



U.S. Department of Energy
Office of River Protection

0075661

P.O. Box 450, MSIN H6-60
Richland, Washington 99352

JAN 18 2008

08-ESQ-015

Ms. Jane A. Hedges, Program Manager
Nuclear Waste Program
Washington State
Department of Ecology
3100 Port of Benton Blvd.
Richland, Washington 99354

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Dear Ms. Hedges:

REQUEST FOR APPROVAL OF REVISION TO THE NOTICE OF CONSTRUCTION (NOC)
AND APPROVAL ORDER FOR THE VENTILATION UPGRADES, 241-AY AND 241-AZ,
AND AMENDMENT TO HANFORD SITE AIR OPERATING PERMIT (AOP) FOR
EMISSION UNIT 200E P-296A042 AMMONIA EMISSION LIMIT

Reference: Ecology letter from R. Skinnerland to S. J. Olinger, ORP, "Ecology Review of
Emissions in Excess of Order 94-07," dated October 23, 2007.

0074221

The U.S. Department of Energy, Office of River Protection requests approval of the NOC revision (Attachment 1) for the 241-AY/AZ Tank primary ventilation (Emission Unit 200E P-296A042) and an amendment to AOP Number 00-55-006 (Attachment 2). This revision is being submitted, as required by the Washington State Department of Ecology, in response to the 2007 emission exceeding of ammonia from the emission point (Reference), in compliance with "Washington Administrative Code (WAC) 173-400-107, and the AOP."

The revised NOC includes a request for an amendment of the ammonia emission limit of 0.05 lbs/hr currently listed in the AOP, to accommodate increased ammonia emissions, and a construction activity for the removal and/or discontinuation of the use of the High-Efficiency Gas Absorber (HEGA) filter.

The waste capacity of the AY/AZ tanks will not be altered by activities under this NOC revision. Evaluation of recent sampling data indicates the source term contained in the tanks has changed since the last revision to this NOC, due to ongoing single-shell tank waste transfers. Specifically, although ammonia emissions have increased since the origination of this NOC, the anticipated levels are well within acceptable source impact levels of WAC 173-460 and will not injure the public or environment.

The activities proposed with this NOC revision, including discontinuation of the use of a HEGA filter, will not cause an increase in emissions above criteria thresholds nor greater than small-quantity emission rates and therefore, do not represent a significant modification to an existing emission unit.

Ms. Jane A. Hedges
08-ESQ-015

-2-

JAN 18 2008

If you have any questions, please contact me, or your staff may contact Dennis W. Bowser,
Office of Environmental Safety and Quality, (509) 373-2566.

Sincerely,



Shirley J. Olinger, Manager
Office of River Protection

ESQ:DWB

Attachments: (2)

cc w/attachs:

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5-2-4, #-09

Attachment 1
08-ESQ-015

Notice of Construction Revision for the 241-AY/AZ Tank Primary
Ventilation (Emission Unit 200E P-296A042)

CRITERIA AND TOXICS AIR EMISSIONS NOTICE OF CONSTRUCTION APPLICATION FOR OPERATION OF 241-AY AND 241-AZ TANK FARMS EXHAUSTER

Prepared By:
L. L. Penn

Date Published
January 2008



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Office of River Protection under Contract DE-AC27-99RL14047

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Criteria and Toxic Air Emissions Notice of Construction Application for Operation of 241-AY
and 241-AZ Tank Farms Exhauster

EXECUTIVE SUMMARY

This document serves as a notice of construction pursuant to the requirements of *Washington Administrative Code* 173-460-040, and as a request for approval to modify pursuant to Title 40, *Code of Federal Regulations*, Part 61.07, for operation of 296-A-42 exhauster in support of each of the following tanks; 241-AZ-101, 241-AZ-102, 241-AY-101 and 241-AY-102. It revises and supersedes *Notice of Construction for Ventilation Upgrades for 241-AY and 241-AZ Tank Farms Ventilation Upgrades*, March 1994, updating the source term, corresponding emissions estimates, toxic best available control technology analysis, amending ammonia emission limits and allowing for the removal and/or discontinuation of the use of the high-efficiency gas absorber filter currently installed on the ventilation system.

No new activities generating a change in potential emissions will take place. However, additional process knowledge and sampling activities conducted since approval of the original notice of construction indicate a need to update estimates to include newly identified analytes in the tanks. A contributing factor in determining potential toxic air pollutants and criteria pollutants from this system is the on-going effort to stage waste retrieved from single-shell tanks into double-shell tanks prior to treatment. Due to retrieval activities, waste from any of the single-shell tanks may be transferred to the 241-AY and 241-AZ tanks. In spite of this influence, the estimated emissions remain below Small Quantity Emission Rates, as identified in *Washington Administrative Code* 173-460-080, and dispersed emission concentrations remain below acceptable source impact levels as defined in *Washington Administrative Code* 173-460-150 and -160. No ambient air quality standard will be exceeded for any criteria pollutant.

Criteria and Toxic Air Emissions Notice of Construction Application for Operation of 241-AY
and 241-AZ Tank Farms Exhauster

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LIST OF TERMS

ABCASH	automated bar coding of air samples at Hanford
AERMOD	American Meteorological Society/U.S. Environmental Protection Agency Regulatory Model
ALARA	as low as reasonably achievable
ASIL	acceptable source impact levels
ASME	American Society of Mechanical Engineers
CAS	Chemical Abstracts Service
DST	double-shell tank
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
HEGA	high efficiency gas absorber
HEME	high-efficiency mist eliminator
HEPA	high-efficiency particulate air
NOC	notice of construction
ORP	U.S. Department of Energy, Office of River Protection
SEPA	<i>State Environmental Policy Act of 1971</i>
SQER	small quantity emission rate
SST	single-shell tank
TAP	toxic air pollutants
T-BACT	toxic best available control technology
TWINS	Tank Waste Inventory Network System
VOC	volatile organic compounds
WAC	<i>Washington Administrative Code</i>
WDOH	Washington State Department of Health

Units

cfm	cubic feet per minute
Ci	curie
ft.	feet
gal.	gallons
in.	inch(es)
ppm	parts per million

Criteria and Toxic Air Emissions Notice of Construction Application for Operation of 241-AY
and 241-AZ Tank Farms Exhauster

METRIC CONVERSION CHART

Into metric units			Out of metric units		
If you know	Multiply by	To get	If you know	Multiply by	To get
Length			Length		
inches	25.40	millimeters	millimeters	0.0393	inches
inches	2.54	centimeters	centimeters	0.393	inches
feet	0.3048	meters	meters	3.2808	feet
yards	0.914	meters	meters	1.09	yards
miles	1.609	kilometers	kilometers	0.62	miles
Area			Area		
square inches	6.4516	square centimeters	square centimeters	0.155	square inches
square feet	0.092	square meters	square meters	10.7639	square feet
square yards	0.836	square meters	square meters	1.20	square yards
square miles	2.59	square kilometers	square kilometers	0.39	square miles
acres	0.404	hectares	hectares	2.471	acres
Mass (weight)			Mass (weight)		
ounces	28.35	grams	grams	0.0352	ounces
pounds	0.453	kilograms	kilograms	2.2046	pounds
short ton	0.907	metric ton	metric ton	1.10	short ton
Volume			Volume		
fluid ounces	29.57	milliliters	milliliters	0.03	fluid ounces
quarts	0.95	liters	liters	1.057	quarts
gallons	3.79	liters	liters	0.26	gallons
cubic feet	0.03	cubic meters	cubic meters	35.3147	cubic feet
cubic yards	0.76456	cubic meters	cubic meters	1.308	cubic yards
Temperature			Temperature		
Fahrenheit	subtract 32 then multiply by 5/9ths	Celsius	Celsius	multiply by 9/5ths, then add 32	Fahrenheit
Energy			Energy		
kilowatt hour	3,412	British thermal unit	British thermal unit	0.000293	kilowatt hour
kilowatt	0.948	British thermal unit per second	British thermal unit per second	1.055	kilowatt
Force/Pressure			Force/Pressure		
pounds per square inch	6.895	kilopascals	kilopascals	0.14504	pounds per square inch

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

Criteria and Toxic Air Emissions Notice of Construction Application for Operation of 241-AY
and 241-AZ Tank Farms Exhauster

1.0 LOCATION

U.S. Department of Energy, Office of River Protection
Hanford Site,
200 East Area Tank Farms
Richland, Washington 99352

The 241-AY and 241-AZ Tank Farms are located south of AN Tank Farm in the 200 East Area, at the corner of Canton Avenue and Seventh Street. The geodetic coordinates for these tank farms are as follows:

Latitude: 46° 33' 18" N
Longitude: 119° 31' 01" W

The exhauster which ventilates these tanks is assigned stack number 296-A-42 and is listed in Air Operating Permit Number 00-05-006 under number 200E P-296A042-001

2.0 RESPONSIBLE MANAGER

Shirley J. Olinger, Manager
U.S. Department of Energy, Office of River Protection
P.O. Box 550
Richland, Washington 99352
(509) 376-6677

3.0 PROPOSED ACTIONS

The activities proposed by this notice of construction (NOC) are to operate the 296-A-42 Ventilation System in support of Tanks 241-AZ-101, 241-AZ-102, 241-AY-101, and 241-AY-102. Emissions from these tanks are ventilated through Exhauster 296-A-42. The waste capacity of the tanks will not be altered. Construction activities on the ventilation system in this application consist of the removal and/or discontinuation of the use of the high-efficiency gas absorber (HEGA) filter.

The activities proposed with this NOC revision will not cause an increase in emissions above criteria thresholds nor greater than small quantity emissions rates (SQER) and therefore, do not represent a significant modification to an existing emission unit. However, additional sampling data indicate the source term contained in the tanks has changed since the last revision to this NOC, due to ongoing single-shell tank (SST) waste transfers. Specifically, ammonia emissions have increased since the origination of this NOC. Therefore, an amendment is requested to encompass anticipated operating emission increases.

Criteria and Toxic Air Emissions Notice of Construction Application for Operation of 241-AY
and 241-AZ Tank Farms Exhauster

4.0 STATE ENVIRONMENTAL POLICY ACT

In accordance with *Washington Administrative Code (WAC) 197-11, State Environmental Policy Act of 1971*, the Washington State Department of Health (WDOH) has identified and adopted the following *National Environmental Protection Act (NEPA)* documentation as being appropriate for this proposal after independent review. These documents meet the agencies review needs for the current proposal:

- DOE/EIS-0212, "Safe Interim Storage of Hanford's Tank Waste Final Environmental Impact Statement"
- 60 FR 61687, "Record of Decision for Safe Interim Storage of Hanford Tank Wastes"
- DOE/EIS-0189, "Tank Waste Remediation System, Hanford Site, Richland, Washington, Final Environmental Impact Statement"
- 62 FR 8693, "Record of Decision for the Tank Waste Remediation System"

5.0 PROCESS DESCRIPTION

The 241-AZ-101, 241-AZ-102, 241-AY-101, and 241-AY-102 tanks are double-shell tanks (DST). The inner shell is constructed from heat-treated, stress relieved, steel. The outer shell is constructed of non stress-relieved steel. The two shells are separated by a 2.5-ft. annulus and contained inside a concrete shell. The tanks have a usable waste volume of approximately 1,000,000 gallons.

The 241 AY and 241 AZ tanks are part of a *Resource Conservation and Recovery Act of 1976* treatment, storage, and or disposal unit. The tanks contain mixed waste in the form of liquids or contained solids (suspended or settled). The contents in each of the four tanks could be mixed periodically to control gas entrapment in the settled solids, to control temperature, for chemical treatment, or for waste retrieval. Contained solids are mobilized, as required, as part of this process by hydraulic action of the mixer pumps or by use of air lift circulators in each of the tanks. Mobilization of contained solids normally occurs in a single tank in each farm at a time. During such activities, as well as during storage, the ventilation system maintains the vapor space in each tank below atmospheric pressure.

Mixer pumps are operated in a batch mode as needed to maintain waste uniformity during staging and to mix the waste for a period before and during transfer. As required by operational directives, mixer pumps will be operated until waste samples verify that adequate mixing has been achieved. Waste samples will be collected periodically. If dilution/conditioning is needed, the pH and temperature of the diluents will be adjusted by means of a caustic supply system.

Criteria and Toxic Air Emissions Notice of Construction Application for Operation of 241-AY and 241-AZ Tank Farms Exhauster

Once the waste is verified acceptable, the transfer lines will be preheated/flushed with water, and the waste transfer to the treatment facility will follow. After the transfer, the lines will be flushed again with water.

An application to modify all four tanks and associated equipment was previously submitted (DOE/ORP-2000-14, "Nonradioactive Air Emissions Notice of Construction Application for Installation and Operation of a Waste Retrieval System in Double Shell Tanks," July 2001) and approved, (DE00NWP-001R1) to allow for installation and operation of waste retrieval systems and equipment.

Construction activities on the ventilation system in this application consist of the removal and/or discontinuation of the use of the HEGA filter.

6.0 TANK VENTILATION AND EMISSIONS CONTROL SYSTEM

Inlet air for the AZ and AY tanks is provided through the inlet air filters. Air flow is from the tank to a glycol cooled recirculation system and to a common header. The common header is considered the emission source. The emission point is the 296-A-42 stack.

The recirculation system takes vapor from the tank, cools and condenses it to remove vapor and some entrained particulate, further removes moisture via a separator, and returns a portion of the cooled vapor to the tank. This provides cooling for the tank while reducing air emissions. Nominal flow rates in the recirculation system vary from 0 m³/sec. (bypassed) to 0.25 m³/sec. per tank, at standard temperature and pressure conditions.

When mixer pumps are operating in a tank, the 0.25 m³/sec. drawn from this tank may not be recirculated, but may be combined with the flow from the other tanks for a total discharge to the emissions control system flow range of 0.4 to 0.5 m³/sec. Numerous other combinations of discharge flow rates are possible but the combined annual average discharge flow rate to the emissions control system will not be greater than 0.5 m³/sec. During system upset conditions, such as an automatic shutdown of one exhaust train and start of the opposite train, discharge flow rates could reach 0.6 m³/sec. for several seconds. The combined flow is discharged to the emissions control system.

Air is exhausted from each tank independently through 10.5-in. diameter exhaust ducts. The ducts connect to a 55-ft. high stack. The exhaust station consists of two filtration subsystems and the stack. Either subsystem can collectively ventilate all the tanks together at a maximum flow rate of approximately 1,000 ft.³/min. (0.42 m³/sec.). Only one system operates at a time, while the other remains in standby as a backup. A schematic of the 241-AZ/AY Tank Farm Exhaust System is shown in Figure 1.

Currently each filtration subsystem consists of a condenser, high-efficiency mist eliminator, heater, and two high-efficiency particulate air (HEPA) filters in series with a gas adsorption unit between the HEPAs. Each HEPA filter is rated for 1,000 ft.³/min. and is equipped with fluid seals. The HEPAs are individually tested annually (per ASME N510) to a minimum efficiency

Criteria and Toxic Air Emissions Notice of Construction Application for Operation of 241-AY and 241-AZ Tank Farms Exhauster

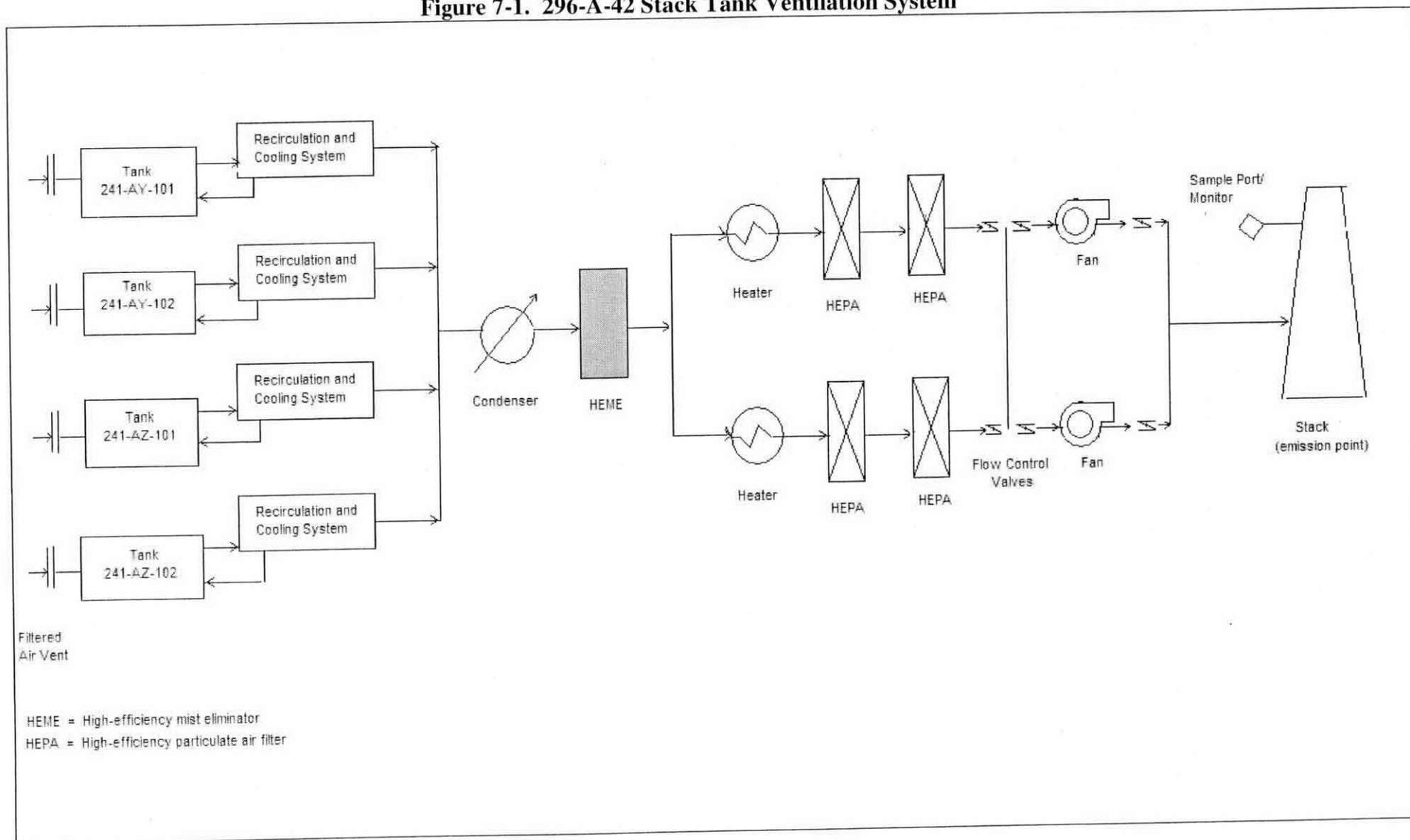
of 99.95 percent for the removal of particulates with a median diameter of 0.3 microns. For purposes of calculating abated particulate emissions, only the HEPA filter control efficiencies are used.

The only modification that will be made to the existing ventilation or emissions control systems under this NOC is the removal and/or discontinuation of the use of the HEGA filter. Previously, a HEGA filter was installed between the two HEPA filters as part of an upgrade program for the 296-A-42 ventilation system. It was installed to control potential Iodine emissions. Operating experience and sampling results since that time have demonstrated that iodine emissions are negligible. Appendix C presents the results of iodine sampling performed before and after installation of the HEGA filter. All values fell within a range of $10E-15\mu\text{Ci}$ to $10E-11\mu\text{Ci}$. The HEGA was not designed to effectively mitigate other emissions such as organics and ammonia. Utilization of the HEGA generates mixed waste and maintenance of this system is not considered as low as reasonably achievable (ALARA). Therefore, the existing the carbon beds will be removed from the housing allowing air to be drawn directly through both HEPA filters in the series.

7.0 DRAWINGS OF CONTROLS

Figure 7-1 is a schematic of the 296-A-42 Stack Tank Ventilation System.

Figure 7-1. 296-A-42 Stack Tank Ventilation System



8.0 SOURCE TERM AND RELEASE RATES

Source term input, derivations of release rates, and dispersion of pollutants are presented in table format in Appendix A. A comparison is made of emissions of individual pollutants with their SQERs. The dispersed concentrations at the site boundary are also compared to their acceptable source impact levels (ASIL). The input data sources, assumptions and methods of derivation are described in the following sections.

8.1 DATA SOURCES

Tank headspace and other sampling data used in determination of emissions from this facility were downloaded in December 2007 from the Tank Waste Information Network System 3 (TWINS) data base.

8.2 ASSUMPTIONS

Emissions from this facility were determined using the following assumptions:

1. Emissions from this facility may contain pollutants that reside in any and all other tank farms.
2. The mechanism for emissions begins with the generation of pollutants in the tank waste. The more volatile of these pollutants find their way into the headspace of the tanks. Once there, these pollutants either exit the tank headspace through an available pathway to the outside environment, remain in the tank headspace, or re-enter the tank waste. It is assumed that eventually a maximum tank headspace concentration is reached. When this occurs, a balance is reached between the quantity of pollutants entering the headspace and the quantity of pollutants exiting the headspace and out into the environment. At this point, the rate of emissions is based simply on the generation of pollutants in the tank waste.
3. It is acknowledged that if the vent rate is changed, the tank headspace equilibrium concentration would change for a period of time until another different equilibrium concentration was reached. It is assumed, however, after the new equilibrium state was reached, total emissions would remain the same as emissions were in the previous state.
4. Equilibrium emissions: It is assumed that equilibrium concentrations in the tank headspace can be found in passively ventilated SSTs. Ventilation flow-rates for passively ventilated tanks were estimated to be between 1 ft.³/min. and 9 ft.³/min., with 5 ft.³/min. considered the average, in HNF-SD-WM-TI-797, *Results of Vapor Space Monitoring of Flammable Gas Watch List Tanks*. As such, the average flow rate of 5 ft.³/min. was used for derivations of quiescent emissions.

Criteria and Toxic Air Emissions Notice of Construction Application for Operation of 241-AY and 241-AZ Tank Farms Exhauster

5. Emission from waste disturbing activities: Quiescent emissions were increased by a factor of 100 during waste retrieval activities to account for elevated emissions during waste disturbances. This factor was based on the observed elevation of emissions that occurred during the original sluicing of Tank 241-C-106 in November of 1998. Using a flame ionization detector (FID), emissions just prior to sluicing were noted to be approximately 15 parts per million (ppm). Just shortly after sluicing began, emissions rose to nearly 500 ppm. This represents an increase factor of 33 (500/15). Based upon this, it is assumed that use of this factor of 100 will bound any emissions from this facility during any activity. Use of this factor in subsequent derivations for Tanks 241-S-102 and 241-S-112 has been shown to be conservative.
6. At times during any given year, no waste disturbing activities will take place; but periodically waste disturbing activities may occur in one or more tanks. Therefore, a conservative assumption was made that at any given time throughout the year at least one of the 4 tanks in these farms would be undergoing waste disturbing activities.
7. An analysis of dispersed concentrations at the site boundary was performed for flow rates from 500 ft.³/min. to 2,000 ft.³/min. and heights of 17 ft. and 28 ft. using AERMOD (American Meteorological Society/U.S. Environmental Protection Agency Regulatory Model). It is assumed that the maximum of these resulting factors is bounding for the A-42 stack with a flow rate of 1,000 ft.³/min. and height of 55 ft.

8.3 EMISSION ESTIMATE METHODOLOGY

The average concentration of pollutants identified from TWINS was used to derive quiescent emissions per tank at an estimated 5 ft.³/min. SST generation rate. This emission rate was next multiplied by the factor of 100 to account for waste disturbing activities.

In addition to headspace sampling, some pollutants, such as N-Nitrosodi-n-butylamine (CAS # 924-16-3), were identified via stack sampling during retrieval activities. It was measured in the stack of the tank being retrieved at a flow rate of 1,000 ft.³/min. To use the retrieval stack data, the concentrations of these pollutants were converted to emissions that might occur in the tank's headspace during active waste disturbing periods. This was accomplished by first calculating a dispersed concentration at the site boundary using a dispersion factor from AERMOD. This result was converted to an assumed headspace concentration by dividing by a factor containing the flowrate and appropriate unit conversions. (These compounds are identified in Appendix A). Using this concentration as a source term, emissions were then estimated in accordance with the method used for all the other pollutants.

With the assumption that at least one tank would be undergoing waste disturbing activities, pollutant emissions derived for quiescent emissions was multiplied by 3 (tanks) and the pollutant emissions derived for waste disturbing activities was added to this to determine the total for this farm.

Emissions were estimated in units of grams per second to accommodate conversion to an off site concentration, which would result from application of an appropriate dispersion factor. These

Criteria and Toxic Air Emissions Notice of Construction Application for Operation of 241-AY and 241-AZ Tank Farms Exhauster

emission rates were further converted to units of pounds per hour and pounds per year. These various units were necessary to establish regulatory comparisons for Class A and B toxic air pollutants (TAP). The comparisons were made for the SQERs), as defined in WAC 173-460-080, as well as the ASILs, as defined in WAC 173-460-150 and -160.

As a special note, cyanide emissions were estimate by converting all the cyanides found in the tanks to-date as "Cyanides, as CN". In WAC 173-460-160, the entry for cyanides is "Cyanides, as CN". This means their concentrations must be adjusted for the molecular weights of CN and the actual species. For example, since CN has a molecular weight of 26 g/mol and acetonitrile (a cyanide specie) has a molecular weight of 41 g/mol, the concentration of CN associated with $1.68\text{E-}2 \text{ mg/m}^3$ of acetonitrile is $(26/41)*1.68\text{E-}2 = 1.1\text{E-}2 \text{ mg/m}^3$. If there were more than one species, then this calculation would be performed for each one. The final result for "Cyanides as CN" is the summation of these calculations.

8.4 TOXIC AIR POLLUTANT EMISSION ESTIMATE

The calculated ammonia emissions resulted in 3,000 lbs per year. The total of the calculated non-ammonia TAPs resulted in 950 lbs per year. No individual TAP is expected to exceed its respective ASIL.

The term "ASIL" is defined in WAC 173-460-020(2) as a concentration of a toxic air pollutant in the outdoor atmosphere in any area, which does not have restricted or controlled access, that is used to evaluate the air quality impacts of a single source. There are three types of ASILs: risk-based, threshold-based, and special. Computations of these types of ASILs are explained in WAC 173-460-110. Most Class A TAPs are listed with ASILs in terms of $\mu\text{g/m}^3$ on an annual average. Some Class A TAPs are listed with ASILs in terms of $\mu\text{g/m}^3$ with special 24-hour averaging times. Most Class B TAPs are listed with ASILs in terms of $\mu\text{g/m}^3$ with 24-hour averaging times.

The Class A compound 1,2 Dichloropropane (CAS # 78-87-2) does not have an SQER but does have an ASIL with a special averaging time of 24 hours. For conservatism, the 24-hour averaging ASIL value was assumed as an annual ASIL to arrive at an SQER of 500 pounds per year.

Several other TAPs identified in the tank farms do not have ASIL values listed in the regulations. However, Ecology, in transmittal of approval conditions for the *Criteria & Toxics Air Emissions Notice of Construction Application for Operations of Waste Retrieval Systems in Single-Shell Tank Farms*, and in accordance with WAC 173-460-110(3)(a) has assigned annual average screening levels for these TAPs. These screening levels are utilized in the same manner as ASILs. The screening levels are provided in Table 8-1 below.

Criteria and Toxic Air Emissions Notice of Construction Application for Operation of 241-AY and 241-AZ Tank Farms Exhauster

Table 8-1. Ecology Assigned Screening Levels

Toxic Air Pollutant	CAS #	TAP CLASS	ASIL (ug/m3)	Averaging Time
N-Nitrosomethylethylamine	10595-95-6	AI	2.00E-04	Annual
N-Nitrosomorpholine	59-89-2	AI	5.30E-04	Annual
N-Nitrosodi-n-propylamine	621-64-1	AI	5.00E-04	Annual
Propionaldehyde	123-38-6	B	160	24-Hour
Carbonyl sulfide	463-58-1	B	19	24-Hour
Acetophenone	98-86-2	B	350	24-Hour

These screening levels were incorporated in the calculations in Appendix A. Emissions are not expected to exceed any identified SQERs nor screening levels.

8.5 VOLATILE ORGANIC COMPOUND EMISSION ESTIMATE

Volatile organic compound (VOC) emissions were estimated using TWINS data titled “Summation of SUMMA organic vapors” and “Summation of Triple Sorbent Trap organic vapors”. This data was averaged and the emission estimate was then derived in a manner consistent with the TAPs emissions estimates. The result was that VOC emissions were estimated to be about 711 pound per year. Average emissions were seen to be about 43 mg/m³. Using the methodology discussed in Section 8.3, emissions were estimated as follows:

$$43 \frac{mg}{m^3} \times 5 \frac{ft^3}{min} \times 0.028 \frac{m^3}{ft^3} \times \frac{lbs}{454g} \times \frac{g}{1000mg} \times \frac{60 min}{hr} \times \frac{8,760hr}{yr} \times (100 + 3) = 711 \frac{lbs}{yr}$$

Thus, emissions of VOCs are not expected to exceed the 2 ton per year threshold, as defined in WAC 173-400-110(5)(d), “General Regulations for Air Pollution Sources.”

8.6 DISPERSION MODELING METHODOLOGY

An analysis of the dispersed concentration at the site boundary was performed using AERMOD, as required by the U.S. Environmental Protection Agency (EPA). Concentration factors for 24-hour and annual average releases from the 200 East area were developed. Averages are based on Hanford Site wind data collected from 2000 through 2005. The input files and resulting factors are as follows:

Table 8-2. AERMOD Dispersion Model

<u>Source Name</u>	<u>Description</u>	<u>24 Hr Max</u>	<u>Annual Max</u>	<u>Location</u>
E10_2000	2000 cfm, 10" dia., 28' release height	1.10331	0.05182	15 km east
E6_1000	1000 cfm, 6" dia., 17' release height	1.3288	0.05548	15 km east
E6_500	500 cfm, 6" dia., 17' release height	1.81318	0.05979	15 km east

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The resulting maximum factors for East Area of 0.05979 were applied to stack emissions to estimate the annual average contaminant concentrations and 1.81318 for a 24-hour average concentration at the Hanford Site boundary. These factors were multiplied by the emissions in g/s. The results give pollutant concentrations at the site boundary in micrograms per cubic meter. The location on the site boundary for the East Area with the highest potential impact was determined to be 15 kilometers (9.3 miles) in the east direction.

TAPs emissions estimates are presented in Table 2 of Appendix B. Emissions of TAPs, as defined in WAC 173-460, are expected to be below the SQERs, as defined in WAC 173-460-080, as well as the ASIL, as defined in WAC 173-460-150 and -160.

9.0 MONITORING DURING OPERATIONS

No sampling is proposed for TAPs or criteria pollutant emissions because all contaminant emissions are below their respective SQERs at the point of emission, and all dispersed contaminant concentrations are below their respective ASILs.

10.0 TOXIC BEST AVAILABLE CONTROL TECHNOLOGY ANALYSIS

A toxic best available control technology (T-BACT) assessment, conducted for SSTs, is presented in Appendix B of this application. It is applicable because the calculated potential emissions from 296-A-42 are bounded by those considered in the development of this T-BACT. The SST T-BACT was based upon ammonia estimates of 6.5 tons per year and non-ammonia TAPs of 1,895 lbs. per year. By comparison, the potential ammonia emissions are 1.5 tons and potential non-ammonia TAP emissions are 950 lbs. from the A-42 stack.

Guidance provided by Washington State Department of Ecology (Ecology) and the EPA for the process to determine best available control technology was followed. Some of the technology options were eliminated from further consideration because of technical infeasibility. The remaining options, adsorption, catalytic oxidation, thermal oxidation and bio-filtration technologies were considered for their capacities to reduce ammonia and non-ammonia TAP compound emissions from the tank farms during retrieval activities. The conclusion of this analysis was that none of the available technologies were economically justifiable per Ecology guidelines as T-BACT. Consequently, T-BACT is proposed to be operation of the standard exhauster configuration (condenser, high-efficiency mist eliminator (HEME), preheater, HEPA filters, fan, stack with monitoring instrumentation).

As part of an upgrade program for the 296-A-42 ventilation system, a Flanders® HEGA filter (24X24X16-in Type-IV (V-bed) stainless steel adsorber, Model AG-GG16-62-NS), was installed between the two HEPA filters. Its purpose was to control potential iodine emissions. Operating experience and sampling results since that time have demonstrated that iodine emissions are

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negligible. Appendix C presents the results of iodine sampling performed before and after installation of the HEGA filter. All values fell within a range of $10\text{E}-15\mu\text{Ci}$ to $10\text{E}-11\mu\text{Ci}$. In accordance with WAC 246-247, this level does not warrant abatement control or monitoring.

Designed as a nuclear grade HEGA, this filter has a very limited capacity to mitigate ammonia and volatile organic compounds. The adsorptive capacity of the carbon bed is approximately 50 percent of its own weight (86 lbs), which means it could adsorb no more than 43 lbs. At that point, it would adsorb no more and could, in fact, begin to desorb some contaminants.

The calculations of potential emissions performed in Section 8.0 indicate the VOC emissions could be 711 lbs/yr and ammonia could be 3,000 lbs/yr.

$$711 \text{ lbs/yr VOCs} = 1.95 \text{ lbs/dy} = 0.08 \text{ lbs/hr}$$

$$3,000 \text{ lbs/yr NH}_3 = 8.22 \text{ lbs/dy} = 0.34 \text{ lbs/hr}$$

This is a combined total of 10.17 lbs/dy

$$43 \text{ lbs divided by } 10.16 \text{ lbs/dy} = 4.2 \text{ days to load-up}$$

$$1.95 \text{ lbs/dy} \times 4.2 \text{ days} = 8.19 \text{ lbs VOCs (or } 1.2\% \text{ of the total) per change-out}$$

$$8.22 \text{ lbs/dy} \times 4.2 \text{ days} = 34.52 \text{ lbs NH}_3 \text{ (again } 1.1\% \text{ of the total) per change-out}$$

This represents just over 1 % mitigation if changed out once per year.

Utilization of the HEGA generates mixed waste and maintenance of this system is not considered ALARA for personnel. Therefore, it is proposed that the existing carbon beds be removed from the housing, allowing the ventilation stream to travel directly through both HEPA filters in the series.

11.0 DURATION OR LIFETIME

This system is expected to operate until completion of the waste retrieval and processing, which is currently scheduled for 2049.

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12.0 REFERENCES

- 00-05-006, 2001, Hanford Air Operating Permit, Washington State Department of Ecology, Olympia, Washington.
- 40 CFR 61, "National Emission Standards for Hazardous Air Pollutant." *Code of Federal Regulations*, as amended.
- 60 FR 61687, "Record of Decision for Safe Interim Storage of Hanford Tank Waste."
- 62 FR 8693, "Record of Decision for Tank Waste Remediation System."
- ANSI/ASME N510, 1995, Testing of Nuclear Air Treatment Systems, American National Standards Institute, New York, New York.
- 04-ED-063, Criteria & Toxics Air Emissions Notice of Construction Application for Operations of Waste Retrieval Systems in Single-Shell Tank Farms, July 2004.
- DOE/ORP-2000-14, Nonradioactive Air Emissions Notice of Construction Application for Installation and Operation of a Waste Retrieval System in Double Shell Tanks, July 2001.
- DOE/EIS-0189, Tank Waste Remediation System, Hanford Site, Richland Washington, Final Environmental Impact Statement, U.S. Department of Energy, Washington, D.C.
- DOE/EIS-0212, Safe Interim Storage of Hanford's Tank Waste Final Environmental Impact Statement, U.S. Department of Energy, Washington, D.C.
- HNF-SD-WM-TI-797, Results of Vapor Space Monitoring of Flammable Gas Watch List Tanks
- RPP-20773, 2004, *Evaluation of Best Available Control Technology for Toxics (T-BACT), Waste Retrieval System Operations in Single Shell Tank Farms*, CH2MHILL Hanford Group, Inc., Richland, WA.
- 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.
- WAC 197-11, "SEPA Rules," *Washington Administrative Code*, as amended.
- WAC 246-247 "Radiation Protection – Air Emissions," *Washington Administrative Code*, as amended.

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APPENDIX A

Criteria and Toxic Air Emissions Notice of Construction Application for Operation of 241-AY and 241-AZ Tank Farms Exhauster

Appendix A. 241-AZ TANK FARM

Toxic Air Pollutant	CAS # [1]	TAP CLASS	Average From TWINS mg/m ³	Emission (lbs/hr)	Emission (lbs/yr)	SQER (A lbs/yr, B lbs/hr)	Farm Emissions divided by SQER [2]	Dispersed - 24hr (ug/m3)	Dispersed - Annual (ug/m3)	ASIL (ug/m3)	Farm Dispersed Emissions divided by ASIL [3]
N-Nitrosomethylethylamine [4]	10595-95-6	AI	2.8E-04	5.3E-07	4.6E-03			1.2E-07	4.0E-09	2.00E-04	2.0E-05
N-Nitrosomorpholine [4]	59-89-2	AI	4.6E-02	8.7E-05	7.6E-01			2.0E-05	6.6E-07	5.30E-04	1.2E-03
N-Nitrosodi-n-propylamine [4]	621-64-1	AI	5.3E-05	1.0E-07	8.9E-04			2.3E-08	7.6E-10	5.00E-04	1.5E-06
1,4-Dichlorobenzene	106-46-7	AI, AII	8.4E-03	1.6E-05	1.4E-01	500	2.8E-04	3.7E-06	1.2E-07	1.5	8.1E-08
1,3-Butadiene	106-99-0	AI, AII	2.1E-02	4.09E-05	3.6E-01	0.5	7.2E-01	9.6E-06	3.1E-07	0.0036	8.6E-05
1,2-Dichloroethane (ethylene chloride)	107-06-2	AI, AII	4.9E-02	9.3E-05	8.2E-01	10	8.2E-02	2.1E-05	7.0E-07	0.038	1.9E-05
Acrylonitrile	107-13-1	AI, AII	5.6E-03	1.1E-05	9.3E-02	10	9.3E-03	2.4E-06	8.0E-08	0.015	5.3E-06
Bis(2-ethylhexyl)phthalate (DEHP)	117-81-7	AI, AII	4.6E-03	8.7E-06	7.6E-02	500	1.5E-04	2.0E-06	6.6E-08	2.5	2.6E-08
1,4-Dioxane	123-91-1	AI, AII	9.4E-02	1.8E-04	1.6E+00	10	1.6E-01	4.1E-05	1.3E-06	0.032	4.2E-05
Perchloroethylene (tetrachloroethylene)	127-18-4	AI, AII	5.3E-02	1.0E-04	8.8E-01	500	1.8E-03	2.3E-05	7.6E-07	1.1	6.9E-07
Polychlorinated Biphenyls (PCBs)	1336-36-3	AI, AII	1.4E-02	2.7E-05	2.3E-01	0.5	4.7E-01	6.1E-06	2.0E-07	0.0045	4.4E-05
Formaldehyde	50-00-0	AI, AII	1.9E-02	3.7E-05	3.2E-01	20	1.6E-02	8.5E-06	2.8E-07	7.7E-02	3.6E-06
Carbon tetrachloride	56-23-5	AI, AII	2.2E-01	4.1E-04	3.6E+00	20	1.8E-01	9.4E-05	3.1E-06	0.067	4.6E-05
N-Nitrosodimethylamine	62-75-9	AI, AII	1.2E-01	2.4E-04	2.1E+00			5.4E-05	1.8E-06	7.1E-05	2.5E-02
Chloroform	67-66-3	AI, AII	1.9E-02	3.6E-05	3.1E-01	10	3.1E-02	8.2E-06	2.7E-07	0.043	6.3E-06
Benzene	71-43-2	AI, AII	8.2E-02	1.6E-04	1.4E+00	20	6.8E-02	3.6E-05	1.2E-06	0.12	9.8E-06
Cadmium	7440-43-9	AI, AII	3.8E-03	7.2E-06	6.3E-02			1.7E-06	5.4E-08	5.6E-04	9.7E-05
Vinyl chloride	75-01-4	AI, AII	2.6E-02	4.9E-05	4.3E-01	10	4.3E-02	1.1E-05	3.7E-07	0.012	3.1E-05
Acetaldehyde	75-07-0	AI, AII	6.9E-01	1.3E-03	1.1E+01	50	2.3E-01	3.0E-04	9.8E-06	0.45	2.2E-05
Dichloromethane (methylene chloride)	75-09-2	AI, AII	3.5E-01	6.6E-04	5.8E+00	50	1.2E-01	1.5E-04	5.0E-06	0.56	8.9E-06
Trichloroethylene	79-01-6	AI, AII	4.2E-02	8.0E-05	7.0E-01	50	1.4E-02	1.8E-05	6.1E-07	0.59	1.0E-06
N-Nitrosodi-n-butylamine	924-16-3	AI, AII	9.2E-03	1.8E-05	1.5E-01			4.0E-06	1.3E-07	6.30E-04	2.1E-04
1,2-Dichloropropane	78-87-5	AI, AIII	2.6E-02	4.9E-05	4.3E-01	[5]	8.6E-04	1.1E-05	3.7E-07	4.0	2.8E-06
p-Nitrochlorobenzene	100-00-5	B	4.9E-03	9.3E-06	8.2E-02	0.02	4.7E-04	2.1E-06	7.0E-08	2.0	1.1E-06
Ethyl benzene	100-41-4	B	6.7E-02	1.3E-04	1.1E+00	5	2.6E-05	2.9E-05	9.7E-07	1,000	2.9E-08

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Toxic Air Pollutant	CAS # [1]	TAP CLASS	Average From TWINS mg/m ³	Emission (lbs/hr)	Emission (lbs/yr)	SQER (A lbs/yr, B lbs/hr)	Farm Emissions divided by SQER [2]	Dispersed - 24hr (ug/m3)	Dispersed - Annual (ug/m3)	ASIL (ug/m3)	Farm Dispersed Emissions divided by ASIL [3]
Styrene	100-42-5	B	1.1E-01	2.0E-04	1.8E+00	5	4.0E-05	4.6E-05	1.5E-06	1,000	4.6E-08
Nitric oxide	10102-43-9	B	4.9E-01	9.3E-04	8.1E+00	2.00	4.6E-04	2.1E-04	7.0E-06	100	2.1E-06
Phenyl ether	101-84-8	B	8.4E-02	1.6E-04	1.4E+00	0.20	8.0E-04	3.7E-05	1.2E-06	23	1.6E-06
Ethyl butyl ketone	106-35-4	B	5.3E-01	1.0E-03	8.9E+00	5	2.0E-04	2.3E-04	7.6E-06	780	3.0E-07
1,2-Epoxybutane	106-88-7	B	2.5E-01	4.7E-04	4.1E+00	0.2	2.4E-03	1.1E-04	3.6E-06	20	5.4E-06
Butane	106-97-8	B	1.3E+00	2.5E-03	2.2E+01	5	5.0E-04	5.7E-04	1.9E-05	6,300	9.0E-08
Acrolein	107-02-8	B	1.4E-02	2.7E-05	2.3E-01	0.02	1.3E-03	6.1E-06	2.0E-07	0.02	3.1E-04
Allyl chloride	107-05-1	B	1.6E-02	3.0E-05	2.6E-01	0.02	1.5E-03	6.8E-06	2.3E-07	1.0	6.8E-06
Allyl alcohol	107-18-6	B	4.7E-03	9.0E-06	7.9E-02	0.20	4.5E-05	2.1E-06	6.8E-08	17	1.2E-07
Methyl formate	107-31-3	B	3.1E-02	5.9E-05	5.2E-01	5	1.2E-05	1.3E-05	4.4E-07	820	1.6E-08
Methyl propyl ketone	107-87-9	B	3.1E-01	5.8E-04	5.1E+00	5	1.2E-04	1.3E-04	4.4E-06	2,300	5.8E-08
1-Nitropropane	108-03-2	B	7.2E-02	1.4E-04	1.2E+00	0.20	6.9E-04	3.1E-05	1.0E-06	20	1.6E-06
Vinyl acetate	108-05-4	B	2.7E-03	5.2E-06	4.6E-02	2.60	2.0E-06	1.2E-06	3.9E-08	200	6.0E-09
Methyl isobutyl ketone (MIBK)	108-10-1	B	1.9E-01	3.7E-04	3.2E+00	5	7.3E-05	8.4E-05	2.8E-06	680	1.2E-07
Isopropyl ether	108-20-3	B	4.0E-01	7.7E-04	6.7E+00	5	1.5E-04	1.8E-04	5.8E-06	3,500	5.0E-08
Methylcyclohexane	108-87-2	B	3.3E-01	6.2E-04	5.5E+00	5	1.2E-04	1.4E-04	4.7E-06	5,400	2.6E-08
Toluene	108-88-3	B	3.4E-01	6.6E-04	5.7E+00	5	1.3E-04	1.5E-04	4.9E-06	400	3.7E-07
Chlorobenzene	108-90-7	B	1.9E-02	3.5E-05	3.1E-01	2.60	1.4E-05	8.1E-06	2.7E-07	150	5.4E-08
Cyclohexanol	108-93-0	B	2.0E-03	3.8E-06	3.4E-02	5	7.7E-07	8.8E-07	2.9E-08	690	1.3E-09
Cyclohexanone	108-94-1	B	9.4E-02	1.8E-04	1.6E+00	5	3.6E-05	4.1E-05	1.3E-06	330	1.2E-07
Phenol	108-95-2	B	2.9E-01	5.5E-04	4.8E+00	1.20	4.6E-04	1.3E-04	4.1E-06	63	2.0E-06
Pentane	109-66-0	B	1.0E+00	1.9E-03	1.7E+01	5	3.8E-04	4.4E-04	1.4E-05	6,000	7.3E-08
Tetrahydrofuran	109-99-9	B	6.5E-01	1.2E-03	1.1E+01	5	2.5E-04	2.8E-04	9.3E-06	2,000	1.4E-07
Methyl isoamyl ketone	110-12-3	B	7.0E-02	1.3E-04	1.2E+00	5	2.7E-05	3.1E-05	1.0E-06	780	3.9E-08
Methyl n-amyl ketone	110-43-0	B	1.9E-01	3.5E-04	3.1E+00	5	7.1E-05	8.1E-05	2.7E-06	780	1.0E-07
Hexane	110-54-3	B	5.2E-01	9.8E-04	8.6E+00	2.60	3.8E-04	2.2E-04	7.4E-06	200	1.1E-06
n-Valeraldehyde	110-62-3	B	2.4E-01	4.6E-04	4.0E+00	5	9.2E-05	1.1E-04	3.5E-06	590	1.8E-07
Cyclohexane	110-82-7	B	2.5E-01	4.8E-04	4.2E+00	5	9.6E-05	1.1E-04	3.6E-06	3,400	3.2E-08
Cyclohexene	110-83-8	B	9.2E-03	1.7E-05	1.5E-01	5	3.5E-06	4.0E-06	1.3E-07	3,400	1.2E-09
Pyridine	110-86-1	B	7.8E-02	1.5E-04	1.3E+00	0.60	2.5E-04	3.4E-05	1.1E-06	53	6.4E-07

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Toxic Air Pollutant	CAS # [1]	TAP CLASS	Average From TWINS mg/m ³	Emission (lbs/hr)	Emission (lbs/yr)	SQER (A lbs/yr, B lbs/hr)	Farm Emissions divided by SQER [2]	Dispersed - 24hr (ug/m3)	Dispersed - Annual (ug/m3)	ASIL (ug/m3)	Farm Dispersed Emissions divided by ASIL [3]
Octane	111-65-9	B	1.9E-01	3.6E-04	3.2E+00	5	7.3E-05	8.3E-05	2.7E-06	4,700	1.8E-08
2-Butoxyethanol	111-76-2	B	1.4E-01	2.6E-04	2.3E+00	5	5.3E-05	6.0E-05	2.0E-06	400	1.5E-07
Nonane	111-84-2	B	1.5E-01	2.8E-04	2.5E+00	5	5.7E-05	6.5E-05	2.1E-06	3,500	1.8E-08
1,2,4-Trichlorobenzene	120-82-1	B	4.0E-02	7.5E-05	6.6E-01	2.00	3.8E-05	1.7E-05	5.7E-07	120	1.4E-07
Diphenylamine	122-39-4	B	3.5E-02	6.7E-05	5.9E-01	0.02	3.4E-03	1.5E-05	5.1E-07	3.3	4.7E-06
Diprophyl ketone	123-19-3	B	2.0E-01	3.7E-04	3.3E+00	5	7.5E-05	8.6E-05	2.8E-06	780	1.1E-07
Propionaldehyde	123-38-6	B	3.0E-01	5.7E-04	5.0E+00	0.02	2.9E-02	1.3E-04	4.3E-06	160	8.2E-07
Isoamyl alcohol	123-51-3	B	5.4E-02	1.0E-04	8.9E-01	5	2.0E-05	2.3E-05	7.7E-07	1,200	1.9E-08
n-Butyl acetate	123-86-4	B	1.8E+00	3.5E-03	3.0E+01	5	6.9E-04	7.9E-04	2.6E-05	2,400	3.3E-07
Tributyl phosphate	126-73-8	B	5.0E-01	9.5E-04	8.3E+00	0.02	4.7E-02	2.2E-04	7.2E-06	7.3	3.0E-05
Methylacrylonitrile	126-98-7	B	1.0E-01	1.9E-04	1.7E+00	0.02	9.6E-03	4.4E-05	1.4E-06	9.0	4.9E-06
Dimethyl acetamide	127-19-5	B	4.6E-02	8.7E-05	7.6E-01	2.00	4.4E-05	2.0E-05	6.6E-07	120	1.7E-07
2,6-Ditert, butyl-p-cresol	128-37-0	B	5.4E-01	1.0E-03	9.0E+00	0.60	1.7E-03	2.4E-04	7.8E-06	33	7.1E-06
Xylenes (m-,o-,p-isomers)	1330-20-7	B	7.3E-01	1.4E-03	1.2E+01	5	2.8E-04	3.2E-04	1.0E-05	1,500	2.1E-07
Ethyl acetate	141-78-6	B	1.5E+01	2.8E-02	2.4E+02	5	5.5E-03	6.3E-03	2.1E-04	4,800	1.3E-06
Mesityl oxide	141-79-7	B	4.2E-02	8.1E-05	7.1E-01	2.60	3.1E-05	1.8E-05	6.1E-07	200	9.2E-08
Heptane (n-Heptane)	142-82-5	B	3.9E-01	7.5E-04	6.6E+00	5	1.5E-04	1.7E-04	5.6E-06	5,500	3.1E-08
Cyclopentane	287-92-3	B	2.0E-01	3.7E-04	3.3E+00	5	7.5E-05	8.6E-05	2.8E-06	5,700	1.5E-08
Crotonaldehyde	4170-30-3	B	3.2E-02	6.0E-05	5.3E-01	0.20	3.0E-04	1.4E-05	4.6E-07	20	6.9E-07
Carbonyl sulfide	463-58-1	B	4.6E-02	8.7E-05	7.6E-01	0.02	4.4E-03	2.0E-05	6.6E-07	19	1.1E-06
Cyanides, as CN (mg/m3 of CN)	51-12-5	B	1.2E+00	2.3E-03	2.0E+01	0.20	1.1E-02	5.2E-04	1.7E-05	17	3.0E-05
3-Heptanone, 5-methyl-	541-85-5	B	2.3E-01	4.3E-04	3.8E+00	5	8.6E-05	9.9E-05	3.3E-06	440	2.2E-07
Methyl isopropyl ketone	563-80-4	B	4.3E-01	8.3E-04	7.2E+00	5	1.7E-04	1.9E-04	6.2E-06	2,300	8.2E-08
2-Hexanone (MBK)	591-78-6	B	1.6E-01	3.0E-04	2.6E+00	1.20	2.5E-04	6.9E-05	2.3E-06	67	1.0E-06
Methyl isocyanate	624-83-9	B	4.2E-02	8.0E-05	7.0E-01	0.02	4.0E-03	1.8E-05	6.1E-07	0.16	1.1E-04
n-Propyl nitrate	627-13-4	B	5.8E-01	1.1E-03	9.7E+00	5	2.2E-04	2.5E-04	8.3E-06	360	7.0E-07
Ethyl alcohol	64-17-5	B	1.5E+00	2.9E-03	2.5E+01	5	5.7E-04	6.6E-04	2.2E-05	6,300	1.0E-07
Acetic acid	64-19-7	B	1.1E-01	2.2E-04	1.9E+00	1.20	1.8E-04	5.0E-05	1.7E-06	83	6.0E-07
Methyl alcohol	67-56-1	B	3.7E+00	7.0E-03	6.1E+01	5	1.4E-03	1.6E-03	5.3E-05	870	1.8E-06
Isopropyl alcohol	67-63-0	B	3.3E-01	6.3E-04	5.5E+00	5	1.3E-04	1.4E-04	4.7E-06	3,300	4.3E-08

Criteria and Toxic Air Emissions Notice of Construction Application for Operation of 241-AY and 241-AZ Tank Farms Exhauster

Toxic Air Pollutant	CAS # [1]	TAP CLASS	Average From TWINS mg/m ³	Emission (lbs/hr)	Emission (lbs/yr)	SQER (A lbs/yr, B lbs/hr)	Farm Emissions divided by SQER [2]	Dispersed - 24hr (ug/m3)	Dispersed - Annual (ug/m3)	ASIL (ug/m3)	Farm Dispersed Emissions divided by ASIL [3]
Acetone	67-64-1	B	2.3E+00	4.4E-03	3.9E+01	5	8.8E-04	1.0E-03	3.3E-05	5,900	1.7E-07
n-Propyl alcohol	71-23-8	B	5.8E-01	1.1E-03	9.7E+00	5	2.2E-04	2.5E-04	8.3E-06	1,600	1.6E-07
n-Butyl alcohol	71-36-3	B	6.1E+00	1.2E-02	1.0E+02	5	2.3E-03	2.6E-03	8.7E-05	500	5.3E-06
Methyl chloroform (1,1,1-Trichloroethane)	71-55-6	B	1.4E-02	2.7E-05	2.3E-01	5	5.3E-06	6.1E-06	2.0E-07	6,400	9.5E-10
Mercury (total)	7439-97-6	B	2.4E-02	4.6E-05	4.0E-01	0.02	2.3E-03	1.1E-05	3.5E-07	3.3E-01	3.2E-05
Silver	7440-22-4	B	4.9E-03	9.2E-06	8.1E-02	0.02	4.6E-04	2.1E-06	7.0E-08	3.3E-01	6.4E-06
Chromium	7440-47-3	B	6.0E-01	1.1E-03	1.0E+01	0.02	5.7E-02	2.6E-04	8.6E-06	1.7	1.5E-04
Methyl bromide	74-83-9	B	1.9E-02	3.6E-05	3.1E-01	0.02	1.8E-03	8.2E-06	2.7E-07	5.0	1.6E-06
Methyl chloride	74-87-3	B	2.4E-02	4.5E-05	4.0E-01	5	9.0E-06	1.0E-05	3.4E-07	340	3.0E-08
Methyl acetylene	74-99-7	B	3.1E-01	6.0E-04	5.2E+00	5	1.2E-04	1.4E-04	4.5E-06	5,500	2.5E-08
Ethyl chloride	75-00-3	B	2.2E-02	4.2E-05	3.7E-01	5	8.5E-06	9.7E-06	3.2E-07	10,000	9.7E-10
Ethanamine	75-04-7	B	9.0E-02	1.7E-04	1.5E+00	1.20	1.4E-04	3.9E-05	1.3E-06	60	6.6E-07
Acetonitrile	75-05-8	B	6.9E-01	1.3E-03	1.2E+01	2.60	5.1E-04	3.0E-04	1.0E-05	220	1.4E-06
Formamide	75-12-7	B	5.0E-02	9.5E-05	8.3E-01	1.20	7.9E-05	2.2E-05	7.2E-07	60	3.6E-07
Carbon disulfide	75-15-0	B	6.7E-01	1.3E-03	1.1E+01	2.00	6.4E-04	2.9E-04	9.6E-06	100	2.9E-06
1,1-Dichloroethane	75-34-3	B	2.3E-02	4.3E-05	3.8E-01	5	8.7E-06	9.9E-06	3.3E-07	2,700	3.7E-09
Vinylidene chloride	75-35-4	B	1.4E-02	2.7E-05	2.4E-01	1.20	2.3E-05	6.2E-06	2.1E-07	67	9.3E-08
Dichlorofluoromethane	75-43-4	B	4.0E-02	7.7E-05	6.7E-01	2.60	3.0E-05	1.8E-05	5.8E-07	130	1.4E-07
Chlorodifluoromethane	75-45-6	B	8.1E-01	1.5E-03	1.3E+01	5	3.1E-04	3.5E-04	1.2E-05	12,000	2.9E-08
Nitromethane	75-52-5	B	4.6E-02	8.8E-05	7.7E-01	5	1.8E-05	2.0E-05	6.6E-07	830	2.4E-08
tert-Butyl alcohol	75-65-0	B	1.1E-01	2.1E-04	1.8E+00	5	4.2E-05	4.8E-05	1.6E-06	1,000	4.8E-08
Trichlorofluoromethane	75-69-4	B	1.2E+00	2.4E-03	2.1E+01	5	4.7E-04	5.4E-04	1.8E-05	19,000	2.8E-08
Dichlorodifluoromethane	75-71-8	B	2.8E-02	5.4E-05	4.7E-01	5	1.1E-05	1.2E-05	4.1E-07	16,000	7.7E-10
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	B	1.2E-01	2.3E-04	2.0E+00	5	4.6E-05	5.2E-05	1.7E-06	27,000	1.9E-09
Dichlorotetrafluoroethane	76-14-2	B	4.1E-02	7.9E-05	6.9E-01	5	1.6E-05	1.8E-05	5.9E-07	23,000	7.8E-10
Ammonia	7664-41-7	B	1.8E+02	3.4E-01	3.0E+03	2.00	1.7E-01	7.8E-02	2.6E-03	100	7.8E-04
Isobutyl alcohol	78-83-1	B	2.1E-02	3.9E-05	3.4E-01	5	7.8E-06	9.0E-06	3.0E-07	510	1.8E-08
sec-Butyl alcohol	78-92-2	B	1.2E-01	2.4E-04	2.1E+00	5	4.7E-05	5.4E-05	1.8E-06	1,000	5.4E-08
Methyl ethyl ketone (MEK)	78-93-3	B	9.3E-01	1.8E-03	1.6E+01	5	3.5E-04	4.1E-04	1.3E-05	1,000	4.1E-07

Criteria and Toxic Air Emissions Notice of Construction Application for Operation of 241-AY and 241-AZ Tank Farms Exhauster

Toxic Air Pollutant	CAS # [1]	TAP CLASS	Average From TWINS mg/m ³	Emission (lbs/hr)	Emission (lbs/yr)	SQER (A lbs/yr, B lbs/hr)	Farm Emissions divided by SQER [2]	Dispersed - 24hr (ug/m3)	Dispersed - Annual (ug/m3)	ASIL (ug/m3)	Farm Dispersed Emissions divided by ASIL [3]
1,1,2-Trichloroethane	79-00-5	B	5.4E-02	1.0E-04	9.1E-01	2.60	4.0E-05	2.4E-05	7.8E-07	180	1.3E-07
Propionic acid	79-09-4	B	7.9E-03	1.5E-05	1.3E-01	2.00	7.5E-06	3.4E-06	1.1E-07	100	3.4E-08
Methyl acetate	79-20-9	B	7.8E-02	1.5E-04	1.3E+00	5	3.0E-05	3.4E-05	1.1E-06	2,000	1.7E-08
1,1,2,2-Tetrachloroethane	79-34-5	B	3.7E-02	7.0E-05	6.2E-01	0.20	3.5E-04	1.6E-05	5.3E-07	23	7.0E-07
Diethyl phthalate	84-66-2	B	1.5E-01	2.9E-04	2.6E+00	0.20	1.5E-03	6.7E-05	2.2E-06	17	4.0E-06
Dibutyl phthalate	84-74-2	B	5.5E-03	1.0E-05	9.2E-02	0.20	5.2E-05	2.4E-06	7.9E-08	17	1.4E-07
Naphthalene	91-20-3	B	2.0E-02	3.7E-05	3.3E-01	2.60	1.4E-05	8.5E-06	2.8E-07	170	5.0E-08
Biphenyl	92-52-4	B	2.9E+00	5.5E-03	4.8E+01	0.02	2.7E-01	1.3E-03	4.1E-05	4.3	2.9E-04
o-Dichlorobenzene (1,2-Dichlorobenzene)	95-50-1	B	1.2E-02	2.3E-05	2.0E-01	5	4.6E-06	5.3E-06	1.8E-07	1,000	5.3E-09
Diethyl ketone	96-22-0	B	8.2E-02	1.6E-04	1.4E+00	5	3.1E-05	3.6E-05	1.2E-06	2,300	1.6E-08
Cumene	98-82-8	B	2.3E-01	4.4E-04	3.9E+00	5	8.8E-05	1.0E-04	3.3E-06	820	1.2E-07
a-Methyl styrene	98-83-9	B	6.5E-02	1.2E-04	1.1E+00	5	2.5E-05	2.8E-05	9.4E-07	810	3.5E-08
Acetophenone	98-86-2	B	1.4E-01	2.7E-04	2.3E+00	0.02	1.3E-02	6.1E-05	2.0E-06	350	1.7E-07
Nitrobenzene	98-95-3	B	8.6E-03	1.6E-05	1.4E-01	0.02	8.2E-04	3.8E-06	1.2E-07	1.7	2.2E-06
Nitrobenzene	98-95-3	B	8.6E-03	1.6E-05	1.4E-01	0.02	8.2E-04	3.8E-06	1.2E-07	1.7	2.2E-06
Total TAPs					3.9E+03						
Total ammonia					3.0E+03						
Total non-ammonia TAPs					9.5E02						

- 1 CAS = Chemical Abstracts Service
- 2 A value greater than 1 would indicate that the SQER was exceeded.
- 3 A value greater than 1 would indicate that the ASIL was exceeded.
- 4 Concentration in headspace calculated from stack sample (see Section 8.3).
- 5 The Class A compound 1,2 Dichloropropane (CAS #78-87-2) does not have an SQER but does have an ASIL with a special averaging time of 24 hours. For conservatism, the 24-hour averaging ASIL value was assumed as an annual ASIL to arrive at an SQER of 500 pounds per year.

Criteria and Toxic Air Emissions Notice of Construction Application for Operation of 241-AY
and 241-AZ Tank Farms Exhauster

APPENDIX B

Criteria and Toxic Air Emissions Notice of Construction Application for Operation of 241-AY
and 241-AZ Tank Farms Exhauster

APPENDIX C

Criteria and Toxic Air Emissions Notice of Construction Application for Operation of 241-AY and
241-AZ Tank Farms Exhauster

APPENDIX C. ABCASH Iodine Emissions - 1994-2007

Stack	EDP Code	Sample Number	Sample Collection Period (Date and Time)		Radionuclide, Calculated Concentration, and Analytical Uncertainty		
			On	Off	Volume cu ft	I-129 ($\mu\text{Ci/ml}$)	% Uncert
296-A-17	E026	S173111	12/13/95 09:32	12/20/95 13:28	17690.3	3.2E-13	60.0
296-A-17	E026	S172018	12/21/95 17:26	12/28/95 09:13	17119.7	1.3E-13	320.0
296-A-17	E026	S143080	12/20/95 13:31	01/03/96 14:36	33514.6	3.4E-13	90.0
296-A-17	E026	S186835	05/01/96 09:38	05/07/96 14:52	14346.1	3.4E-12	25.0
296-A-17	E026	S194321	07/12/96 13:33	07/23/96 13:31	22669.7	9.3E-12	13.5
296-A-17	E026	S203640	10/25/96 14:09	11/01/96 08:36	6141.1	4.1E-12	32.4
296-A-17	E026	S213613	02/11/97 11:28	02/18/97 13:56	17316.9	7.7E-14	490.0
296-A-17	E026	S220099	05/06/97 13:53	05/13/97 10:24	10390.9	7.9E-12	20.0
296-A-17	E026	S232072	09/02/97 09:52	09/09/97 09:30	22750.0	3.4E-13	83.7
296-A-17	E026	S242116	12/02/97 11:06	12/09/97 11:04	12202.7	6.0E-12	21.4
296-A-17	E026	S248898	02/10/98 10:29	02/17/98 13:34	14418.6	2.5E-12	29.2
296-A-17	E027	S143081	12/28/95 09:18	01/03/96 14:39	15340.0	-2.5E-13	170.0
296-A-17	E027	S186836	05/01/96 09:39	05/07/96 14:53	14348.8	-2.2E-13	210.0
296-A-17	E027	S194322	07/12/96 13:34	07/23/96 13:32	22669.7	1.2E-12	39.0
296-A-17	E027	S203641	10/25/96 14:10	11/01/96 08:37	6141.1	4.4E-14	1000.0
296-A-17	E027	S213614	02/11/97 11:28	02/18/97 13:57	17319.7	2.0E-13	209.0
296-A-17	E027	S220100	05/06/97 13:54	05/13/97 10:25	10390.9	1.4E-12	81.3
296-A-17	E027	S232073	09/02/97 09:52	09/09/97 09:31	22753.2	1.1E-11	13.0
296-A-17	E027	S242117	12/02/97 11:06	12/09/97 11:05	12202.7	1.4E-12	26.1
296-A-17	E027	S248899	02/10/98 10:30	02/17/98 13:35	14418.6	-2.0E-13	212.0
296-A-42	E152	S258566	05/11/98 14:54	05/29/98 13:45	36295.0	9.3E-14	173.0
296-A-42	E152	S329790	01/26/00 11:07	02/16/00 09:09	53305.8	1.3E-12	20.3
296-A-42	E152	S339066	04/25/00 13:35	05/11/00 10:24	40112.0	4.0E-12	14.6
296-A-42	E152	S351644	08/13/00 09:05	08/30/00 10:36	41882.0	5.4E-12	12.9
296-A-42	E152	S357009	10/25/00 09:14	11/02/00 14:26	20936.7	5.3E-12	15.1
296-A-42	E152	S367778	01/25/01 08:31	02/14/01 13:36	48265.0	3.8E-13	54.9
296-A-42	E152	S379203	06/11/01 11:21	06/26/01 09:06	29734.0	2.9E-13	68.4
296-A-42	E152	S385142	09/12/01 09:53	09/27/01 09:10	29657.0	1.5E-12	27.8
296-A-42	E152	S397678	11/07/01 10:16	11/19/01 10:23	24570.0	9.5E-13	58.5
296-A-42	E152	S413538	02/12/02 13:43	02/26/02 21:27	29844.0	-2.8E-13	100.0
296-A-42	E152	S424958	05/08/02 10:03	05/21/02 13:01	26881.0	-3.0E-13	100.0
296-A-42	E152	S438173	08/12/02 10:31	09/11/02 13:27	56184.0	-2.1E-14	587.0
296-A-42	E152	S429364	10/24/02 12:53	11/11/02 10:47	37134.0	1.2E-13	172.0
296-A-42	E152	S460506	02/26/03 10:08	03/12/03 09:36	27359.8	-3.9E-14	830.0
296-A-42	E152	S569221	05/27/03 00:00	06/10/03 00:00	29150.0	3.0E-13	85.2
296-A-42	E152	S578970	08/13/03 12:37	08/25/03 10:23	25989.0	8.8E-14	305.0
296-A-42	E152	S594442	12/08/03 09:54	01/27/04 08:38	104113.0	8.4E-14	81.1
296-A-42	E152	s601753	03/03/04 18:41	03/17/04 12:44	9927.0	-5.5E-13	128.0
296-A-42	E152	S613711	08/21/04 15:05	09/03/04 00:35	26323.8	-1.8E-13	160.0
296-A-42	E152	S625348	09/17/04 01:34	10/12/04 01:14	58975.0	7.1E-13	26.6
296-A-42	E152	s631848	11/24/04 02:14	12/08/04 10:14	33263.0	1.4E-12	27.3
296-A-42	E152	s640203	02/03/05 09:49	03/09/05 12:36	77021.0	-3.6E-14	252.0
296-A-42	E152	S648616	03/30/05 09:42	06/09/05 11:10	149775.0	8.3E-15	559.0
296-A-42	E152	s660595	08/29/05 08:55	09/13/05 13:07	34780.0	-2.0E-13	100.0
296-A-42	E152	s662470	10/12/05 13:58	11/17/05 08:48	29922.0	-2.1E-13	117.0
296-A-42	E152	S679007	02/23/06 10:02	03/14/06 10:02	42464.0	-6.3E-14	260.0
296-A-42	E152	S682526	07/05/06 09:04	07/19/06 14:18	32300.0	-2.9E-13	100.0
296-A-42	E152	S695972	08/29/06 12:59	09/12/06 18:21	32335.0	-2.4E-13	100.0
296-A-42	E152	S701513	10/10/06 09:39	10/30/06 10:49	45847.0	4.6E-14	339.0
296-A-42	E152	S711837	01/17/07 08:45	02/02/07 14:38	36287.0	2.0E-15	1000.0
296-A-42	E152	S721382	04/11/07 13:04	04/26/07 11:06	33365.0	1.5E-13	147.0
296-P-26	E041	S143079	12/28/95 09:32	01/03/96 14:27	0.0		100.0

Criteria and Toxic Air Emissions Notice of Construction Application for Operation of 241-AY and
241-AZ Tank Farms Exhauster

**EVALUATION OF BEST AVAILABLE CONTROL
TECHNOLOGY FOR TOXICS (T-BACT)
WASTE RETRIEVAL SYSTEM OPERATIONS IN SINGLE
SHELL TANK FARMS**

U.S. DEPARTMENT OF ENERGY

HANFORD SITE

Report No. RPP-20773

Prepared for

CH2M HILL HANFORD GROUP

Prepared by

CH2M HILL INDUSTRIAL DESIGN & CONSTRUCTION

June 2004

T-BACT for Operations Of Waste Retrieval Systems In Single Shell Tank Farms

EXECUTIVE SUMMARY

This report is an evaluation of Best Available Control Technology for Toxics (T-BACT) for installation and operation of exhausters during retrieval of waste from 141 Single Shell Tanks (SSTs) in the 200 area of the Hanford Site. Operation of the tank farm exhausters will result in emissions of ammonia, a toxic air pollutant (TAP) as defined by the Washington Department of Ecology (Ecology), and 125 non-ammonia (primarily organic) TAPs. Ecology has established acceptable source impact levels (ASILs) for these compounds. The ASILs are ambient concentrations above which Ecology believes that adverse health impacts can occur. Modeling of the Hanford DSTs concluded that no ASILs would be exceeded. Nevertheless, Ecology rules require the submission of a T-BACT analysis, and identification of the proposed T-BACT, for new sources of TAPs.

Guidance provided by Ecology and the US Environmental Protection Agency (EPA) for the process to determine best available control technology was followed. Available technology for the control of emissions of ammonia and non-ammonia TAPs was identified. Some of the technology options were eliminated from further consideration because of technical infeasibility. The remaining options were evaluated for economic impact. All of these options were eliminated because their costs exceeded the amounts Ecology considers to be economically justifiable, as measured by the cost to remove a ton of pollutant. This was primarily due to the low amount of uncontrolled emissions. Even though the options evaluated would remove a high portion of the emissions, typically 98-99%, the cost of the equipment would be prohibitively high according to the available Ecology guidelines. Consequently, T-BACT is proposed to be operation of the standard exhauster configuration (moisture eliminator, preheater, HEPA filters, fan, stack with monitoring instrumentation) with periodic monitoring to confirm that the estimated emission parameters are accurate.

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June 2004 ii

T-BACT for Operations Of Waste Retrieval Systems In Single Shell Tank Farms

1.0 INTRODUCTION AND BACKGROUND

This T-BACT evaluation is a supplement to the Notice of Construction application (NOC) being submitted by the US Department of Energy (DOE) to the Washington Department of Ecology (Ecology) for the installation and operation of exhausters during retrieval of waste from 141 SSTs in the 200 area of the Hanford site. The NOC contains:

1. a description of the facility and the proposed action,
2. a review of SEPA applicability,
3. a discussion of the chemical and physical processes generating emissions,
4. a description of the emission abatement technology,
5. descriptions of the methodologies used to estimate of emissions and model their ambient impact,
6. and a tabulation of the estimated emissions and the modeling results.

The tanks will be ventilated with the existing portable exhausters. These exhauster systems are rated at either 500 or 1,000 ft³/min (standard) exhaust flow. These ventilation systems will be operated during the retrieval of the waste contained in the tanks.

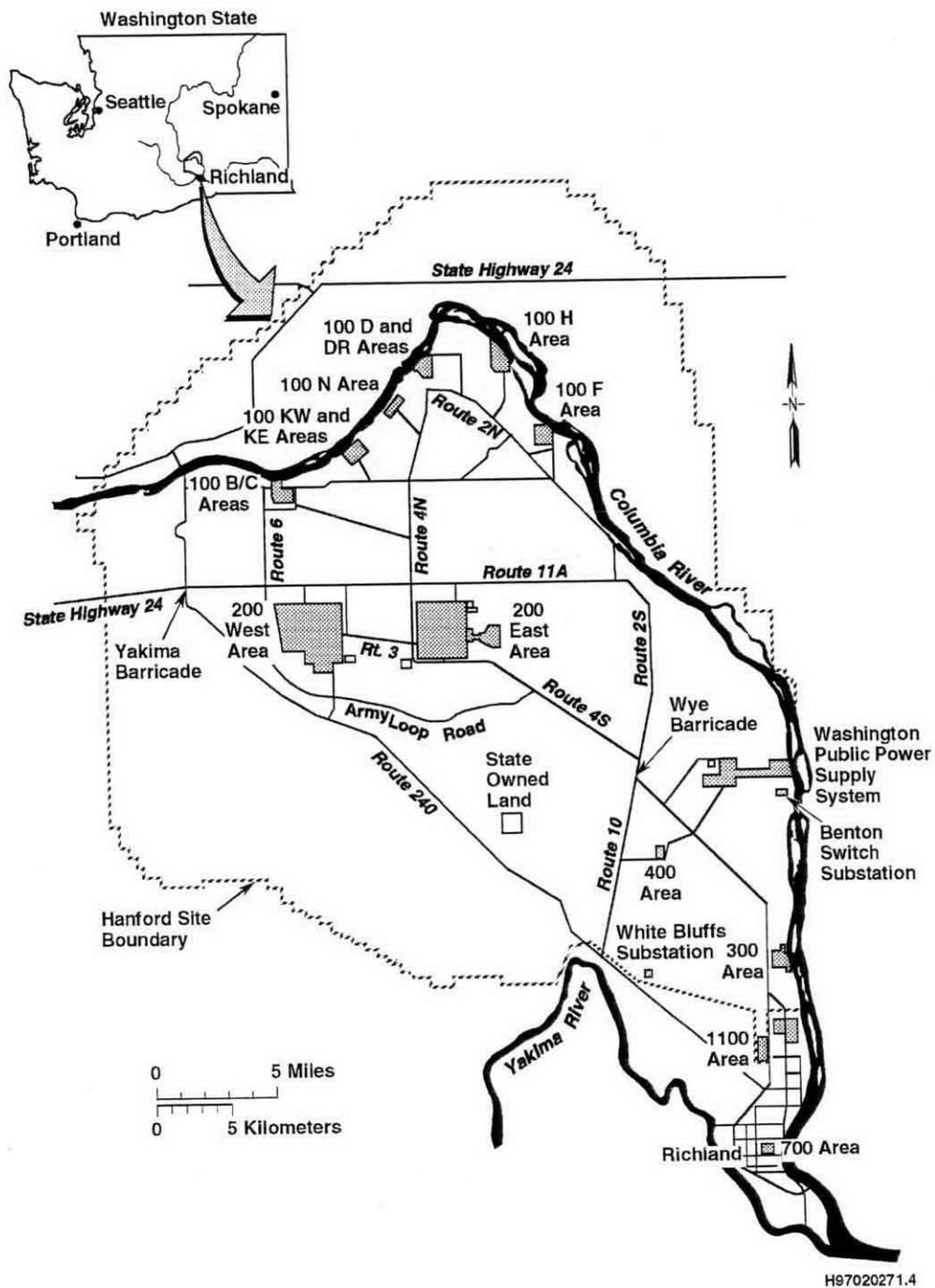
The SSTs are located in the 200 East and 200 West areas of the Hanford Site. Figure 1 shows the location of the Hanford Site in Washington State, and the location of the 200 East and 200 West areas on the Hanford Site.

2.0 SUMMARY OF PROPOSED T-BACT DETERMINATIONS

The proposed T-BACT determinations that are based on the technology evaluations in the following sections of this document are summarized in Table 1.

Pollutant	T-BACT Numerical Limit	Basis of Limit
Ammonia (NH ₃)	6.5 tons per year total from all exhauster stacks	No emission control equipment other than HEPA filters.
Non-ammonia TAPs (as defined by Ecology)	1,895 pounds per year total from all exhauster stacks	No emission control equipment other than HEPA filters.

Figure 1: The Hanford Site



3.0 T-BACT REGULATIONS AND PROCEDURES

Ecology regulates the emission of criteria and toxic air pollutants in the State of Washington. Ecology guidance requires that “a person proposing to construct a new source of air emissions or modify an existing source may be required to submit a notice of construction application to Ecology and undergo a new source review (see WAC 173-400-110).” The NOC must include “proposed methods for air pollution control or prevention, called “best available control technology (BACT).” The source must use Best Available Control Technology for Toxics (T-BACT) for toxic air pollutants (TAPs) which are likely to increase (WAC 173-460-040 (4)(b) and WAC 173-460-060). T-BACT is defined in WAC 173-460-020 (4) as:

"Best available control technology for toxics (T-BACT)" applies to each toxic air pollutant (TAP) discharged or mixture of TAPs, taking in account the potency quantity and toxicity of each toxic air pollutant or mixture of TAPs discharged in addition to the meaning given in WAC 173-400-030(10).

BACT is defined in WAC 173-400-030 (12) as:

"Best available control technology (BACT)" means an emission limitation based on the maximum degree of reduction for each air pollutant subject to regulation under chapter 70.94 RCW emitted from or which results from any new or modified stationary source, which the permitting authority, on a case-by-case taking into account energy, environmental, and economic impacts and other costs, determines is achievable for such source or modification through application of production processes and available methods, systems, and techniques, including fuel cleaning, clean fuels, or treatment or innovative fuel combustion techniques for control of each such pollutant. In no event shall application of the "best available control technology" result in emissions of any pollutants which will exceed the emissions allowed by any applicable standard under 40 CFR Part 60 and Part 61. Emissions from any source utilizing clean fuels, or any other means, to comply with this paragraph shall not be allowed to increase above levels that would have been required under the definition of BACT in the Federal Clean Air Act as it existed prior to enactment of the Clean Air Act Amendments of 1990.

Pollutants and their estimated emission rates are listed in Table 1 of the NOC. Ammonia and 125 non-ammonia compounds have been identified as toxic air pollutants (as defined by Ecology) that will be emitted.

Ecology guidance *How to Apply for a Notice of Construction Air Quality Permit* (Ecology 2003) states that the “top-down” approach is used to establish BACT. This approach is defined in detail in *New Source Review Workshop Manual – Prevention of Significant Deterioration and Nonattainment Area Permitting* (US EPA 1990 – Draft). The approach consists of the following steps:

1. Identify all control technologies
2. Eliminate technically infeasible options
3. Rank remaining control technologies by control effectiveness
4. Evaluate most effective controls and document results

T-BACT for Operations Of Waste Retrieval Systems In Single Shell Tank Farms

5. Select BACT

The economic impacts of the control technology options are evaluated by calculating the cost-effectiveness. This calculation is performed by estimating the total annualized cost of control, in \$/yr, and dividing by the annual amount of emission reduction that would be achieved, in tons/yr. The resulting cost-effectiveness value, in \$/ton, is compared to costs for similar applications and to guidance provided by regulatory agencies.

A request was submitted to the Ecology Air Program to provide any available guidance on reasonable cost-effectiveness for both criteria (BACT) and toxic (T-BACT) pollutants. In response, Mr. Bernard Brady of Ecology stated that a recent survey had identified the “plateau” and “ceiling” BACT cost-effectiveness values in use in the US for criteria pollutants. These values are shown in Table 2.

Pollutant	Plateau	Ceiling
Nitrogen Oxides (NOx)	\$5,500/ton	\$10,500/ton
Carbon Monoxide (CO)	\$5,000/ton	\$8,000/ton
Sulfur Dioxide (SO ₂)	\$2,700/ton	\$10,000/ton
Particulate Matter less than 10 Microns in Aerodynamic Diameter (PM ₁₀)	\$5,700/ton	\$8,000/ton
Volatile Organic Compounds (VOC)	\$3,500/ton	\$8,000/ton

According to Mr. Brady, the plateau is the level “below which a control technology is rarely thrown out as economically unjustifiable. Likewise, there is some higher BACT-cost ceiling above which a control technology is rarely judged economically justifiable.” Levels within a range are evaluated on a case-by-case basis.

Mr. Brady stated that no similar guidance exists for T-BACT and that T-BACT decisions must be made on a case-by-case basis.

Subsequently, it was discovered that one or more Ecology regional offices were evaluating options for establishing numerical cost-effectiveness criteria to be used in evaluation of T-BACT. Two options were identified. The first would be to multiply the emissions of Class A TAPs by 10 and Class B TAPs by 5. These total adjusted emission rates would then be used in the calculation of cost-effectiveness and evaluated against the criteria typically used for criteria pollutants. The second option was to calculate similar weighting factors for each TAP by taking the log (base 10) of the ratio of 27,000 divided by the ASIL for each TAP. For example, the factor for ammonia, with an ASIL of 100 µg/m³, would be $\log(27,000/100) = 2.43$. Both of these methods were used in the evaluation of economic impact in this T-BACT evaluation.

4.0 FACILITY DESCRIPTION AND EMISSION PARAMETERS

Retrieval and closure operations will be conducted at 141 tanks in 12 SST farms in the 200 West and 200 East areas. The waste stored in the SST tanks will be transferred to the DSTs for storage, treatment, retrieval, and disposal.

Most of the SSTs are normally passively ventilated. However, induced mechanical ventilation will be used during active retrieval operations. The ventilation systems will serve as containment systems for radioactive particulates present in the tank headspace, remove flammable gases and vapors that evolve from the liquid surface in the SSTs, remove condensed moisture to enable remote viewing by television camera, and remove heat. The ventilation systems will do this by drawing outside air into and through the tank vapor space. After the air leaves the vapor spaces in the tanks, the ventilation exhauster systems will condition this air to remove entrained condensed moisture, reduce relative humidity by increasing the temperature, and filter out particulates. The air will be monitored and sampled for radioactive particulate before being discharged to the atmosphere from the stacks.

The existing portable exhausters will be used to provide the mechanical ventilation on tanks during active retrieval. These exhausters have nominal ratings of either 500 standard cubic feet per minute (scfm) or 1,000 scfm. The actual maximum air flow conditions at the exhauster stacks (atmospheric pressure) are expected to be:

Nominal 500 scfm Exhauster

Actual flowrate - 658 actual cubic feet per minute (acfm)
Temperature - 120 °F to 170 °F
Relative humidity - 61 percent

Nominal 1,000 scfm Exhauster

Actual flowrate - 1,320 acfm
Temperature - 120 °F to 170 °F
Relative humidity - 61 percent

Actual conditions for any tank and exhauster combination can be expected to vary from the conditions above, depending upon the total air pathway pressure drop, the specifics of the retrieval method, and atmospheric conditions.

The major components of the SST exhauster ventilation systems are as follows:

- Moisture de-entrainment (optional)
- Heater
- Prefilter
- HEPA filters (2 stages)
- Fans
- Exhaust stack
- Monitoring and control instruments and equipment.

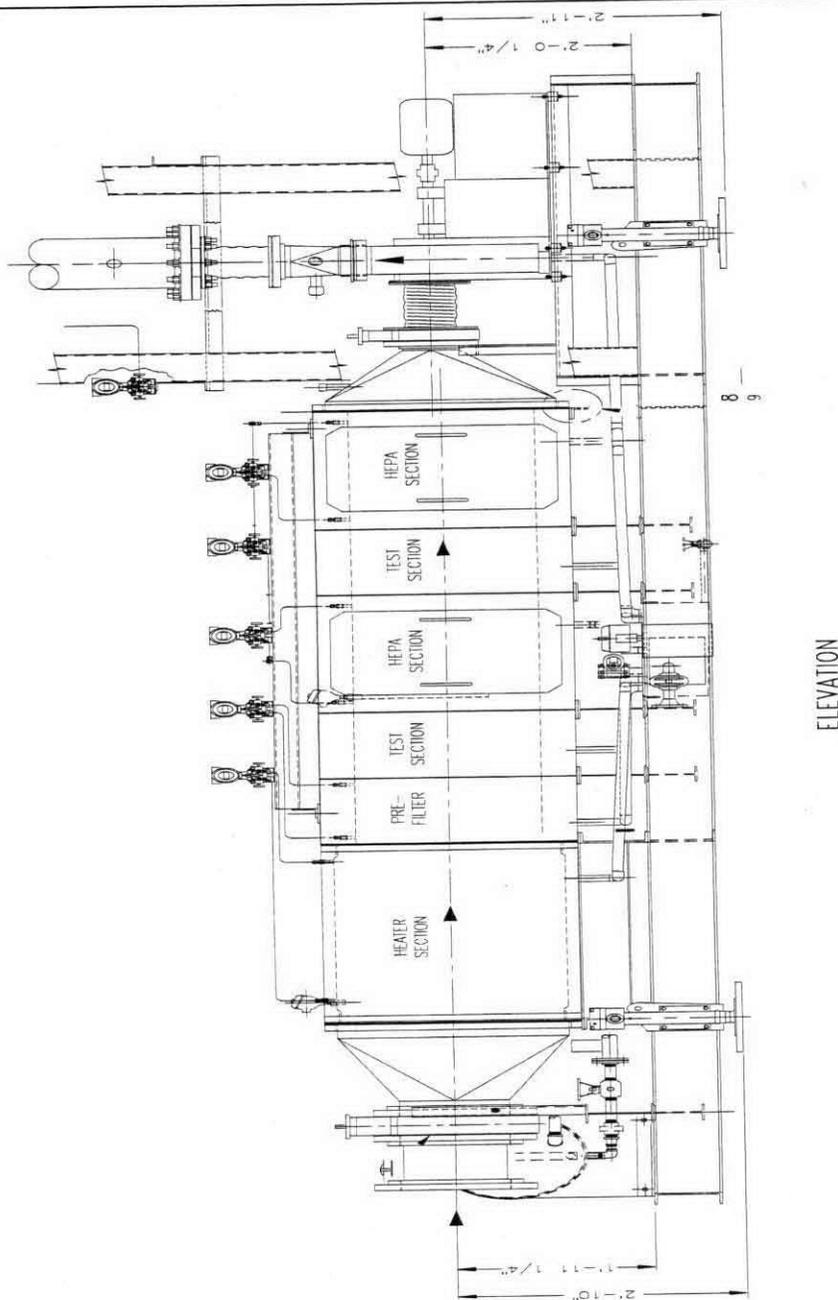
The exhauster ventilation systems will remove particulate and moisture, collect condensate, and reduce relative humidity in the exhaust stream.

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Moisture may be removed via an optional de-entrainer (moisture separator). Collected condensate will be returned to a SST. The primary ventilation system will reduce the relative humidity by heating the exhaust air stream before it enters the prefilter and the HEPA filters. The prefilter will remove the relatively large particulate and reduce the load on the HEPA filters. The ventilation system will use two banks of HEPA filters qualified by the manufacturer to remove 99.97 percent of particulate greater than or equal to 0.3 microns (μm) when tested in accordance with ASME AG-1a, Section FC.

Each exhauster system will have a centrifugal fan following the last bank of HEPA filters. Each fan will discharge directly to a stack. Figure 2 shows the typical exhauster system design.

Figure 2: Typical Exhauster Configuration



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Estimated TAP emissions from the SST exhauster systems are listed in Table 6 of the NOC. The TAPs include ammonia and 125 other compounds (primarily organic). The following exhauster discharge parameters in Tables 3 and 4 were derived from the emission estimates and the design air flow conditions for both sizes of available exhausters. It was assumed that 3-500 scfm exhausters and 1-1,000 scfm exhauster would be in use at any time. The Table 3 and Table 4 data will be used in the evaluation of emission control equipment options. Calculations used to derive some of the parameters are in the Appendix.

Table 3: Exhauster Discharge Parameters for Each Nominal 500 SCFM Tank Farm Exhauster System		
Parameter	Value	Units
Annual Ammonia Emissions	2,600	Pounds
Annual Toxic Non-ammonia Emissions	379	Pounds
Annual Emissions of the 21 Class A Non-ammonia TAPs	25	Pounds
Annual Emissions of the 104 Class B TAPs and Other Unclassified TAPs	354	Pounds
Actual Volumetric Air Flow Rate	658	Actual cubic feet per minute
Temperature	120 - 170	°F
Relative Humidity	61	%
Barometric Pressure	14.33	Pounds per square inch, absolute
Specific Humidity	0.206	Pounds of water per pound of dry air
Humid Volume	21.1	Cubic feet per pound of dry air
Mass Flow Rate – Moist Air	2,252	Pounds per hour
Mass Flow Rate – Dry Air	1,868	Pounds per hour
Ammonia Concentration	281	Parts per million by volume
Non-ammonia TAP Concentration	10	Parts per million by volume

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Table 4: Exhauster Discharge Parameters for Each Nominal 1,000 SCFM Tank Farm Exhauster System		
Parameter	Value	Units
Annual Ammonia Emissions	5,200	Pounds
Annual Toxic Non-ammonia Emissions	758	Pounds
Annual Emissions of the 21 Class A TAPs	50	Pounds
Annual Emissions of the 104 Class B Non-ammonia TAPs and Other Unclassified TAPs	708	Pounds
Actual Volumetric Air Flow Rate	1,316	Actual cubic feet per minute
Temperature	120 - 170	°F
Relative Humidity	61	%
Barometric Pressure	14.33	Pounds per square inch, absolute
Specific Humidity	0.206	Pounds of water per pound of dry air
Humid Volume	21.1	Cubic feet per pound of dry air
Mass Flow Rate – Moist Air	4,504	Pounds per hour
Mass Flow Rate – Dry Air	3,736	Pounds per hour
Ammonia Concentration	281	Parts per million by volume
Non-ammonia TAP Concentration	10	Parts per million by volume

5.0 IDENTIFICATION AND EVALUATION OF EMISSION CONTROL TECHNOLOGY OPTIONS

5.1. General Approach

The first step in the BACT analysis is to identify emission control technology options for the pollutants to be controlled. As noted previously, the pollutants are ammonia and 125 non-ammonia TAPs. For ammonia, information was sought for any application that was specific for ammonia, but also for technology applicable in general to inorganic vapor control. For the non-ammonia TAPs (which are primarily organics), information was sought for the specific compounds, but also for technology applicable to volatile organic compounds (VOC) as a general pollutant category. Information was obtained from the following sources:

- EPA's RACT (reasonable available control technology) /BACT (best available control technology)/LAER (lowest achievable emission rate) Clearinghouse (RBLC) database
- State and Local environmental regulatory agency databases
- EPA technical guidance documents
- EPA's *Compilation of Air Pollutant Emission Factors* (AP-42)
- Maximum Achievable Control Technology (MACT) background information documents and other reference material
- Emission control equipment vendor information
- The general technical literature

The information sources that were reviewed are listed in the Reference section.

Estimates of capital and operating costs were made primarily by using EPA's *COST-AIR* spreadsheets, adjusted as necessary for typical costs associated with equipment engineering, installation, operation, and related activities on the Hanford site. These spreadsheets are based on the cost estimating algorithms in the *EPA Air Pollution Control Cost Manual*. The spreadsheets also provide information on energy, water, fuel, water required and wastewater generated.

5.2. Detailed Evaluation for Ammonia

5.2.1 Emission Control Technologies Identified for Ammonia

The following emission control technologies have been identified for destruction or removal of ammonia:

- Absorption (scrubbing)
- Condensation

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- Adsorption
- Thermal oxidation
- Biofiltration

5.2.2 Elimination of Technically Infeasible Options for Ammonia

The only identified emission control technology that is technically infeasible for this application is condensation. This control approach reduces the temperature of the air stream below the condensation temperature of the pollutant, which is then captured and removed in the liquid phase. However, it was determined that, due to the low concentration of ammonia in the air stream, the temperature would have to be reduced to unrealistic levels for condensation to occur. Calculations of condensation temperature are in the Appendix. A temperature this low is not reasonably achievable with commercially available refrigeration equipment. Therefore, this option was eliminated from further consideration.

5.2.3 Rank Remaining Control Technologies by Control Effectiveness

The remaining control technologies are ranked in Table 5. The ranking and control effectiveness listed should be considered approximate, as these are affected by emission stream parameters, especially the inlet ammonia concentration.

Option	Control Effectiveness	Comments
Absorption (scrubbing)	90 – 99%	It is easier to achieve high control effectiveness with high inlet concentrations.
Adsorption	~98%	Typical activated carbon is not effective. Impregnated carbon, zeolites, or ion exchange resin might be used.
Thermal Oxidation	Unknown. Likely near 99% at sufficiently high temperature	Not normal ammonia control option. The nitrogen in the ammonia will be oxidized to nitrogen oxides.
Biofiltration	60 – 99%	Effectiveness varies widely, depending upon gas stream conditions and biofilter design parameters.

5.2.4 Evaluation of Absorption (Scrubbing) for Ammonia Control

Control of ammonia emissions is a very common, and effective, application of absorption technology. A typical countercurrent scrubber for gas absorption is shown in Figure 3. This configuration results in the highest ammonia removal efficiency. The EPA document *Control and Pollution Prevention Options for Ammonia Emissions* states that control efficiencies up to 99% have been achieved in practice. Various packing materials are shown in Figure 4.

FIGURE 3: TYPICAL SCRUBBER FOR AMMONIA ABSORPTION

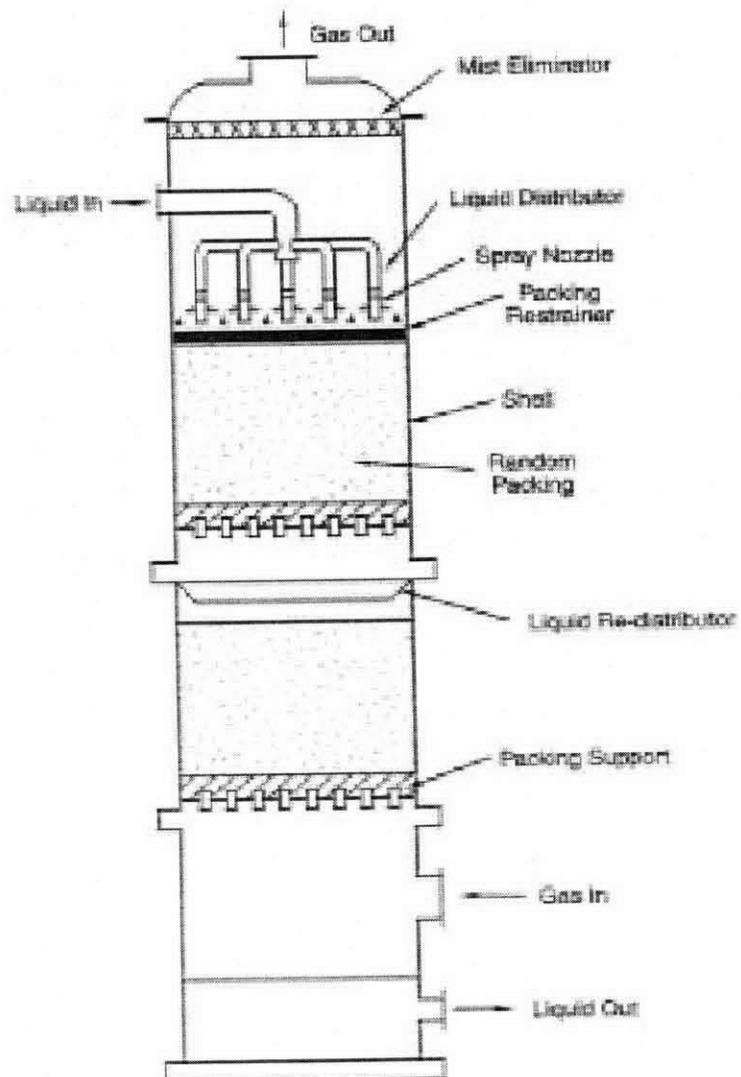
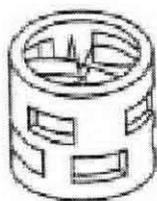
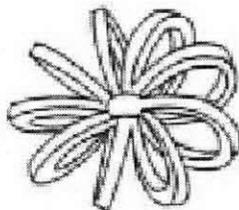


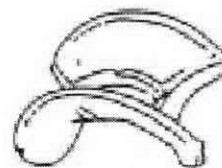
FIGURE 4: TYPICAL SCRUBBER PACKING MATERIAL



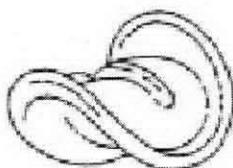
Pall Ring



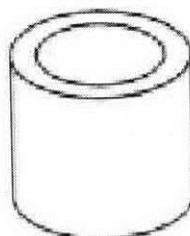
Tellerette



Intalox Saddle



Berl Saddle



Raschig Ring

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Ammonia is very soluble in water, which is the solvent typically used for ammonia scrubbing. Chemicals, such as sulfuric acid, can be added to the scrubbing solution to react with the ammonia to grossly increase the capacity for ammonia absorption into the scrubbing liquid. Depending upon the inlet ammonia concentration in the air stream, the desired outlet air stream ammonia concentration, the types and amounts of additives to the scrubbing solution, and other system parameters, some of the scrubber water can be recirculated. The amount of recirculation that can be used is limited by the concentration of ammonia in the inlet scrubber solution, which must be less than the concentration in equilibrium with the ammonia in the scrubber exhaust stream. Recirculation reduces both the amount of makeup supply water and the amount of wastewater to be treated. An alternative that is frequently implemented is to add sulfuric acid to the scrubber water, thereby converting the ammonia to soluble ammonium sulfate. This increases the allowable recirculation of the scrubbing fluid, which is limited only by the solubility of the ammonium sulfate in water.

Estimates were made of capital and operating costs for scrubbing ammonia-laden exhauster gas at removal efficiencies varying from 70% to 99%. The scrubbers were initially sized assuming that the inlet scrubbing liquid would exert no ammonia vapor pressure. This could be achieved by either using once-through water or by adding sulfuric acid to convert the ammonia to ammonium sulfate. Partial costs are summarized in Tables 6 and 7. The cost calculations are in the Appendix. These estimates include the scrubbers with usual accessories, duct, and fans. Factors typically applied to projects conducted at the Hanford Site were applied to the equipment cost to account for tasks such as installation and engineering. Costs not accounted for in the estimates included wastewater conveyance and treatment, secondary containment, heat tracing and weatherproofing, and health and safety evaluation for the sulfuric acid treatment alternative. The scrubber water would not be able to be handled by draining to the waste storage tanks or by using in retrieval operations. The total volume of all scrubber water for the once-through alternative would be about 135 gallons per minute (gpm), or about 27 gpm per tank. Scrubber water with sulfuric acid would not be allowed to enter the waste storage tanks because: 1) the tanks are made of carbon steel and acidic contents would accelerate corrosion, 2) lowering the pH of the tank contents would increase the rate of hydrogen generation, and 3) the likelihood of the tank contents reaching criticality would increase. An option would be to blowdown the scrubber liquid to dedicated onsite storage tanks and periodically transported to the effluent treatment plant (ETF). However, this would generate about 25 tons of ammonium sulfate per year. This would put the waste treatment plant at or near its capacity to handle sulfates and nitrates. Therefore, neither of these options would be technically feasible without additional cost.

Table 6: Ammonia Control Cost Summary – One Nominal 1,000 SCFM Scrubber

Removal Efficiency	Total Capital Investment	Total Annualized Cost	Cost-Effectiveness
99%	\$2,940,000	\$581,000	\$226,000/ton
95%	\$2,200,000	\$452,000	\$183,000/ton
90%	\$1,910,000	\$401,000	\$172,000/ton

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Removal Efficiency	Total Capital Investment	Total Annualized Cost	Cost-Effectiveness
80%	\$1,640,000	\$355,000	\$171,000/ton
70%	\$1,500,000	\$330,000	\$181,000/ton

Removal Efficiency	Total Capital Investment	Total Annualized Cost	Cost-Effectiveness
99%	\$6,380,000	\$1,310,000	\$339,000/ton
95%	\$4,870,000	\$1,050,000	\$283,000/ton
90%	\$4,290,000	\$947,000	\$270,000/ton
80%	\$3,760,000	\$854,000	\$274,000/ton
70%	\$3,470,000	\$804,000	\$294,000/ton

Even without all costs included, the cost-effectiveness values in Tables 6 and 7 for the range of removal efficiencies are all well above the maximum Ecology BACT ceiling level for criteria pollutants of \$10,500 per ton.

The cost-effectiveness values can also be compared to the T-BACT guidelines proposed by Ecology’s Eastern Regional Office (ERO). One proposed guideline for Class B TAPs, such as ammonia, is to multiply the BACT criteria by 5. The guideline information does not state to which BACT pollutant the multiplier should be applied. Using the range of BACT plateau (\$2,700/ton to \$5,700/ton) and ceiling (\$8,000/ton to \$10,500/ton) values as the base, the range of criteria for ammonia would be a plateau of \$13,500/ton to \$28,500/ton and a ceiling of \$40,000/ton to \$52,500/ton. All cost-effectiveness values in Table 6 for a 1,000 scfm scrubber are well above ceiling criterion determined by this method. All cost-effectiveness values in Table 7 for a 500 scfm scrubber are also well above the ceiling criterion determined by this method.

The other guideline proposed by Ecology’s ERO is to multiply the BACT cost-effectiveness criteria by the $\log(27,000/\text{ASIL})$. The ASIL for ammonia is $100 \mu\text{g}/\text{m}^3$. The adjustment factor for ammonia is 2.431:

$$\log\left(\frac{27000}{100}\right) = 2.431$$

Applying this factor to the same base values noted above results in a plateau of \$13,900/ton and a ceiling of \$25,500/ton. All cost-effectiveness values in both Tables 6 and 7 for 1,000 scfm and 500 scfm scrubbers are well above the ceiling criterion determined by this method

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An alternative scrubbing approach would be to recirculate as much scrubber water as feasible, without addition of acid. This was evaluated for the case of 90% ammonia removal. The overall costs were higher than for the once-through option because the scrubbers would need to be much larger. There would also be a substantial blowdown requirement. Although some of the non-ammonia TAPs are water soluble, the high level of recirculation of the scrubbing fluid would cause their concentrations to quickly buildup to the level where absorption would cease. Therefore, control of non-ammonia TAPs should not enter into the cost-effectiveness calculation.

The energy required to operate scrubbers would include primarily the electricity to operate fan and pump motors. The air-side pressure drop would be high enough that another fan would need to be added to supplement the fan in each existing exhaust package.

The primary environmental impact from operation of scrubbers would be the generation of a wastewater stream to be treated.

It can be concluded from this analysis that the use of scrubber technology to reduce ammonia emissions would not be economically justifiable per Ecology guidelines as T-BACT.

5.2.5 Evaluation of Adsorption for Ammonia Control

Control of ammonia emissions by adsorption is not a widespread application of this technology. The most common adsorbents for emission control are activated carbon, selected specific zeolites, or ion exchange resin. Carbon and most common zeolites are not effective at adsorbing ammonia. Clinoptilolite zeolite can adsorb ammonia. Although ion exchange could possibly work, it is not commonly practiced.

Carbon that has been impregnated with phosphoric or sulfuric acid can adsorb ammonia. Ammonia will not adsorb to the carbon, but activated carbon provides a large surface area in a relatively small volume. Ammonia will react chemically with phosphoric acid on the carbon surface to form ammonium phosphate.

Adsorption onto the surface of activated carbon or zeolites is a reversible physical process. Many commercial applications using this technology include onsite regeneration of the adsorbent. Steam or hot gas (typically nitrogen) drives the adsorbed material from the surface of the adsorbent to a recovery process, allowing the adsorbent to be used again. However, the reaction of ammonia with phosphoric acid is a non-reversible chemical process. Therefore, the impregnated carbon can be used only once and must then be discarded.

An estimate was made of capital and operating costs for adsorbing ammonia-laden exhaust gas with activated carbon impregnated with phosphoric acid. The costs and other major parameters are summarized in Tables 8 and 9. The calculations are in the Appendix. The EPA *COST-AIR* spreadsheet for carbon adsorption was revised to reflect operation with only one adsorbing vessel (no vessels for offline desorption) and for the use of carbon only once (no regeneration). This decreases the costs usually associated with onsite regeneration of adsorbent, but increases cost of adsorbent replacement and

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disposal. These cost estimates are conservatively low since they do not include the following:

- Carbon disposal
- Final decontamination and disposal of the equipment
- Duct and fan necessary to connect with exhauster system and overcome added pressure drop

Parameter	Total Capital Investment
Total Capital Investment	\$3,050,000
Total Annualized Cost	\$824,000/yr
Amount of Carbon to Disposal	52 tons/yr
Ammonia Emission Reduction	2.55 tons/yr
Cost-Effectiveness	\$324,000/ton

Parameter	Total Capital Investment
Total Capital Investment	\$7,080,000
Total Annualized Cost	\$1,510,000/yr
Amount of Carbon to Disposal	76 tons/yr
Ammonia Emission Reduction	3.8 tons/yr
Cost-Effectiveness	\$396,000/ton

This cost-effectiveness values are higher than any of the ceiling value guidance, as described in the previous section on absorption.

Many of the non-ammonia TAPs (which are primarily organics) present in the exhauster air stream would be effectively adsorbed onto activated carbon at typical ambient conditions of temperature and humidity. However, the high temperature (170 °F) of the gas stream effectively eliminates the capability of the carbon to adsorb most compounds. Therefore, control of non-ammonia TAPs should not enter into the cost-effectiveness calculation (see the discussion in Section 5.3.6 on the application of adsorption technology to non-ammonia TAPs). Conversely, the high temperature promotes the chemical reaction of ammonia and phosphoric acid, optimizing the removal of ammonia from the air stream.

T-BACT for Operations Of Waste Retrieval Systems In Single Shell Tank Farms

It can be concluded from this analysis that the use of adsorption technology to reduce ammonia emissions would not be economically justifiable per Ecology guidelines as T-BACT.

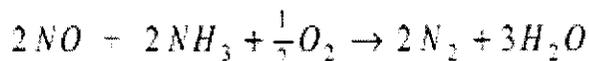
5.2.6 Evaluation of Thermal Oxidation for Ammonia Control

Ammonia vapor is a flammable gas. Therefore, thermal oxidation is a technically feasible, although not commonly used, method to use to reduce ammonia emissions. Nitrogen in ammonia would be expected to oxidize to nitrogen oxides (NOx). The hydrogen would oxidize to water vapor.

The air exhausted from the waste storage tanks also contains nitrous oxide (N₂O), in addition to the ammonia and a variety of primarily organic compounds. N₂O is not considered by Ecology to be a TAP. The N₂O in the tank exhaust air would most likely oxidize to nitric oxide (NO) in the thermal oxidizer.

The burner used for a thermal oxidizer would generate emissions from the fuel combustion. These would include NOx emissions from fixation of nitrogen in the combustion air and from oxidation of fuel-bound nitrogen (not significant for gaseous fuels).

In addition to reducing the amount of ammonia emissions by oxidizing to NOx and water vapor, there could also be some reduction of ammonia emissions through a reaction between ammonia and NO. This is the reaction that occurs in selective non-catalytic reduction (SNCR), an emission control method that uses ammonia to chemically reduce NOx to nitrogen and water vapor. The SNCR ammonia reaction equation is:



However, the SNCR reaction is effective only under specific operating conditions. Even under optimum conditions with balanced flowrates of NO and ammonia, it is seldom more than 50% efficient. There would be no control of the relative flowrates of NO and ammonia in the thermal oxidizer. Therefore, effective reduction of ammonia emissions by this mechanism is highly unlikely.

Cost-effectiveness calculations were based on an assumed 99% reduction of ammonia and non-ammonia TAP (primarily organic) emissions. This assumption results in conservatively low calculated cost-effectiveness values. However, it should be recognized that most of the nitrogen in the ammonia would be oxidized to NO and emitted. The N₂O from the tanks would also be oxidized to NO and emitted.

An estimate of capital and operating costs was made using the EPA *COST-AIR* spreadsheet for thermal oxidation with 0%, 35%, 50%, and 70% recuperative heat recovery. The 0% heat recovery case was the most cost-effective. The cost-effectiveness calculations do not take into account the fact that the oxidation of the ammonia will produce NOx emissions.

The costs and other major parameters are summarized in Tables 10 and 11. The calculations are in the Appendix. These cost estimates are conservatively low since they do not include the following:

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- Final decontamination and disposal of the equipment
- Duct and fan necessary to connect with exhauster system and overcome added pressure drop
- The additional costs for supplying and storing propane or diesel fuel. Natural gas is not available on the site.

Parameter	Value
Total Capital Investment	\$4,010,000
Heat Recovery	0%
Total Annualized Cost	\$817,000/yr
Ammonia and NOx Emission Reduction	2.98 ton/yr
Toxic Non-ammonia TAP Emission Reduction	0.38 ton/yr
Cost-Effectiveness, NH3 Only	\$316,000/ton
Cost-Effectiveness, Non-ammonia TAPs Only	\$2,180,000/ton
Cost-Effectiveness, all Pollutants	\$277,000/ton

Parameter	Value
Total Capital Investment	\$10,200,000
Heat Recovery	0%
Total Annualized Cost	\$1,860,000/yr
Ammonia and NOx Emission Reduction	4.47 ton/yr
Non-ammonia TAP Emission Reduction	0.57 ton/yr
Cost-Effectiveness, NH3 Only	\$483,000/ton
Cost-Effectiveness, Non-ammonia TAPs Only	\$3,310,000/ton
Cost-Effectiveness, all Pollutants	\$421,000/ton

The overall cost-effectiveness values are higher than any of the ceiling value guidance, as described in the previous section on absorption. It can be concluded from this analysis that the use of thermal oxidation technology to reduce ammonia emissions would not be economically justifiable per Ecology guidelines as T-BACT

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The primary environmental drawback of this option is the generation of NO_x emissions from the ammonia, tank N₂O, and from combustion of fuel in the burner. Other pollutants, such as carbon monoxide and volatile organic compounds, would also be generated from the fuel combustion.

5.2.7 Evaluation of Biofiltration for Ammonia Control

Biofiltration is known to be effective in controlling emissions of ammonia. Biofiltration involves the use of microorganisms growing in a solid media bed to remove and oxidize compounds in a contaminated airstream. A typical biofilter consists of a media bed containing contaminant degrading microorganisms, a media support structure, a foul air distribution system, and some method of controlling the biofilter moisture content. The media can consist of various materials including soil, peat, compost, sand, or synthetic material. Typically, the airstream to be treated is distributed over the bottom of the biofilter bed and forced upward through the media. The moist filter media provide physical and chemical conditions appropriate for the transfer of the contaminants from the vapor phase and support microbial biodegradation of the adsorbed contaminants.

Estimates were made of capital and operating costs for using a biofilter to control the ammonia-laden exhaust gas. The costs and other major parameters are summarized in Tables 12 and 13. Biofiltration will also reduce emissions of organics, which comprise most of the non-ammonia TAPs. Therefore, the cost data are shown for control of all TAPs. A conservatively high overall removal efficiency of 95% was assumed. The calculations are in the Appendix. The *biofiltration* sheet from the EPA *sty-cost* workbook, supplemented with standard cost factors used for construction at the Hanford site, was used. These cost estimates are conservatively low since they do not include the following:

- Media disposal
- Final decontamination and disposal of the equipment
- Duct and fan necessary to connect with exhauster system and overcome added pressure drop
- Equipment to reduce the temperature to the optimum range of 100 – 110 °F.

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Table 12: Ammonia Biofiltration Cost Summary – One Nominal 1,000 SCFM System	
Parameter	Total Capital Investment
Total Capital Investment	\$5,250,000
Total Annualized Cost	\$987,000/yr
Emission Reduction for all TAPs	2.83 ton/yr
Cost-Effectiveness on all TAPs	\$349,000/ton

Table 13: Ammonia Biofiltration Cost Summary – Three Nominal 500 SCFM Systems	
Parameter	Total Capital Investment
Total Capital Investment	\$14,600,000
Total Annualized Cost	\$2,710,000/yr
Emission Reduction for all TAPs	4.24 ton/yr
Cost-Effectiveness on all TAPs	\$639,000/ton

These cost-effectiveness values are higher than any of the ceiling value guidance, as described in the previous section on absorption.

It can be concluded from this analysis that the use of biofiltration technology to reduce ammonia emissions, or the combined emissions of all TAPs, would not be economically justifiable per Ecology guidelines as T-BACT.

5.3. Detailed Evaluation for Non-ammonia TAPs

5.3.1 Emission Control Technologies Identified for Non-ammonia TAPs

The following emission control technologies have been identified for destruction or removal of non-ammonia TAPs:

- Thermal oxidation
- Catalytic Oxidation
- Adsorption
- Absorption (scrubbing)
- Biofiltration
- Condensation

5.3.2 Elimination of Technically Infeasible Options for Non-ammonia TAPs

Absorption and condensation are considered to be technically infeasible for this application. Absorption is typically only used as an emission control technology for compounds that are water soluble. Review of the list of non-ammonia TAP compounds expected to be emitted from the exhausters indicates that there is a mix of soluble and insoluble compounds. If a scrubber, with water as the absorbing solution, were to be used to collect the water-soluble compounds, the water would have to be used on a once-through basis. The Effluent Treatment Facility (ETF) is about one mile away. This is too far to realistically pump the scrubber discharge. The quantity generated would be too large to practically truck and treat. The scrubber discharge would have to be treated onsite, probably through the use of a distillation or other recovery systems. This would be an expensive and complex system that would remove only a portion of the compounds from the air stream.

It is possible to remove non-water soluble organics from the air stream by using an organic solvent instead of water. However, this would have to be a solvent with a very low vapor pressure under the operating conditions that would be effective for most of the organic compounds. If the solvent had any appreciable vapor pressure, it could contribute to the overall organic emission rate. There would also need to be a method, probably distillation, to remove the collected organic compounds from the organic solvent so that it would be available for reuse. This system would be expensive and complicated. This option was eliminated from further consideration.

The other emission control technology that is considered to be technically infeasible for this application is condensation. This control approach reduces the temperature of the air stream below the condensation temperature of pollutant. The pollutant is then captured and removed in the liquid phase. However, it was determined that, due to the low concentration of non-ammonia TAPs in the air stream (approximately 10 ppmv on an annual average), the temperature would have to be reduced to unrealistic levels for condensation of any appreciable amount to occur. Therefore, this option was eliminated from further consideration.

5.3.3 Rank Remaining Control Technologies by Control Effectiveness

The remaining control technologies are ranked in Table 14. The ranking and control effectiveness listed should be considered approximate, as these are affected by emission stream parameters, especially the types of pollutants and their inlet concentrations.

Option	Control Effectiveness	Comments
Thermal Oxidation	98 – 99+%	Various types and degrees of heat recovery are available.
Catalytic Oxidation	98 – 99%	Various types and degrees of heat recovery are available.

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Option	Control Effectiveness	Comments
Biofiltration	60 – 99%	Effectiveness varies widely, depending upon gas stream conditions and biofilter design parameters.
Adsorption	~98%	Activated carbon, zeolites, or resins can be used as the adsorbent.

5.3.4 Evaluation of Thermal Oxidation for Control of Non-ammonia TAPs

Thermal oxidation is a common and effective means for controlling emissions of organic compounds, which comprise most of the non-ammonia TAPs. The primary variations in types of thermal oxidizer relate to the type and degree of heat recovery used. Operation of a thermal oxidizer without heat recovery is prohibitively expensive, except for applications with very high concentrations of combustible compounds in the treated gas stream.

The cost-effectiveness of this approach was determined by estimating the annualized cost from a thermal oxidizer operating at 1,600 °F, which is likely the optimum temperature for destroying a wide range of organics. This evaluation was conducted for oxidizers using both recuperative and regenerative heat recovery. The estimates were of capital and operating costs were made using the applicable EPA *COST-AIR* spreadsheets.

