx exceeding the threshold limit of two tons per year. The ventilation system will have abatement controls and monitoring devices and will operate at approximately 10,000 cubic feet per minute.</i>	
Date of Change: To be provided in the regulatory agency	
The date the approval order is issued by the Washington State Department of Ecology.	
Describe the emissions resulting from the change:	
Emissions of all Toxic Air Pollutants as defined in WAC 173-400 and 460 are calculated to be below their respective SQER and ASIL values. Criteria pollutant NOx exceeds the threshold limits of WAC 173-400-110. Expected NOx emissions will be approximately 8 tons per 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 Ecology	
For Hanford Use Only:	
AOP Change Control Number:	Date Submitted: