DOE/RL-95-62
Revision 1

UC-630

Nonradioactive Air Emissions Notice of Construction Project W-320, 241-C-106 Tank Sluicing

Date Published
October 1996

United States
Department of Energy
P.O. Box 550
Richland, Washington 99352

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DISCLM-5.CHP (8-91)

REVISION HISTORY

All changes made in Revision 1 are noted by a vertical bar in the left margin, adjacent to section that was revised.

Revision 1 to this Notice of Construction has been made to:

(1) Document the results of changing the previous headspace aerosol characterization to reflect the use of 241-AY-102 tank supernate instead of conditioned water for sluicing operations. This minor process change will minimize waste volume and does not measurably affect the toxic pollutant emission rates that were approved in Revision 0.

(2) Include updated information regarding the concentration of organic pollutants. This change results in an increase in predicted emissions compared to Revision 0.

(3) Reflect the current thinking regarding the potential for small amounts of gaseous air pollutants to be emitted as sluicing operations occur in 241-C-106 tank. This change also represents an increase in predicted emissions compared to Revision 0.

Tank waste characterization is a continuing effort and as new information becomes available, periodic updates to this (and other) Notices of Construction could become necessary. Despite the increase in predicted emissions resulting from items (2) and (3), calculations show that emissions for all pollutants are within their respective small quantity emission rates.

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FIGURES

TABLES

METRIC CONVERSION CHART

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

Into metric units | Out of metric units

If you know	Multiply by	To get	If you know	Multiply by	To get
Length			**Length**		
inches	25.40	millimeters	millimeters	0.0393	inches
inches	2.54	centimeters	centimeters	0.393	inches
feet	0.3048	meters	meters	3.2808	feet
yards	0.914	meters	meters	1.09	yards
miles	1.609	kilometers	kilometers	0.62	miles
Area			**Area**		
square inches	6.4516	square centimeters	square centimeters	0.155	square inches
square feet	0.092	square meters	square meters	10.7639	square feet
square yards	0.836	square meters	square meters	1.20	square yards
square miles	2.59	square kilometers	square kilometers	0.39	square miles
square miles	259	hectares	hectares	0.00391	square miles
acres	0.404	hectares	hectares	2.471	acres
Mass (weight)			**Mass (weight)**		
ounces	28.35	grams	grams	0.0352	ounces
pounds	0.453	kilograms	kilograms	2.2046	pounds
short ton	0.907	metric ton	metric ton	1.10	short ton
Volume			**Volume**		
fluid ounces	29.57	milliliters	milliliters	0.03	fluid ounces
quarts	0.95	liters	liters	1.057	quarts
gallons	3.79	liters	liters	0.26	gallons
cubic feet	0.03	cubic meters	cubic meters	35.3147	cubic feet
cubic feet per minute	0.02832	cubic meters per minute			
cubic yards	0.76	cubic meters	cubic meters	1.308	cubic yards
Temperature			**Temperature**		
BTU/hour	2.93 E-4	kilowatts			
Fahrenheit	subtract 32 then multiply by 5/9ths	Celsius	Celsius	multiply by 9/5ths, then add 32	Fahrenheit

NONRADIOACTIVE AIR EMISSIONS
NOTICE OF CONSTRUCTION
PROJECT W-320, 241-C-106 TANK SLUICING

1.0 INTRODUCTION

This document serves as a Notice of Construction for the Phase II activities of Project W-320, 241-C-106 Tank Sluicing, pursuant to the requirements of Washington Administrative Codes (WAC) 173-400 and 173-460. Phased permitting for Project W-320 was discussed with the Washington State Department of Ecology (Ecology) on November 2, 1993. In April 1994, it was deemed unnecessary because the Phase I activities did not constitute a new source of emissions and therefore did not require approval from Ecology.

The 241-C-106 tank is a 2-million liter capacity, single-shell tank (SST) used for radioactive waste storage since 1947. Between mid-1963 and mid-1969, 241-C-106 tank received high-heat waste, PUREX (plutonium-uranium extraction) Facility high-level waste, and strontium-bearing solids from the strontium and cesium recovery activities. In 1971, temperatures exceeding 99°C were observed in the tank, and therefore, a ventilation system was installed to cool the tank. In addition, approximately 22,712 liters of cooling water are added to the tank each month to prevent the sludge from drying out and overheating. Excessive drying of the sludge could result in possible structural damage. The current radiolytic heat generation rate has been calculated at 32 kilowatts (kW) plus or minus 6 kW (WHC 1993b). The 241-C-106 tank was withdrawn from service in 1979 and currently is categorized as 'not leaking'.

The heat generation in 241-C-106 tank has been identified as a key safety issue on the Hanford Site (WHC 1991). The evaporative cooling provided by the added water during operation and/or sluicing maintains the 241-C-106 tank within its specified operating temperature limits. Project W-320, "241-C-106 Tank Sluicing", will mobilize and remove the heat-generating sludge, allowing the water additions to cease. Following sludge removal, the 241-C-106 tank could be placed in a safe, interim stabilized condition. Tank-to-tank sluicing, an existing, proven technology, will provide the earliest possible closure of this safety issue. The sluicing will also fulfill a *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement) (Ecology et al. 1996) milestone to resolve the high-heat issue and demonstrate waste retrieval. The waste will be transferred to 241-AY-102 tank, a double-shell tank (DST) with greater heat load capacity than the 241-C-106 tank.

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2.0 FACILITY IDENTIFICATION AND LOCATION

U.S. Department of Energy, Richland Operations Office
Hanford Site
200 East Area, 241-C Tank Farm, 241-C-106 Tank
Richland, Washington 99352

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

Mr. Mike Royack, Director
Tank Operations Division
U.S. Department of Energy, Richland Operations Office
P.O. Box 550
Richland, Washington 99352
(509) 376-0933.

Project W-320 will affect both the 241-C Tank Farm and the 241-AY Tank Farm. Emissions increased over current routine operations will occur only at the 241-C Tank Farm. Both Tank Farms are located in the 200 East Area of the Hanford Site. The C Tank Farm is due north of the PUREX Facility and the AY Tank Farm is northeast of the PUREX Facility. Figure 2-1 shows the location of the 200 East Area within the Hanford Site and Figure 2-2 shows the location of the 241-AY and 241-C Tank Farms and the 241-C-106 tank within the 200 East Area.

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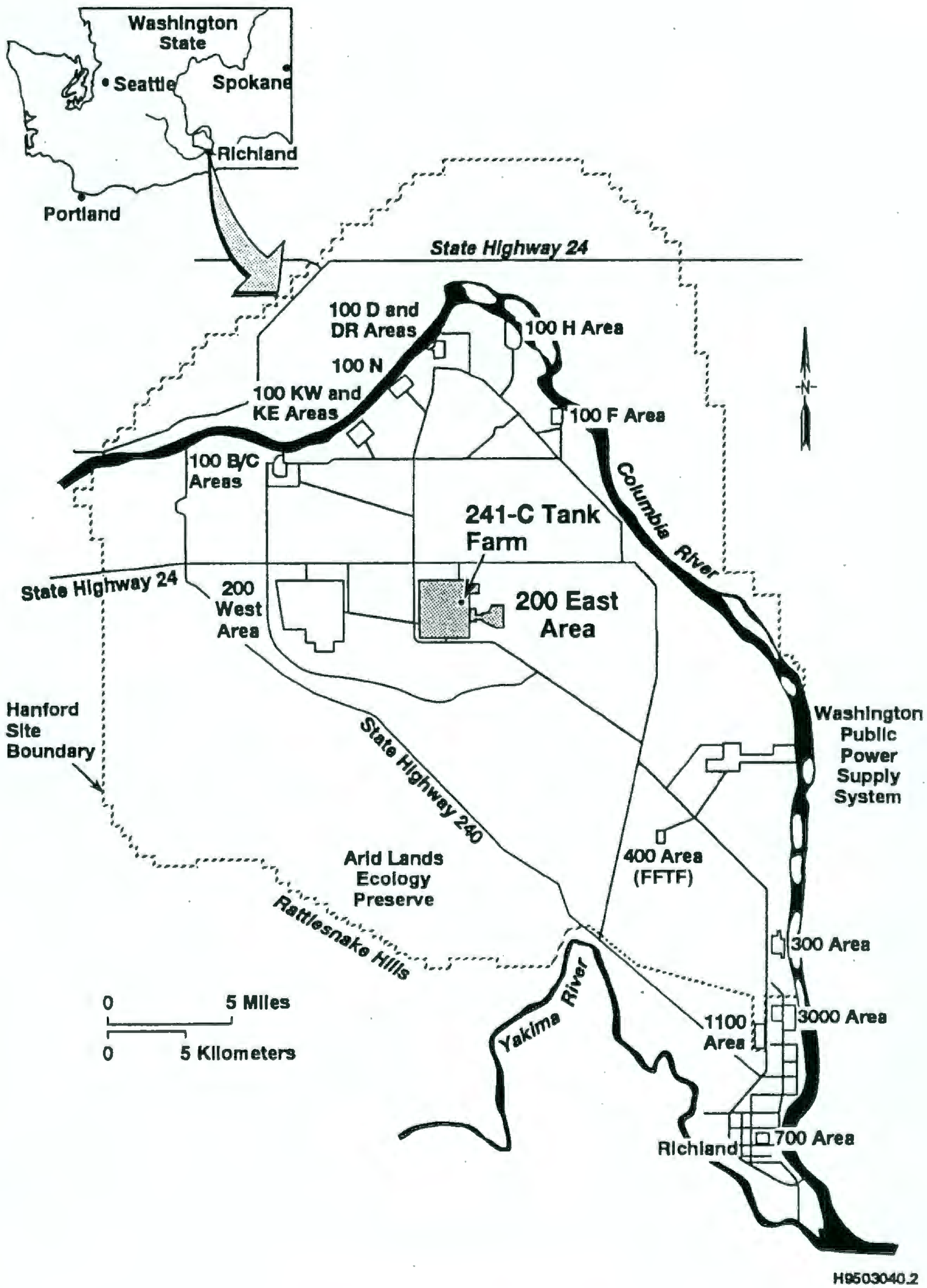

Figure 2-1. Hanford Site.

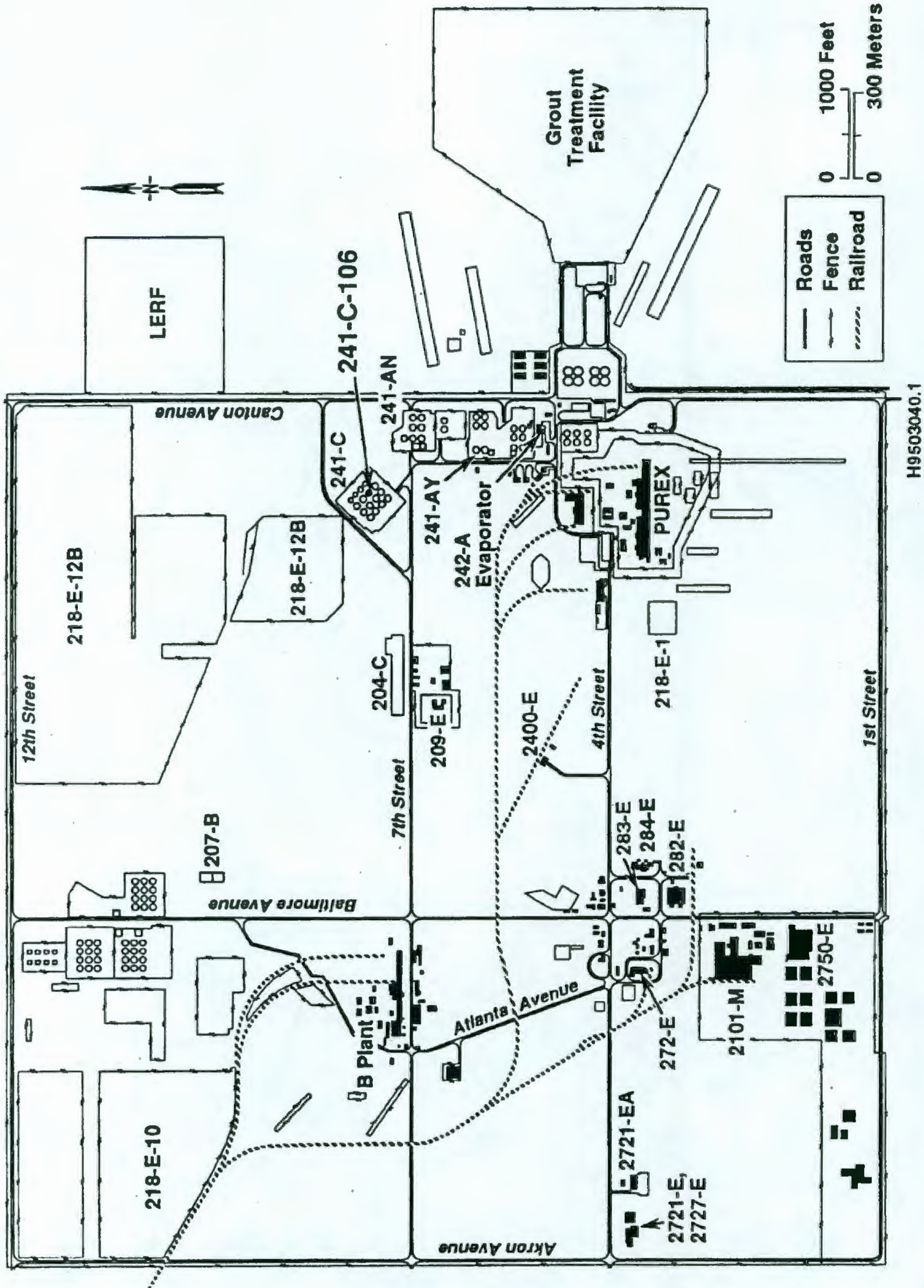

Figure 2-2. Location of 241-C-106 Tank within the 200 East Area.

3.0 PROJECT INFORMATION

The 241-C-106 tank is 23.6 meters in diameter and constructed of reinforced concrete with a carbon-steel liner on the bottom and sides with a 30.5-centimeter-deep dished bottom and a useable waste depth of approximately 4.9 meters at the sidewall. The dome is constructed of 38.1-centimeter-thick reinforced concrete.

3.1 PROCESS DESCRIPTION

The 241-C-106 tank waste retrieval sluicing system (WRSS) is designed to remove the sludge and transport the material to the 241-AY-102 DST through the use of one of two new, temporary, neargrade, bermed, double-encased transfer lines. The pipelines each will be 4 inches in diameter and will run in parallel for approximately 0.4 kilometers to connect the two tanks. The minimum design life of the process and ventilation equipment is 2 years. Figure 3-1 provides a view of the 241-C-106 tank with the sluicing equipment installed. The scope of the WRSS for the 241-C-106 tank includes the following functions (WHC 1994a):

- Mobilizing and retrieving waste in 241-C-106 tank
- Conveying waste out of 241-C-106 tank
- Transferring waste to the 241-AY-102 at a controllable rate
- Confining and filtering airborne hazardous and radionuclide particulate and vapors from 241-C-106 tank by use of a new ventilation system
- Removing heat as required to maintain safe temperature levels in 241-C-106 tank
- Monitoring and controlling operations
- Shielding operations and maintenance actions.

The liquid used for sluicing the waste from the 241-C-106 tank has been changed from corrosion-inhibited water to liquid waste (supernate) in the 241-AY-102 tank. This change in sluicing liquid was made to minimize waste volume. Comparison of analytical data from samples taken from both 241-C-106 and 241-AY-102 tanks has verified the combined waste from the tanks is compatible. The change in sluicing liquids from corrosion-inhibited water to supernate from the 241-AY-102 tank has no measurable increase in the concentration of toxic air pollutants in the stream aerosol in the 241-C-106 tank because supernate in the 241-AY-102 tank is 99.2 percent water. Therefore, no measurable increase in abated or unabated emissions are attributed to this change.

Before beginning sluicing operations, the amount of waste currently in the 241-AY-102 tank will be reduced by pumping to another DST to make room for the 241-C-106 tank waste to be recovered by sluicing operations. When sluicing operations begin, the supernate level in the 241-AY-102 tank will be low enough so that most of the solids in 241-C-106 plus the anticipated liquid additions (e.g., line flushes) can be accommodated in the 241-AY-102 tank. If the liquid volume additions preclude this, the sluicing operations will be stopped to let the solids settle in the 241-AY-102 tank. Subsequently, the excess liquid will be transferred from the 241-AY-102 tank into an alternate DST.

During the initial operations of the WRSS, the 241-C-106 tank slurry pump will be raised to pump liquids with low solids content. While monitoring instrumentation, the pump will be lowered until the desired slurry concentration is achieved. This will ensure that the initial, very-high solids content slurry does not plug the transfer line to the 241-AY-102 tank.

The variable speed sluice pump in the 241-AY-102 tank will be started simultaneously with slurry pump in 241-C-106 tank to provide fluid to the 241-C-106 tank sluicer. The main purpose of having a variable speed slurry pump will be to help maintain a minimum liquid 'heel' in the 241-C-106 tank.

An in-tank imaging system that provides near real-time pictures of waste-surface-contour depictions during sluicing operations will be used to help control and direct the sluicing operations.

This closed-loop sluicing technique, using a high-volume (1,324 liters per minute), low-pressure (2,206 kilopascals) stream of liquid, will break up and remove the sludge while minimizing the potential for leakage. The waste solids against the tank walls will not be sluiced until the sluicing operations are nearing completion. This will minimize the potential for the sluicing stream to cause a leak by impinging on a weak point in the tank wall or by potentially opening a corroded or a sludge-plugged area.

Before sluicing operations begin, the sluicer will be used to excavate a cavity in the waste into which the slurry pump will be lowered. After the minimum liquid volume required to maintain effective slurry pump operations is determined, by using the in-tank imaging system and evaluating the characteristics of the pump, sluicing operations will begin. The direction of the sluicer will be controlled from the sluicing control station using the in-tank imaging system and a simple controller to aim the sluicer. Sluicing will be accomplished with the sluicer located on the opposite side of the tank from the pump to create channels in the waste, which will direct the flow of waste to the intake of the slurry pump.

3.2 VENTILATION AND EMISSIONS CONTROL SYSTEM DESCRIPTION

The ventilation system will be designed to remove process and radiogenic heat during waste retrieval, maintain a negative pressure on the tank, control emissions to the atmosphere, and handle an aerosol mass loading of 313 milligrams per cubic meter.

Approximately 29.5 to 34.6 cubic meters per minute of air will be withdrawn from the tank headspace. The air stream will flow through a condenser and be split, with approximately 24.4 cubic meters per minute being returned to the tank headspace through a demister and a preheater to decrease the humidity of the air stream and to add cooled air to the headspace to balance the heat energy added by the slurry pump. The remaining flow (nominally, 6.5 cubic meters per minute with a maximum of 10.2 cubic meters per minute) will be exhausted through the emissions control system consisting of a high-efficiency mist eliminator (HEME), a high-efficiency metal filter (HEMF), a heater, and two high-efficiency particulate air (HEPA) filters before discharge to the atmosphere. Figure 3-2 shows the process flow diagram of the ventilation and emissions control systems. The condenser and demister are part of the process and will not be part of the emissions control system because the material collected will be returned to the tank. The primary function is to support the sluicing process rather than emissions control. Operations will depend on these components to maintain the visibility in the tank headspace, allowing use of the in-tank imaging system.

The ventilation system will run under one of two modes: sluicing-operation or sluicing-shutdown. The operations mode will require the ventilation system to operate at its nominal design capacity of 6.5 cubic meters per minute. During periods of shutdown, for maintenance activities requiring a higher ventilation capacity than can be provided by the sluicing vent system to maintain a negative pressure on the tank, the sluicing vent system will be turned off and the tank will be exhausted through the existing vent system.

The existing vent system pulls air, from both 241-C-106 and 241-C-105 tanks, through inlet assemblies, which consists of a prefilter and a HEPA filter on each tank. The air exits 241-C-105 tank at 33.98 cubic meters per minute and 241-C-106 tank at 65.14 cubic meters per minute. The two streams are combined and 99.12 cubic meters per minute of air is routed through a deentrainer, a heater, a roughing filter, and two HEPA filters in series before entering the fan and exhausting through a 40.64-centimeter diameter, 4.41-meter high stack. The measured, average stack flow rate is 95.35 cubic meters per minute and the average exhaust temperature is 54.4°C. The stack is equipped with sample probes for continuous air monitoring and record sampling.

3.2.1 Stack Description

The WRSS stack will be 4.9 meters high with a 15.2-centimeter diameter duct. The average stack temperature will be approximately 21°C. The nominal exhaust rate will be approximately 6.5 cubic meters per minute.

3.2.2 Control Equipment Efficiencies

Particulate emissions will be controlled with a HEME, a HEMF, and two HEPA filters. The controls are used primarily to control radionuclide pollutants. The HEME is assumed to provide complete removal of entrained water, and has a removal efficiency of 93 percent for particulates 3 microns and larger. The HEMF and HEPA filters are each assumed to be 99.95 percent efficient for the removal of particulates that are 0.3 microns and larger. The HEMFs are considered more efficient at particulate removal than HEPA filters (99.99 percent for 0.1 microns); however, for conservatism, the HEMF is considered as being no more efficient than a HEPA.

To determine the overall particulate decontamination factor (DF) for the control system, the individual component DFs were multiplied together. A DF of 2,000 was used for the HEMF and each HEPA filter and a DF of 14 was used for the HEME. The overall DF is 1.1 E+11.

No controls are proposed for nonparticulate emissions.

3.3 MONITORING DESCRIPTION

The sampling and monitoring system will be designed to collect particulate samples isokinetically per ANSI N13.1 and with a minimum sample collection efficiency for 10 micron sized particles of 50 percent. The sample probes will be located in the stack per 40 CFR 60, Appendix A, Method 1. Stack flow measurement will be via an automated system that will be certified accurate in accordance with 40 CFR 52, Appendix E. This automated system will use multi-point differential pressure arrays with temperature sensors for mass flow compensation. The stack flow rate, in addition to providing totalized data for emission calculations, will be used to automatically adjust and ensure the sample flow is isokinetic to within plus or minus 10 percent. Flow measurement accuracy will be equal to, or better than, plus or minus 2 percent of the reading over a 10:1 range plus 1/2 percent full scale over the operating temperature range. Overall, the air sampling system will meet the requirements of ANSI N13.1, ANSI N42.18, 40 CFR 52, Appendix E, and 40 CFR 60, Appendix A. The sampler will operate continuously and will be calibrated and audited in accordance with current onsite procedures. In addition, for operational purposes, the stack will contain a monitor for beta and gamma radiation.

The monitoring system is being put in place in accordance with radioactive air emission regulations. No sampling is required for nonradioactive air emissions because all contaminant emissions are below their respective small quantity emission rates or below their acceptable source impact level at the point of emission as opposed to the boundary of the Hanford Site. However, organic vapor analyzers (OVAs), or similar instruments for detecting fugitive organic emissions, as part of Hanford's Industrial Hygiene program to monitor worker exposure, will be used to monitor for volatile organic compounds (VOCs) a minimum of three times as follows:

1) Once before sluicing operations begin.
2) Once during sluicing operations, and
3) Once after sluicing operations are completed.

As discussed in Section 4.0 of this NOC, significant quantities of VOCs are not expected. The data obtained in the course of monitoring worker exposure will be used to verify VOC emissions are less than 50 parts per million (ppm).

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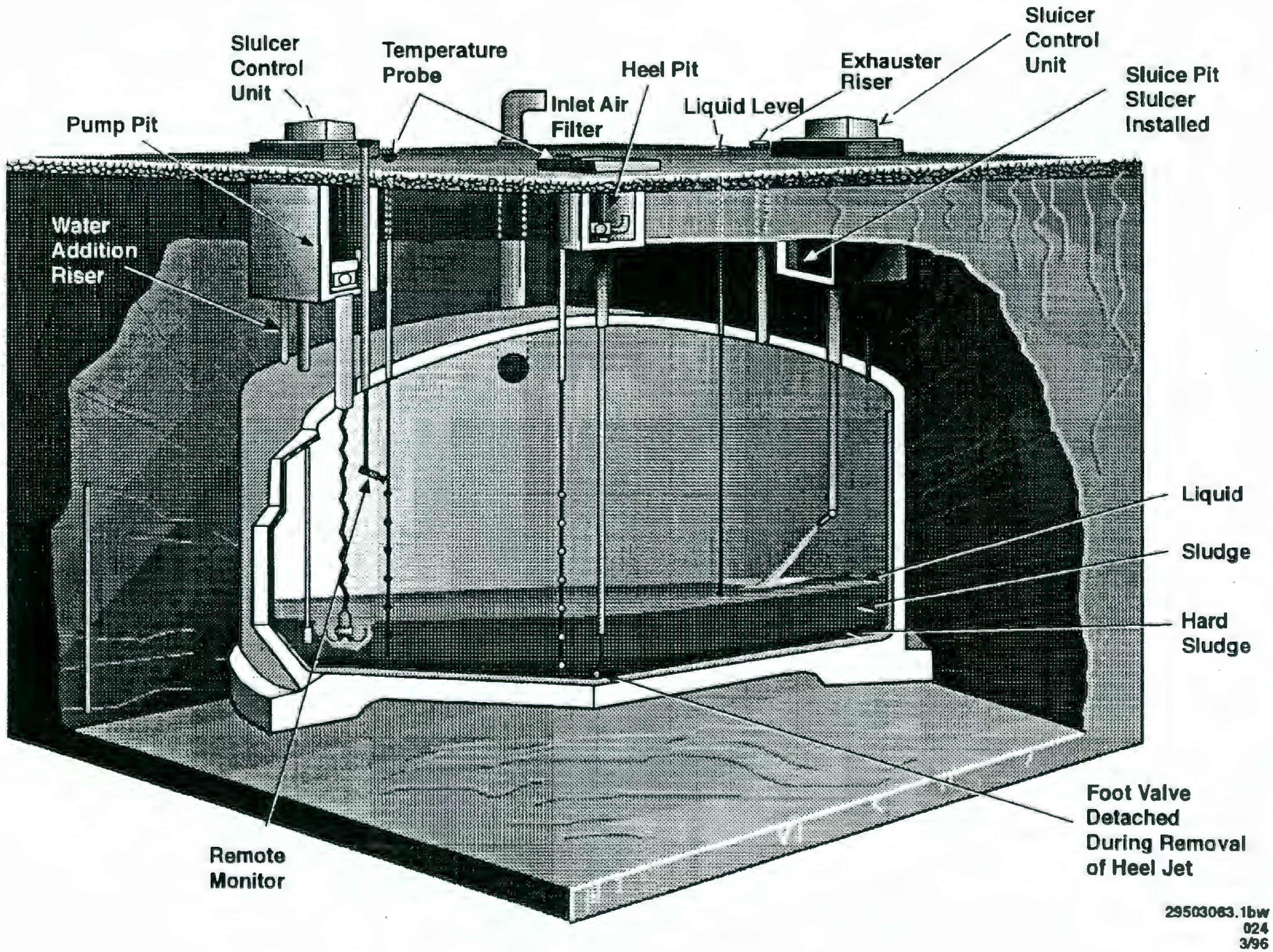

Figure 3-1. 241-C-106 Tank with Sluicing Equipment Installed.

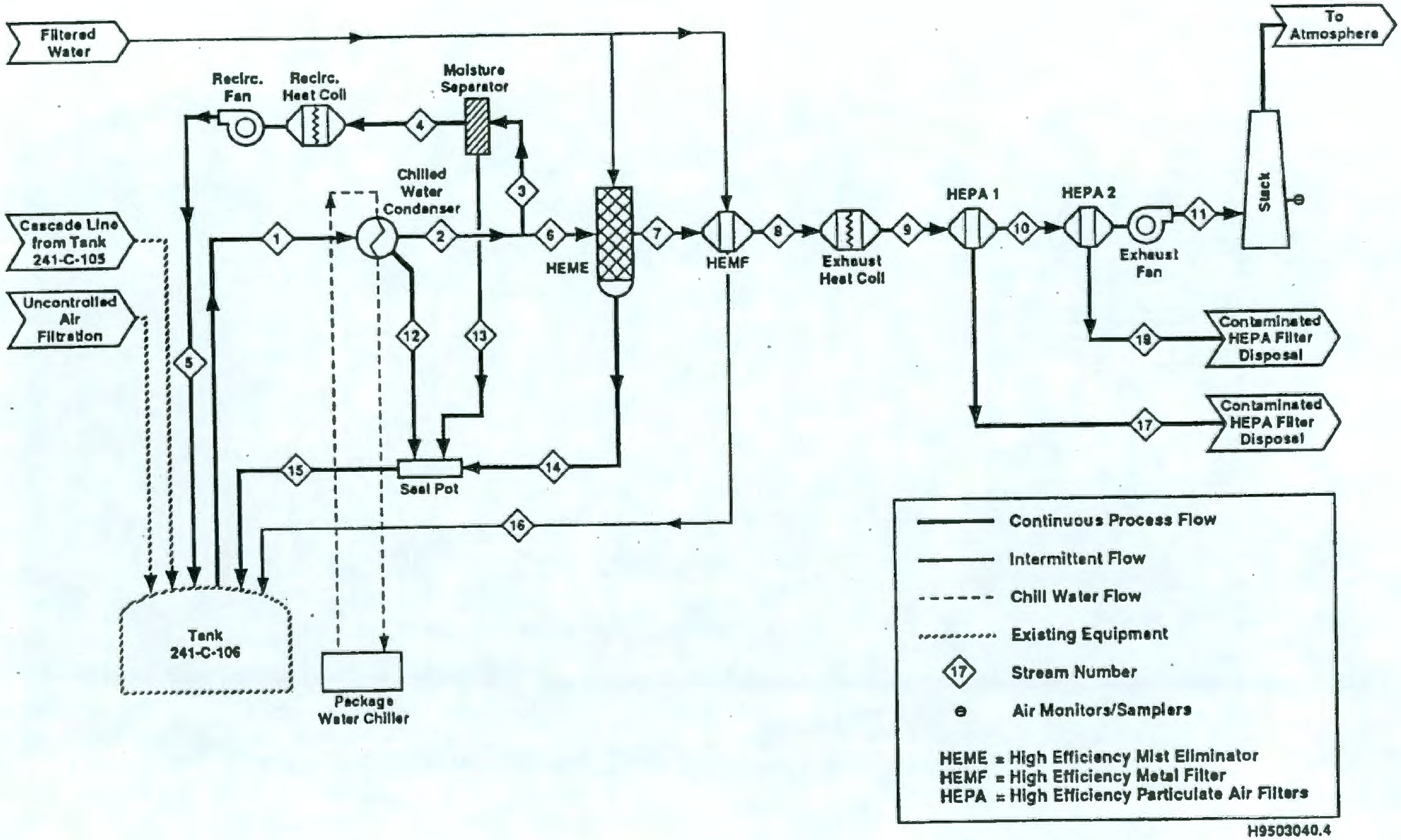

Figure 3-2. Ventilation and Emissions Control Systems Flow Diagram.

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4.0 EMISSIONS ESTIMATION

The waste in 241-C-106 tank includes approximately 745,724 liters of sludge, of which 545,098 liters are considered high-heat waste. The waste is stratified into a number of layers. The upper layers consist of approximately 654,874 liters of soft sludge with a harder upper crust, and the remaining 90,850 liters form a hard layer at the bottom of the tank.

The estimated emissions from the sluicing operation are based on the most current headspace aerosol characterization and the nominal flow rate of the exhauster. A model was developed to predict characterization and concentration of the aerosols produced by sluicing (PNL 1995a). The headspace aerosol composition was developed (WHC 1996a) from the characterization data of the 241-C-106 tank sludge (WHC 1993a) and the supernate from 241-AY-102 (WHC 1995).

The results show a total unabated aerosol mass of 313 milligrams per cubic meter. Of that total, 95.2 percent is water and 4.8 percent is the insoluble solids.

4.1 CRITERIA POLLUTANTS PER WAC 173-400-030

The following discusses the two criteria pollutants, VOCs and fine particulate matter (PM_{10}) (WAC 173-400-030) expected to be emitted by 241-C-106 tank sluicing activities.

Significant quantities of volatile or semivolatile vapor phase components in the headspace are not expected based on process knowledge or available characterization data. Also, no source mechanisms have been identified for their production in the 241-C-106 tank. This position is supported further by the thermal history of the tank in which the high temperatures indicate that significant concentrations of VOCs would have long since been exhausted from the tank. Analysis of available data taken from the headspace of the 241-C-106 tank in February 1994 (PNL 1995b) indicates a total gaseous VOC emission rate of 23 pounds per year. Table 4-1 shows the tank concentration of each VOC, its corresponding acceptable source impact level (ASIL), the SQE rate, and the unabated emission. The analysis assumed a maximum ventilation rate of 30.88 cubic meters per minute. Additional conservatism is built into the analysis by assuming the entire air pollutant concentration goes up the stack, rather than extracting a large portion of it to be recirculated back into the tank at the rate of 24.4 cubic meters per minute, which will be the case during actual operation.

The organic compounds were evaluated in the form of insoluble aerosols. This is a conservative approach, using the efficiencies of the HEMF and HEPA filters to remove the contaminants instead of the higher efficiencies of the HEME. Based on an aerosol solids loading of 15.024 milligrams per cubic meter (313 milligrams per cubic meter total aerosol mass X 0.048 solids), 1.5464 milligrams per cubic meter of that loading are organic compounds (refer to Table 4-2). This includes 0.2 milligram per cubic meter oxalate that is contributed by the AY-102 supernate because the TOC content of the supernate is assumed to be in the form of oxalate. The corresponding emission rate is 2.63 E-11 pounds per year.

Table 4-2 shows the individual compounds, their respective concentrations in the headspace, and the resulting emission rates. The total VOC emission rate is the sum of those contributed in the gaseous form (23 pounds per year) and those contributed in the aerosol form (2.63 E-11 pounds per year).

The potential total particulate concentration at the stack exit was calculated by dividing the overall DF into the total aerosol mass of 313 milligrams per cubic meter, multiplied by the average flow rate of the exhauster (6.5 cubic meters per minute). The potential total particulate emissions at the stack exit would be [(313 milligrams per cubic meter/1.1 E+11) (10^3 micrograms per milligram)] [(6.5 cubic meters per minute) (60 minutes per hour) (24 hours per day) (365 days per year)], which equals 9.72 micrograms per year. Because of the high efficiency of the control equipment, particulate emissions from this project are not being considered as a concern.

4.2 TOXIC AIR POLLUTANTS PER WAC 173-460-080

Toxic air pollutant emissions are anticipated to be in particulate form as well as gaseous.

Significant quantities of gaseous air pollutants are not expected based on the same justification presented previously for VOCs. However, a February 1994 vapor space sample (PNL 1995b) showed evidence of some gaseous air pollutants in the 241-C-106 tank headspace. Results of the analysis of this data are presented in Table 4-1 and show an annual TAPs emission rate of 278 pounds. The analysis also shows the unabated emission rate for each gaseous TAP to be less than the corresponding SQE rate.

Aerosols will be generated mechanically by the process of sluicing large amounts of pressurized liquids entrained with sludge. Table 4-3 lists the toxic air pollutant emissions expected to be in particulate form. The list, reduced from that in reference WHC 1996a, contains only regulated compounds. The total organic content (TOC) and total inorganic content (TIC) of the 241-AY-102 supernate (the sluicing media) is very low, i.e., 6.25 E-08 and 5.95 E-08 milligrams per cubic meter, respectively. The 241-AY-102 supernate also contains very low concentrations (2.43 E-08 milligrams per cubic meter) of sulfate anions. None of these components contributes significantly to the 313 milligrams per cubic meter aerosol mass. The Table 4-3 contains the calculated aerosol concentrations in the tank headspace, the mass flow rate before the control equipment (shown as Stream 6 on Figure 3-2), and the mass flow rate after the emissions control equipment before discharge to the atmosphere (shown as Stream 11 on Figure 3-2).

Calculations used to arrive at the values in Table 4-3 are provided in the following. The representative set of calculations uses aluminum as an example. Mass flow rates for the remaining compounds are calculated in the same manner. Stream values presented in Table 4-3 are taken from a spread sheet and rounding differences will be noticed if the calculations are done by hand.

The mass flow rate at Stream 6 (flow split to the exhauster) is equal to the mass flow rate of Stream 2 (total system flow) minus the mass flow rate of Stream 3 (flow split to the headspace recirculation). To determine the mass flow rate at Stream 6, the mass flow rates of Streams 1, 2, and 3 must first be determined.

The mass flow rate at Stream 1 is determined as follows:

Headspace concentration * headspace flow rate / conversion factor (1)

$$4.19\ \text{E+00}\ \frac{mg}{m^3} * 1090\ \frac{ft^3}{min} \Big/ 35.3\ \frac{ft^3}{m^3}$$

$$\textbf{Stream 1} = 1.29\ \text{E+02}\ \frac{mg}{min.}$$

The mass flow rate at Stream 2 is determined as follows:

Stream 1 / Decontamination Factor for the condenser (2)
(4 for aqueous soluble solids, 3 for aqueous insoluble solids, 1 for vapors)

$$1.29\ \text{E+02}\ \frac{mg}{min} / 4$$

$$\textbf{Stream 2} = 3.23\ \text{E+01}\ \frac{mg}{min.}$$

The mass flow rate at Stream 3 is determined as follows:

Stream 2 * recirculation flow rate / headspace flow rate (3)

$$3.23\ \text{E+01}\ \frac{mg}{min} * 860\ \frac{ft^3}{min} \Big/ 1090\ \frac{ft^3}{min}$$

$$\textbf{Stream 3} = 2.55\ \text{E+01}\ \frac{mg}{min.}$$

The mass flow rate at Stream 6 is determined as follows:

Stream 2 - Stream 3 (4)

$$3.23\ \text{E+01}\ \frac{mg}{min} - 2.55\ \text{E+01}\ \frac{mg}{min}$$

$$\textbf{Stream 6 (aluminum)} = 6.80\ \text{E+00}\ \frac{mg}{min.}$$

The mass flow rate at Stream 11 is determined as follows:

Stream 6 / Overall DF (5)
(1 for vapors)

6.80 E+00 / 1.1 E+11

Stream 11 = 6.18 E-11 $\frac{mg}{min.}$

Table 4-4 compares the particulate emissions against the regulated quantities of the contaminants. Table 4-4 contains the acceptable source impact level (ASIL), SQE rates, and the unabated and abated emissions from Project W-320. As indicated, emissions are well below the SQE rates with or without the abatement equipment in use. For the Class A compounds without SQE rates, the emissions meet the ASILs at the point of discharge.

In conclusion, all gaseous and particulate TAP emissions resulting from Project W-320 are in compliance with the ASILs. This is demonstrated by meeting the SQE rates, or, for compounds without applicable SQE rates, by meeting the ASILs at the point of emission.

Table 4-1. Gaseous Air Pollutant Emissions Regulated per WAC 173-460*. (sheet 1 of 2)

Toxic air pollutant	Class	ASIL milligrams per cubic meter	SQE pounds per year	Tank concentration milligrams per cubic meter	Unabated emission pounds per year
Methyl chloride	B	3.40 E-01	4.37 E+04	2.25 E-04	8.04 E-03
Methyl chloroform	B	6.40 E+00	4.37 E+04	1.19 E-03	4.25 E-02
Dichlorodifluoro-methane	B	1.60 E+01	4.37 E+04	1.08 E-03	3.86 E-02
1,1,2-trichloro-1,2,2 trifluoroethane	B	2.70 E+01	4.37 E+04	8.36 E-04	2.99 E-02
Vinylidene chloride	B	6.70 E-02	1.05 E+04	4.33 E-04	1.55 E-02
Ethyl benzene	B	1.00 E+00	4.37 E+04	4.74 E-04	1.69 E-02
Toluene	B	4.00 E-01	4.37 E+04	6.11 E-03	2.18 E-01
Nonane	B	3.50 E+00	4.37 E+04	2.29 E-04	8.19 E-03
Octane	B	4.70 E+00	4.37 E+04	1.64 E-04	5.86 E-03
Acetic acid	B	8.30 E-02	1.05 E+04	1.80 E-02	6.44 E-01
Methyl n-amyl ketone	B	7.80 E-01	4.37 E+04	3.76 E-04	1.34 E-02
Methyl propyl ketone	B	2.30 E+00	4.37 E+04	2.20 E-04	7.87 E-03
Nitric oxide	B	1.00 E-01	1.76 E+04	3.50 E-01	1.25 E+01
2 Hexanone (MBK)	B	6.70 E-02	1.05 E+04	2.23 E-04	7.97 E-03
Trichlorofluoromethane	B	1.90 E+01	4.37 E+04	3.88 E-03	1.39 E-01
Acetonitrile	B	2.20 E-01	2.28 E+04	4.27 E-03	1.53 E-01
Acetone	B	5.90 E+00	4.37 E+04	6.00 E-02	2.15 E+00
n-Butyl alcohol	B	5.00 E-01	4.37 E+04	6.00 E-02	2.15 E+00
Chloroform	AI, AII	4.30 E-05	1.00 E+01	5.33 E-04	1.91 E-02
Cyanides as CN	B	1.70 E-02	1.75 E+03	3.33 E-03	1.19 E-01
Ammonia	B	1.00 E-01	1.75 E+04	6.80 E+00	6.83 E+01
Carbon tetrachloride	AI, AII	6.70 E-05	2.00 E+01	6.86 E-04	2.45 E-02
Benzene	AI, AII	1.20 E-04	2.00 E+01	1.63 E-03	5.83 E-02

Table 4-1. Gaseous Air Pollutant Emissions Regulated per WAC 173-460*. (sheet 2 of 2)

Toxic air pollutant	Class	ASIL milligrams per cubic meter	SQE pounds per year	Tank concentration milligrams per cubic meter	Unabated emission pounds per year
Dichloromethane (methylene chloride)	AI, AII	5.60 E-04	5.00 E+01	3.44 E-01	1.23 E+01
Tributal phosphate	B	7.30 E-03	1.75 E+02	1.46 E-01	5.22 E+00
1,3-Butadiene	AI, AII	3.60 E-06	0.50 E+00	1.05 E-03	3.75 E-02
				Total TAPS	2.78 E+02
				Total VOCs	2.3 E+01

*Source: PNNL 1996.
ASIL = acceptable source impact level.
SQE = small quantity emissions.

Table 4-2. Emissions from 241-C-106 Tank Regulated per WAC 173-400. (sheet 1 of 2)

Organic compound (aerosol)	Headspace concentration (milligrams per cubic meter)	Abated emissions (pounds per hour)	Abated emissions (pounds per year)
Oxalate[a]	0.7774	-	-
Oxalate[b]	0.2000	-	-
Oxalate[c]	0.1025	-	-
Total oxalate	1.0799	2.11 E-15	1.85 E-11
Bis (2-ethylhexyl) phosphate[c]	0.3756	7.35 E-16	6.44 E-12
Butyl bis (2-ethylhexyl) phosphate[c]	0.0398	7.80 E-17	6.83 E-13
Tri-butyl phosphate[c]	0.0284	5.49 E-17	4.81 E-13
Butyl bis (2-ethylhexyl) phosphate[c]	0.0170	3.26 E-17	2.86 E-13
Tris (2-ethylhexyl) phosphate[c]	0.0057	1.00 E-17	8.76 E-14
Total organics	1.5464	3.01 E-15	2.63 E-11

[a] Derived from the uniformly distributed oxalate content in 241-C-106 tank sludge solids.

$$\left(313\ \frac{\text{mg}}{\text{m}^3}\right)\left(0.048\ \frac{\text{mg solid}}{\text{mg}}\right)\left(80.2\ \frac{\text{g oxalate}}{\text{L}}\right)\left(\frac{\text{L}}{1{,}550\text{ g sludge}}\right)$$
$$= 0.7774\ \frac{\text{mg oxalate}}{\text{m}^3}.$$

where

$$313\ \frac{\text{mg}}{\text{m}^3} \text{ and } 0.048\ \frac{\text{mg solid}}{\text{mg}} \text{ (from WHC 1994b)}$$

$$80.2\ \frac{\text{g oxalate}}{\text{L}} \text{ and } \frac{\text{L}}{1{,}550\text{ g solids}} \text{ (from WHC 1996b).}$$

[b] Derived from the uniformly distributed organic content of 241-AY-102 tank supernate, which is assumed to be composed of oxalate; where

$$0.2000\ \frac{\text{mg oxalate}}{\text{m}^3} \text{ (WHC 1996a).}$$

Table 4-2. Emissions from 241-C-106 Tank Regulated per WAC 173-400.
(sheet 2 of 2)

[c] Derived from the speciation of the 'sludge oil' contained in 241-C-106 tank sludge solids (WHC 1996c). For oxalate, the concentration is calculated as

$$\left[313\ \frac{mg}{m^3}\right]\left[0.048\ \frac{mg\ solid}{mg}\right]\left[0.02\ \frac{mg\ oil}{mg\ sludge}\right]\left[\frac{1\ mg\ sludge}{(1.0-0.472)\ mg\ solids}\right]\left[\frac{0.18\ mg\ oxalate}{mg\ oil}\right] = 0.1025\ \frac{mg\ oxalate}{m^3}.$$

where

$$313\ \frac{mg}{m^3} \text{ and } 0.048\ \frac{mg\ solid}{mg} \quad \text{(from WHC 1994b)}$$

$$\frac{mg\ sludge}{(1.0-0.472)\ mg\ solids} \quad \text{(from WHC 1996b)}$$

$$0.02\ \frac{mg\ oil}{mg\ sludge} \text{ and } 0.18\frac{mg\ oxalate}{mg\ oil} \quad \text{(from WHC 1996c).}$$

where it is assumed that the unspeciated content shown in Table 4-2 is oxalate. Similar calculations are performed for the other sludge oil components identified in Table 4-2.

Table 4-3. Particulate Emissions from 241-C-106 Tank Regulated per WAC 173-460. (sheet 1 of 2)

Compound	Toxic air pollutant class	Headspace aerosol concentration mg/m^3	Unabated mass flow (Stream 6)* mg/min	Abated mass flow (Stream 11)* mg/min
Aluminum (aluminum, as soluble salts)	B	4.19 E+00	6.82 E+00	6.09 E-11
Antimony	B	1.06 E-01	2.30 E-01	2.05 E-12
Arsenic (arsenic and inorganic arsenic compounds)	A Annual	1.42 E-02	2.31 E-02	2.06 E-13
Barium (barium, soluble compounds Ba)	B	1.28 E-02	2.08 E-02	1.86 E-13
Boron (borates, pentahydrate)	B	1.28 E-02	2.08 E-02	1.86 E-13
Calcium (calcium hydroxide)	B	6.92 E-02	1.50 E-01	1.34 E-12
Chromium (chromium hexavalent metal and compounds)	A Annual	6.38 E-02	1.04 E-01	9.28 E-13
Copper (copper dusts and mists, as Cu)	B	1.09 E-02	1.77 E-02	1.58 E-13
Iron (iron salts, soluble as Fe)	B	3.00 E+00	4.88 E+00	4.36 E-11
Lead (lead compounds)	A 24 Hr	9.11 E-02	1.98 E-01	1.77 E-12
Magnesium (magnesium oxide fume)	B	1.53 E-02	3.32 E-02	2.97 E-13
Manganese (dust and compounds)	B	1.64 E-01	2.67 E-01	2.38 E-12
Phosphorus	B	2.66 E-01	5.77 E-01	5.16 E-12
Selenium	B	5.10 E-02	8.30 E-02	7.41 E-13
Silver (silver, soluble compounds as Ag)	B	7.65 E-02	1.25 E-01	1.11 E-12
Sodium (sodium hydroxide)	B	5.69 E+00	9.26 E+00	8.27 E-11

Table 4-3. Particulate Emissions from 241-C-106 Tank Regulated per WAC 173-460. (sheet 2 of 2)

Compound	Toxic air pollutant class	Headspace aerosol concentration mg/m^3	Unabated mass flow (Stream 6)* mg/min	Abated mass flow (Stream 11)* mg/min
Thallium	B	4.37 E-02	7.12 E-02	6.35 E-13
Uranium	B	1.49 E-02	3.23 E-02	2.89 E-13
Zirconium	B	2.19 E-02	4.75 E-02	4.24 E-13
Hydroxide (sodium hydroxide)	B	4.23 E-08	6.89 E-08	6.26 E-19
Nitric oxide (NO_2, NO_3)	B	1.31 E-08	2.13 E-08	1.94 E-19
Fluoride	B	1.92 E-09	3.13 E-09	2.84 E-20
Chloride	B	1.10 E-08	1.79 E-08	1.63 E-19

* Refer to Figure 3-2.
mg/m^3 = milligrams per cubic meter.
mg/min = milligrams per minute.
NA = not applicable.

Table 4-4. 241-C-106 Tank Particulate Emissions Comparison to Small Quantity Emission Rates. (sheet 1 of 2)

Compound	Toxic air pollutants class	Acceptable source impact level µg/m³	small quantity emissions rate lbs/hr	Unabated emissions lbs/hr	Abated emissions lbs/hr (µg/m³)
Aluminum (aluminum, as soluble salts)	B	6.7	0.02	9.02 E-04	8.06 E-15
Antimony	B	1.7	0.02	3.04 E-05	2.72 E-16
Arsenic (arsenic and inorganic arsenic compounds)	A Annual	2.3 E-04	NA	3.06 E-06	2.73 E-17 (3.17 E-11)
Barium (barium, soluble compounds Ba)	B	1.7	0.02	2.76 E-06	2.46 E-17
Boron (borates, pentahydrate)	B	3.3	0.02	2.76 E-06	2.46 E-17
Calcium (calcium hydroxide)	B	17	0.2	1.99 E-05	1.77 E-16
Chromium (chromium hexavalent metal and compounds)	A Annual	8.3 E-05	NA	1.37 E-05	1.23 E-16 (1.42 E-10)
Copper (copper dusts and mists, as Cu)	B	3.3	0.02	2.35 E-06	2.10 E-17
Iron (iron salts, soluble as Fe)	B	3.3	0.02	6.46 E-04	5.77 E-15
Lead (lead compounds)	A 24 Hr	0.5	NA	2.62 E-05	2.34 E-16 (2.71 E-10)
Magnesium (magnesium oxide fume)	B	33	0.6	4.39 E-06	3.92 E-17
Manganese (dust and compounds)	B	0.4	0.02	3.53 E-05	3.15 E-16
Phosphorus	B	0.33	0.02	7.64 E-05	6.82 E-16
Selenium	B	0.67	0.02	1.10 E-05	9.81 E-17

Table 4-4. 241-C-106 Tank Particulate Emissions Comparison to Small Quantity Emission Rates. (sheet 2 of 2)

Compound	Toxic air pollutants class	Acceptable source impact level µg/m³	small quantity emissions rate lbs/hr	Unabated emissions lbs/hr	Abated emissions lbs/hr (µg/m³)
Silver (silver, soluble compounds as Ag)	B	0.033	0.02	1.65 E-05	1.47 E-16
Sodium (sodium hydroxide)	B	6.7	0.02	1.23 E-03	1.09 E-14
Thallium	B	0.33	0.02	9.41 E-06	8.40 E-17
Uranium	B	0.67	0.02	4.28 E-06	3.82 E-17
Zirconium	B	17	0.2	6.29 E-06	5.62 E-17
Hydroxide (sodium hydroxide)	B	6.7	0.02	9.11 E-12	8.28 E-23
Nitric oxide (NO_2, NO_3)	B	100	2.0	2.82 E-12	2.56 E-23
Fluoride (as F)	B	8.3	.02	2.37 E-12	2.15 E-23
Chloride (as Cl)	B	5.0	.02	2.37 E-12	2.15 E-23

µg/m³ = micrograms per cubic meter.
lbs/hr = pounds per hour.
NA = not applicable.

5.0 SCHEDULE

Project W-320 has been phased; with Phase I consisting of activities that do not constitute a source of new emissions. Those activities, including removal of existing equipment, earthwork, modification of pits, installation of the transfer piping, and installation of the control room and instrumentation and electrical needs, began in February 1994. Phase II construction activities, consisting of the activities and emissions described in this NOC, began on August 1, 1995. Sluicing operations are scheduled to commence in calendar year 1997 and will be continuous with an expected waste retrieval duration of 1 year. The 241-C-106 tank WRSS will be operated up to 24 hours a day, 7 days a week. Personnel will be assigned only to the sluicing operation for the duration of the retrieval. The WRSS is estimated to have a lifetime of approximately 2 years.

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