The costs and other major parameters are summarized in Tables 15 and 16. The calculations are in the Appendix. These cost estimates are conservatively low since they do not include the following:

- Final decontamination and disposal of the equipment
- Higher equipment costs associated with meeting standards and typical practice for operating at the Hanford site
- Duct and fan necessary to connect with exhauster system and overcome added pressure drop

Type of Heat Recovery	Amount of Heat Recovery	Total Capital Investment	Cost-Effectiveness
Recuperative	0	\$4,010,000	\$2,180,000/ton
Recuperative	35%	\$5,850,000	\$2,980,000/ton
Recuperative	50%	\$6,940,000	\$3,460,000/ton
Recuperative	70%	\$8,530,000	\$4,170,000/ton

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Type of Heat Recovery	Amount of Heat Recovery	Total Capital Investment	Cost-Effectiveness
Recuperative	0	\$10,200,000	\$3,310,000/ton
Recuperative	35%	\$14,500,000	\$4,620,000/ton
Recuperative	50%	\$17,300,000	\$5,470,000/ton
Recuperative	70%	\$21,200,000	\$6,670,000/ton

These cost-effectiveness values for all of the thermal oxidation alternatives are higher than the maximum Ecology BACT ceiling level for volatile organic compounds (VOC) of \$8,000 per ton.

The cost-effectiveness values can also be compared to the T-BACT guidelines proposed by Ecology's ERO. One proposed guideline is to multiply the BACT criteria for Class A TAPs by 10 and the criteria for Class B TAPs by 5. It is assumed that the multipliers would be applied to the VOC BACT criteria, since the non-ammonia TAPs are primarily organic and, therefore, are a subset of VOC. Using this approach, the criteria for Class A non-ammonia TAPs would be a plateau of \$35,000/ton and a ceiling of \$80,000/ton. The criteria for Class B non-ammonia TAPs would be a plateau of \$17,500/ton and a ceiling of \$40,000/ton. The non-ammonia TAPs emitted from the SSTs will be a mix of Class A and Class B. It is assumed that the criteria for the mixture would be determined by weighting according to mass fraction. The estimated annual non-ammonia TAP emissions are 249 pounds of Class A and 3,540 pounds of Class B. The weighted criteria would be:

$$\text{Plateau} = \$18,650/\text{ton} \left[(\$35,000)(249/3789) + (\$17,500)(3540/3789) \right] = \$18,650$$

$$\text{Ceiling} = \$42,629/\text{ton} \left[(\$80,000)(249/3789) + (\$40,000)(3540/3789) \right] = \$42,629$$

All cost-effectiveness values in Table 15 for a 1,000 scfm thermal oxidizer are higher than the ceiling criterion determined by this method. All cost-effectiveness values in Table 16 for a 500 scfm thermal oxidizer are also higher than the ceiling criterion determined by this method. Therefore, thermal oxidation would not be considered economically justifiable per Ecology guidelines by this method of evaluation.

The other guideline proposed by Ecology's ERO is to multiply the BACT cost-effectiveness criteria by the $\log(27,000/\text{ASIL})$. This adjustment was calculated for each non-ammonia TAP and the overall adjustment to be applied to the criteria was determined by weighting, as described in the previous paragraph. The resulting overall adjustment factor is 1.66. Therefore, the weighted criteria determined by this method would be:

$$\text{Plateau} = \$5,810/\text{ton} \quad (\$3,500 \times 1.66 = \$5,810)$$

$$\text{Ceiling} = \$13,280/\text{ton} \quad (\$8,000 \times 1.66 = \$13,280)$$

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All cost-effectiveness values in Table 15 for a 1,000 scfm thermal oxidizer are higher than the ceiling criterion determined by this method. All cost-effectiveness values in Table 16 for a 500 scfm thermal oxidizer are also higher than the ceiling criterion determined by this method. Therefore, thermal oxidation would not be considered economically justifiable per Ecology guidelines by this method of evaluation.

It should also be noted that this option would result in emissions of products of incomplete combustion, such as NO_x, carbon monoxide (CO), and volatile organic compounds (VOC) generated by the fuel. Also, the chlorine which is contained in some of the chlorinated organic compounds would be converted to hydrogen chloride in the exit gas. Chloride also introduces the possibility of the formation of minute concentrations of dioxins.

It can be concluded from this analysis that the use of thermal oxidation technology to reduce non-ammonia TAP compound emissions would not be economically justifiable per Ecology guidelines as T-BACT.

5.3.5 Evaluation of Catalytic Oxidation for Control of Non-ammonia TAPs

Catalytic oxidation is also a common and effective means for controlling emissions of organic compounds, which comprise most of the non-ammonia TAPs. It is similar to thermal oxidation, except that combustion is promoted through the use of a catalyst. This allows oxidation of the pollutants to proceed at a lower temperature. A catalytic oxidation temperature of 900 °F is typical. The lower temperature, compared to the temperature of thermal oxidation, results in a lower fuel requirement. Generation of NO_x is also lower at the reduced temperature. As with thermal oxidation, the primary variations in types of catalytic oxidizer relate to the type and degree of heat recovery used.

The cost-effectiveness of this approach was determined by estimating the annualized cost from a thermal oxidizer operating at 900°F, which is likely the optimum temperature for destroying a wide range of organics. This evaluation was conducted for oxidizers using various degrees of recuperative heat recovery. The estimates were of capital and operating costs were made using the applicable EPA *COST-AIR* spreadsheets.

The costs and other major parameters are summarized in Tables 17 and 18. The calculations are in the Appendix. These cost estimates are conservatively low since they do not include the following:

- Final decontamination and disposal of the equipment
- Higher equipment costs associated with meeting standards and typical practice for operating at the Hanford site
- Duct and fan necessary to connect with exhauster system and overcome added pressure drop

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Type of Heat Recovery	Amount of Heat Recovery	Total Capital Investment	Cost-Effectiveness
Recuperative	0	\$3,670,000	\$2,050,000/ton
Recuperative	35%	\$4,780,000	\$2,570,000/ton
Recuperative	50%	\$4,230,000	\$2,300,000/ton
Recuperative	70%	\$4,790,000	\$2,560,000/ton

Type of Heat Recovery	Amount of Heat Recovery	Total Capital Investment	Cost-Effectiveness
Recuperative	0	\$7,830,000	\$2,990,000/ton
Recuperative	35%	\$10,840,000	\$3,950,000/ton
Recuperative	50%	\$8,910,000	\$3,310,000/ton
Recuperative	70%	\$10,030,000	\$3,660,000/ton

These cost-effectiveness values for all of the catalytic oxidation alternatives are higher than any of the ceiling value guidance, as described previously.

It should also be noted the chlorine which is contained in some of the chlorinated toxic organic compounds can poison some catalyst materials, causing reduction in their effectiveness. Mist droplets in the feed can destroy the catalyst too.

It can be concluded from this analysis that the use of catalytic oxidation technology to reduce non-ammonia TAP compound emissions would not be economically justifiable per Ecology guidelines as T-BACT.

5.3.6 Evaluation of Biofiltration for Non-ammonia TAP Control

Costs were estimated for the use of biofiltration to control emissions of ammonia and non-ammonia TAPs in Section 5.2.7. The costs are summarized in Tables 12 and 13. These cost-effectiveness values are higher than any of the ceiling value guidance, as described in previous sections.

It can be concluded from this analysis that the use of biofiltration technology to reduce non-ammonia TAP emissions, or the combined emissions of all TAPs, would not be economically justifiable per Ecology guidelines as T-BACT.

5.3.7 Evaluation of Adsorption for Non-ammonia TAP Control

Control of non-ammonia TAP emissions (which are primarily organic) by adsorption is a widespread and effective application of this technology. The most common adsorbents

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for emission control are activated carbon and zeolites. The effectiveness of these materials is dependent upon the characteristics of the individual compound, such as their boiling points.

One limitation on the performance of either activated carbon or zeolites is that their capacity to adsorb decreases significantly with high temperature, high moisture content, and low inlet concentration. The exhaust air stream is at high temperature (170 °F), fairly high humidity (61% relative humidity), and low inlet concentration (10 ppmv). In order to estimate the cost-effectiveness for a reasonable condition, the cost of an air-cooled heat exchanger was included in the analysis. This would allow the air stream temperature to be reduced to about 120 °F.

Adsorption onto the surface of activated carbon or zeolites is a reversible physical process. Many commercial applications using this technology include onsite regeneration of the adsorbent. Steam or hot gas (typically nitrogen) drives the adsorbed material from the surface of the adsorbent to a recovery process, allowing the adsorbent to be used again. The cost estimate included the cost of equipment to allow onsite regeneration using steam. However, the cost of equipment to recover the organics from the condensed stream, or to treat as a waste, was not included.

An estimate was made of capital and operating costs using the applicable EPA *COST-AIR* spreadsheet for carbon adsorption. The costs and other major parameters are summarized in Tables 19 and 20. The calculations are in the Appendix. These cost estimates are conservatively low since they do not include the following:

- Final adsorbent disposal
- Final decontamination and disposal of the equipment
- Higher equipment costs associated with meeting standards and typical practice for operating at the Hanford site
- Duct and fan necessary to connect with exhauster system and overcome added pressure drop
- Supplying steam for carbon regeneration
- Recovery or disposal of the organic/water mixture recovered after regeneration of the adsorbent.

Parameter	Total Capital Investment
Total Capital Investment	\$5,430,000
Total Annualized Cost	\$1,055,000/yr
Non-ammonia TAP Emission Reduction	0.38 ton/yr
Cost-Effectiveness	\$2,840,000/ton

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Parameter	Total Capital Investment
Total Capital Investment	\$13,400,000
Total Annualized Cost	\$2,490,000/yr
Non-ammonia TAP Emission Reduction	0.57 ton/yr
Cost-Effectiveness	\$4,470,000/ton

These cost-effectiveness values are higher than any of the ceiling value guidance, as described previously.

It can be concluded from this analysis that the use of adsorption technology to reduce non-ammonia TAP compound emissions would not be economically justifiable per Ecology guidelines as T-BACT.

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6.0 REFERENCES

- 00-05-006, 2001, *Hanford Air Operating Permit*, Washington State Department of Ecology, Olympia, Washington.
- AMCA 99, 1999, *Standards Handbook*, Air Movement and Control Association International, Inc., Arlington Heights, Illinois
- ANSI/ASME AG-1, 1997, *Code on Nuclear Air and Gas Treatment*, American Society of Mechanical Engineers, New York, New York.
- 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.
- ANSI/ASME N509, 1980, *Nuclear Power Plant Air Cleaning Units and Components*, American National Standards Institute/American Society of Mechanical Engineers, New York, New York.
- EPA, 1990, *New Source Review Workshop Manual – Prevention of Significant Deterioration and Nonattainment Area Permitting*, US Environmental Protection Agency
- EPA, CICA Fact Sheet, Packed-Bed/Packed-Tower Wet Scrubber
- EPA, CICA Fact Sheet, Spray-Chamber/Spray-Tower Wet Scrubber
- EPA, *Compilation of Air Pollutant Emission Factors*, AP-42, Fifth Edition, Volume 1
- EPA-452/F-03-018, CICA Fact Sheet, Catalytic Incinerator
- EPA-452/F-03-019, CICA Fact Sheet, Flare
- EPA-452/F-03-020, CICA Fact Sheet, Incinerator – Recuperative Type
- EPA-452/F-03-021, CICA Fact Sheet, Regenerative Incinerator
- EPA-452/F-03-022, CICA Fact Sheet, Thermal Incinerator
- EPA, February 1996, *COST-AIR Control Cost Spreadsheets*, US Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina
- EPA/452/B-02-001, January 2002, *EPA Air Pollution Control Cost Manual*, Sixth Edition, US Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina

T-BACT for Operations Of Waste Retrieval Systems In Single Shell Tank Farms

EPA 456/F-98-004, July 1998, *TECHNICAL BULLETIN – ZEOLITE – A VERSATILE AIR POLLUTANT ADSORBER*, US Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina

EPA 456/F-99-004, May 1999, *TECHNICAL BULLETIN – CHOOSING AN ADSORPTION SYSTEM FOR VOC: CARBON, ZEOLITE, OR POLYMERS?*, US Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina

EPA-456/R-95-002, April 1995, *Control and Pollution Prevention Options for Ammonia Emissions*, US Environmental Protection Agency, Office of Air Quality Planning and Standards and Office of Research and Development, Research Triangle Park, North Carolina

EPA 456/R-01-004, December 2001, *TECHNICAL BULLETIN – REFRIGERATED CONDENSERS FOR CONTROL OF ORGANIC AIR EMISSIONS*, US Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina

EPA/625/6-91/014, June 1991, *Handbook – Control Technologies for Hazardous Air Pollutants*, US Environmental Protection Agency, Office of Research and Development, Washington, D.C.

EPA RACT (reasonably available control technology)/BACT (best available control technology)/LAER (lowest achievable emission rate) Clearinghouse (<http://cfpub1.epa.gov/rblc/cfm/basicsearch.cfm>)

Kohl and Riesenfeld, September 1979, *Gas Purification*, Third Edition

Perry and Chilton, 1973, *Chemical Engineers' Handbook*, Fifth Edition, 1973

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.

Attachment 2
08-ESQ-015

Air Operating Permit Number 00-55-006 Amendment

HANFORD SITE AIR OPERATING PERMIT

Notification of Administrative Permit Amendment

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

This change is allowed pursuant to WAC 173-401-720(1) and WAC 173-401-720(2):

1. Corrects typographical errors,
2. Identifies a change in the name, address, or phone number of any person identified in the permit, or provides a similar minor administrative change at the source,
3. Requires more frequent monitoring or reporting by the permittee,
4. Allows for a change in ownership or operational control of a source where the permitting authority determines that no other change is necessary, provided that a written agreement containing the specific information of the transfer between the current and new permittee has been submitted to the permitting authority,
5. Incorporates into the chapter 401 permit the terms, conditions, and provisions from orders approving notice of construction applications processed under an EPA-approved program; provided that the program meets procedural requirements listed in WAC 173-401, and
6. Changes addressed in the administrative permit amendment can be implemented immediately upon submittal.

Permit Number: 00-05-006

Provide the following information pursuant to WAC-173-401-720:

Description of the change:

This revises and supercedes the *Notice of Construction for Ventilation Upgrades for 241-AY and 241-AZ Tank Farms Ventilation Upgrades, March 1994*, amending the limit of 0.05 lbs/hr for ammonia emissions, cited in Condition 1.0 of Approval Order 94-07, and eliminating the use of a HEGA filter on the ventilation system. The title has been changed to *Criteria and Toxic Air Pollutant Air Emissions Notice of Construction Application for 241-AY and 241-AZ Tank Farms Exhauster* to more accurately designate the content of the document.

The source term and corresponding emission estimates have been updated, including ammonia, to reflect recently acquired sampling data as well as the impacts of ongoing waste material transfers.

No new construction activities, nor process changes, will take place as a result of this amendment; and no actual emission increases of Criteria Air Pollutants nor Toxic Air Pollutants are expected as a result of the changes.

T-BACT is proposed to be operation of the standard exhauster configuration (condenser, HEME, preheater, HEPA filters, fan, stack with monitoring instrumentation).

Submittal Date of Change:

Upon approval of modification.

Describe the emissions from orders approving notice of construction applications processed

under an EPA-approved program; provided that the program meets procedural requirements listed in WAC 173-401:

Estimated emissions remain below Small Quantity Emission Rates as identified in WAC 173-460-080 and dispersed emission concentrations remain below their respective ASILs as defined in WAC 173-460-150 and -160.

The annual average total calculated VOCs were 0.08 lbs/hour or 711 lbs/year (3.1E-01 tons/yr). Calculated ammonia emissions were 0.45 lbs per hour or 3,000 lbs/yr (1.5E00 tons/yr). Currently the HEGA offers approximately 1% abatement of Ammonia and VOCs, both of which are currently and potentially below SQERs and Threshold limits as defined by WAC 173-400-110.

Emission concentrations for the TAPs were estimated using dispersion modeling unit concentration dispersion factors developed with AERMOD. Concentration factors for 24-hour and annual average releases in both the 200 East and 200 West Areas were developed. Averages are based on Hanford Site wind data collected from 2000 through 2005. For conservatism the resulting maximum factor for East Area of 0.05979 was applied to stack emissions to estimate the annual average contaminant concentrations and 1.81318 for a 24 hour average concentration at the Hanford Site boundary. These factors were multiplied by the emissions in g/s. The results give pollutant concentrations at the Site boundary in micrograms per cubic meter. The location on the Site boundary for the East Area with the highest potential impact was determined to be 15 kilometer (9.3 miles) in the east direction.

List the terms, conditions, and provisions from orders approving notice of construction applications processed under an EPA-approved program; provided that the program meets procedural requirements listed in WAC 173-401:

Agency provides.

For Hanford Site Use Only:

AOP Change Control Number:

Date: