Toxic Air Pollutants Notice of Construction for Rotary Mode Core Sampling Systems Three and Four and Modification of System Two

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V. L. Birkland

V. L. Birkland

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REVISION HISTORY

All changes made in this document are noted by a vertical bar in the left margin.

The Washington State Department of Ecology approved the original Notice of Construction for the Rotary Mode Core Sampling System Two in 1993 (DOE/RL-93-41). A *State Environmental Policy Act* (SEPA) Environmental checklist was completed and submitted during the 1993 approval process.

Revision 0 was submitted to Ecology in 1995 and replaced the original 1993 NOC.

Revision 1 updates Revision 0 as follows.

- The waste tank vapor characterization program is nearing completion. All existing vapor space data will be used when calculating toxic air emissions from Rotary Mode Core Sampling activities. The vapor space data from 102 waste tanks can be found in the Tank Waste Inventory System available on the World Wide Web located at URL <http://TWINS.PNL.GOV:8001/>.
- Revision 0 did not provide a method to perform emissions calculations for compounds that do not have a small quantity emission rate listed in Washington Administrative Code Chapters 173-460. A method to estimate emissions for these chemicals consistent with the technical approach in Revision 0 is included in Revision 1, Section 6.0.
- The Appendix B emissions calculation formula were modified. Revision 1 calculates emissions per tank. Revision 0 calculated annual emissions per exhaust

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TERMS

1		
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4	ASIL	acceptable source impact level
5		
6	DNFSB	Defense Nuclear Facilities Safety Board
7	DST	double-shell tank
8		
9	Ecology	Washington State Department of Ecology
10		
11	HEPA	high-efficiency particulate air
12	HNF	Hanford Nuclear Facility (document identifier)
13		
14	LMHC	Lockheed Martin Hanford Corporation
15		
16	NOC	notice of construction
17		
18	PNNL	Pacific Northwest National Laboratory
19		
20	RMCS	rotary mode core sampling
21		
22	SST	single-shell tank
23	SQER	small quantity emission rate
24		
25	T-BACT	best available control technology for toxics
26	TAP	toxic air pollutant
27	TOC	total organic carbon
28	Tri-Party	<i>Hanford Federal Facility Agreement and Consent Order</i>
29	Agreement	
30		
31	VOC	volatile organic compounds
32		
33	WAC	<i>Washington Administrative Code</i>
34		
35		

TOXIC AIR POLLUTANTS NOTICE OF CONSTRUCTION
FOR ROTARY MODE CORE SAMPLING SYSTEMS THREE
AND FOUR AND MODIFICATION OF SYSTEM TWO

1.0 INTRODUCTION

The Washington State Department of Ecology (Ecology) approved the construction and operation of Rotary Mode Core Sampling (RMCS) System Two on November 22, 1993 (NOC-93-04). This approval supported the characterization of waste in the single-shell tanks (SSTs) and double-shell tanks (DSTs) on the Hanford Site. The waste tank characterization sampling and analysis effort is vital to the safe operations of the Hanford Site tank farms, and the timely collection of the information necessary to support retrieval, pretreatment, disposal planning, and final closure strategy.

Based on the Defense Nuclear Facilities Safety Board (DNFSB) *Recommendation 93-05 Implementation Plan* (DOE-RL-94-001), U.S. Department of Energy, Richland Operations Office (DOE-RL) proposed the expedited construction and operation of two additional RMCS systems to support characterization of waste stored in SSTs and DSTs. RMCS currently is scheduled for approximately 50 (active or passively ventilated) of the 149 SSTs in the 200 East and 200 West Areas. If necessary, the RMCS will be used to sample other tanks currently not scheduled, subject to the requirements of this document and any applicable Ecology approval order. The typical components of the RMCS systems are shown in Figure 1. It should be noted that the Flammable Gas Detector cart (Figure 1) is not being used during RMCS at this time.

RMCS is scheduled for approximately 40 tanks that are not actively ventilated. These tanks operate at atmospheric pressure with passive (breather) high-efficiency particulate air (HEPA) filters. The RMCS system uses nitrogen gas to cool and purge the drill bit assembly. Without the use of a portable ventilation system, the additional gas from RMCS might unsafely pressurize tanks that are not actively ventilated. The RMCS system also will generate aerosols and dust in the tank vapor head space. HEPA filters will be required on the portable exhauster during rotary mode core drilling to control radionuclide particulate emissions.

Figure 1. Typical Components of the Rotary Mode Core Sampling System.

2.0 PROCESS INFORMATION

The RMCS system was designed to sample tanks containing hardened wastes. A prominent feature of this sampling system is the use of nitrogen gas to cool and purge the drill bit assembly. The purge will also allow a more complete sample recovery by clearing cuttings that might otherwise obstruct the sampler drill bit, and prevents cross contamination of different waste layers in the tank. The preferred mode of sampling is push-mode, which does not involve rotation of the drill string or significant purge gas flow. When the waste is too hard to push through, the core sample truck is placed in rotary mode to allow the bit to drill through the waste. It is during the rotary mode operation that an exhaust system is necessary.

Of the approximately 50 tanks scheduled for RMCS, 40 tanks are not actively ventilated and operate at atmospheric pressure with passive HEPA filters. A portable HEPA filtered exhauster will be employed during RMCS in tanks that are not actively ventilated to prevent potentially unsafe tank pressurization and to control potentially radioactive aerosols and dust generated by RMCS. The portable exhauster must also be moved between tank farms as needed with the RMCS system. Each exhauster may emit Toxic Air Pollutants (TAPs) subject to WAC 173-460.

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3.0 CONTROL EQUIPMENT INFORMATION

Particulate emissions will be controlled with prefilters and HEPA filters, which are being installed primarily to control radionuclide pollutants. The HEPA filters are rated to remove 99.95 percent for particulates with a median diameter of 0.3 micrometer and larger. Efficiency testing will be performed annually in accordance with onsite procedures. A total abated particulate emission value of 9.6 grams per year (0.02 pound per year), or a maximum daily average of 0.06 gram per day (1.4 E-04 pounds per day), was provided to Washington State Department of Health (pursuant to WAC 246-247-110) and, thus, will not be regulated by Ecology.

A discussion of the best available control technology for toxics (T-BACT) is included as Appendix A of this document. The recommendation of the T-BACT assessment is that no controls for TAP compounds be installed.

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4.0 STACK INFORMATION

The RMCS systems will be portable systems operating in the 200 East and 200 West Areas of the Hanford Site. Each system (Figure 1) is comprised primarily of a RMCS truck, an optional exhaustor platform (Figure 2), an optional less than 500-horsepower diesel powered electric generator (typically 300 horsepower), and a pressurized nitrogen gas tank platform.

The portable exhaust stack will be approximately 4.3 m (14 ft) high, with an effective height of more than 4.6 m (15 ft), and have a 10-cm (4-in.) diameter duct. The average stack temperatures will be approximately 27°C (80°F) and the exhaust rate will be approximately $5.7 \pm 1.4 \text{ m}^3/\text{min}$ ($200 \pm 50 \text{ ft}^3/\text{min}$).

Figure 2. Design Drawing of Exhaust System.

5.0 PROCESS FLOW INFORMATION

5.1 EXHAUSTER DESIGN

The exhauster system (i.e., control equipment, fan, and stack) design is shown in Figure 2. The exhauster is attached to a tank riser by a flexible connector. A prefilter is located in the filter housing immediately upstream of two HEPA filters in series. These HEPA filters are designed to remove particulate radionuclides. After passing through the HEPA filters, the exhaust gas is released to the atmosphere through the stack. The stack will contain an access port for monitoring both total organic carbon (TOC) and ammonia.

Operation of an exhauster is required to maintain a negative tank pressure with respect to the atmosphere during RMCS and to prevent uncontrolled radionuclide particulate emissions. With the addition of nitrogen and in-leakage to the tank, flow through the exhauster is designed for control at $5.7 \text{ m}^3/\text{min}$ ($200 \text{ ft}^3/\text{min}$). At $5.7 \text{ m}^3/\text{min}$ ($200 \text{ ft}^3/\text{min}$) tank pressure is about -250 Pa or $-1 \text{ in. water gauge (w.g.)}$. Loss of the required exhauster will result in the automatic shutdown of the drilling process.

5.2 METHOD OF OPERATION

[This paragraph moved to section 6.1]

Whenever the drill bit is rotating, nitrogen gas will be injected into the drill string at approximately $0.85 \text{ m}^3/\text{min}$ ($30 \text{ ft}^3/\text{min}$) to a maximum of $2.8 \text{ m}^3/\text{min}$ ($100 \text{ ft}^3/\text{min}$). Each 48.3-cm (19-in.) segment requires 5 to 20 minutes of drilling. While the sampler is being changed out after each segment, nitrogen will be injected into the drill string at approximately $0.03 \text{ m}^3/\text{min}$ ($1 \text{ ft}^3/\text{min}$). This will maintain the hydrostatic head in the drill string (preventing waste from entering the space just sampled) and will allow for pressurization and depressurization of the sample receiver as necessary for sampler changeout.

Once a complete core has been obtained, the RMCS truck may either be repositioned on the same riser or moved to a different riser on the same tank to obtain a second core. When tank sampling is complete, the RMCS system will be disconnected and moved to the next tank. During system connection and disconnection, as-low-as-reasonably-achievable (ALARA) principles will be followed.

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6.0 TOXIC AIR POLLUTANT EMISSIONS ESTIMATION

In general, gas and vapor emissions from the exhauster can be estimated from quiescent waste tank headspace characterization data, headspace volumes, and exhauster flow rates. Current knowledge of the tank headspace gases and vapors, and the fact that tank headspace volumes are large compared to the specified exhauster flow rates, suggest TAP emission rates will be relatively low.

6.1 EMISSIONS CALCULATIONS

Before connecting the RMCS system to any tank, an air emissions estimate will be calculated, as described in Appendix B, using the existing tank vapor space data. If the calculated emission rate for any TAP exceeds its SQER, the actual RMCS exhauster operating time will be limited to maintain TAP emissions below the SQER. If the calculated emission rate for any TAP exceeds 50 percent of the established SQER, effluent monitoring will be performed as described in Appendix B.

The existing tank characterization vapor space data indicate some waste tanks contain chemical compounds that do not have WAC 173-460 SQER values. The TWINS database currently contains approximately 125 chemical compounds and classes of compounds identified in tank waste, of which six compounds do not have SQER values. A method to demonstrate compliance and/or monitoring requirements for each of these individual compounds is addressed in Section 6.2.

Generally, compounds with no SQERs will be modeled for atmospheric dispersion, as allowed by WAC 173-460-080, using an EPA code (EPA-454-B-95-003a) and specific Hanford Site meteorological data to calculate the site boundary concentrations. The dispersion analyses will be performed in accordance with Appendix C. The worst-case concentration at any Hanford site boundary will be compared to the acceptable source impact level (ASIL) for the contaminant as listed in WAC 173-460. A Hanford Site boundary concentration less than the ASIL renders the tank acceptable for RMCS.

6.2 SPECIFIC TAP CALCULATIONS

Propionaldehyde and acetophenone, both Class B TAPs as listed in WAC 173-460-160, do not have an assigned ASIL or SQER values. A conservative assumption of assigning the smallest SQER for a Class B TAP (0.02 pound per hour) will be used in Appendix B calculations to provide an acceptable level of public health protection.

The Class A compound N-nitrosodimethylamine does not have an SQER value but does have a WAC 173-460-150 ASIL value assigned. This compound will be modeled for dispersion and compared to the ASIL value.

The Class A compound 1,2 dichloropropane does not have an SQER but does have an ASIL with a special averaging time of 24 hours. This compound also

will be modeled for dispersion and compared to the 24-hour average ASIL value specified in WAC 173-460.

N-nitrosomorpholine does not have an SQER or ASIL value. To evaluate the risk of exposing the public to an unacceptable dose of this Class A TAP, a study was performed by Pacific Northwest National Laboratory (PNNL 1996) to identify a compound with similar toxicological characteristics to N-nitrosomorpholine. PNNL identified 1-nitrosopyrrolidine as the chemical toxicity surrogate for N-nitrosomorpholine. The calculated ASIL for N-nitrosomorpholine using 1-nitrosopyrrolidine as a surrogate is 1.63 E-03 micrograms per cubic meter. This ASIL will be used for comparison of offsite concentrations in the event a tank containing this compound requires RMCS.

The Class A TAPs, dioxins and furans (considered together as one TAP by WAC 173-460-050), do not have an SQER value but do have an ASIL. In accordance with WAC 173-460-050, dioxin and furan emissions are combined and considered as one TAP conservatively expressed as an equivalent emission of 2,3,7,8 tetrachlorodibenzo-p-dioxin (TCDD). This TCDD compound is highly chlorinated, extremely carcinogenic, and has been assigned the smallest ASIL value of any compound listed in WAC 173-460.

With respect to the waste tanks, no dioxins have been detected and the furans detected in the tanks consist of 35 species of nonchlorinated furans (PNNL 1996). Given this information, the use of TCDD for Hanford tank nonchlorinated furans in the waste tanks is inappropriate. To evaluate the risk of exposing the public to an unacceptable dose of the nonchlorinated furans, a study was performed to identify a compound with toxicological characteristics believed to be representative of nonchlorinated furans. The study identified 1,4-Dioxane as the surrogate (PNNL 1998). The 1,4-dioxane ASIL will be used for comparison of offsite concentrations in the event a tank containing nonchlorinated furans requires RMCS.

The emissions resulting from the operation of the RMCS system are in compliance with the required standards of WAC-173-460. Compliance will be demonstrated by estimating emissions per Appendix B methodology, and limiting exhaust operation time such that actual emissions are less than the SQERs for those TAPs that have SQERs and less than the substitute SQERs or substitute ASILs for the specific TAPs described in this section. Stack emissions monitoring will be performed only for those tanks that meet Appendix B monitoring criteria.

7.0 SUMMARY OF COMPLIANCE WITH REQUIREMENTS

Appendix A includes a T-BACT assessment, which recommends no controls for organic or inorganic vapors. The emissions resulting from the operation of the RMCS system are in compliance with the required standards of WAC-173-460. Compliance will be demonstrated by estimating emissions per Appendix B methodology, and limiting exhaust operation time such that actual emissions are less than the SQERs for those TAPs that have SQERs and less than the substitute SQERs or substitute ASILs for the specific TAPs described in Section 6.2. Stack emissions monitoring will be performed only for those tanks that meet Appendix B monitoring criteria.

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8.0 REFERENCES

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- DOE/RL 94-0001, *Recommendation 93-05 Implementation Plan*, U.S. Department of Energy, Richland, Washington.
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- HNF-SD-WM-TSR-006, *Tank Waste Remediation System Technical Safety Requirements*, Fluor Daniel Hanford Company, Richland Washington.
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- PNNL, 1996, Letter report to C. Grando (WHC) from D. Maughan (PNNL), *Chemical Toxicity of N-Nitrosomorpholine (59-89-2)*, dated August 23, 1996.
- PNNL, 1998, Letter report to D. Shuford (LMHC) from D. Maughan (PNNL), *A Status Report on the Cancer Potential of Furan Chemicals in the Hanford Tank Headspace Gases and a Recommended Surrogate and ASIL for use in Assessing Chronic Public Exposure*, dated March 12, 1998.

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APPENDIX A

**BEST AVAILABLE CONTROL
TECHNOLOGY FOR TOXICS ASSESSMENT**

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APPENDIX A

BEST AVAILABLE CONTROL TECHNOLOGY FOR TOXICS ASSESSMENT

A1.0 INTRODUCTION

This appendix provides the basis for the management of toxic air pollutants resulting from rotary mode core sampling (RMCS) activities. The information is intended to demonstrate that the control equipment selected for the exhausters for the RMCS system complies with the requirements concerning the Best Available Control Technology for Toxics (T-BACT) as defined in the *Washington Administrative Code (WAC)* Chapter 173-460. The conclusions reached in this document are based on an evaluation of control technologies following the procedure described by the U.S. Environmental Protection Agency (in their draft policy document)¹ and Ecology in an implementation resource manual.²

A description of the RMCS system, including the purpose for the system, is included in the Notice of Construction (NOC), to which this document has been appended. Please refer to the NOC for any information not directly related to the control of toxics.

A2.0 UNABATED EMISSIONS

Before connecting the RMCS system to a tank, the vapor space will be sampled and analyzed for TAPs. As discussed in Section 6.0 of this NOC, a calculation for all TAPs listed in the TWINS data base for each tank will be performed as described in Appendix B before RMCS.

A3.0 TOP DOWN PROCEDURE

There are five basic steps to determine T-BACT for a source. The first step is to identify all available control options. The second step is to eliminate options that are technically not feasible. The third step is to rank the remaining control technologies in order of control effectiveness. The fourth step is to evaluate the most effective controls considering energy, environmental, and economic impacts. If the top candidate is shown to be technically or economically not feasible, the next most stringent alternative

¹ *Prevention of Significant Deterioration and Nonattainment Area Permitting (Draft)*, U.S. Environmental Protection Agency, Washington, D.C., 1990.

² *Regulating Toxics, Implementation Resource Manual*, State of Washington Department of Ecology, Olympia, Washington, 1991.

1 is evaluated. Finally, a T-BACT selection is made when the most effective
2 control option cannot be eliminated because of energy, environmental, or
3 economic impacts.

4 5 6 **A4.0 CONTROL TECHNOLOGIES AVAILABLE**

7
8
9 Several technologies are available for the control of the contaminants
10 included in the unabated emissions estimate. It should be noted that the
11 exhauster will be equipped with a HEPA filter, regardless of the
12 recommendation of this T-BACT analysis as a result of the requirements of
13 WAC 246-247 and the U.S. Department of Energy.

14
15 Both organic and inorganic compounds are included in the unabated
16 emissions estimate. The control technologies for each type of compound will
17 be discussed separately.

18 19 20 **A4.1 CONTROLS FOR VOLATILE ORGANIC COMPOUNDS**

21
22 This section describes the various technologies for the control of
23 volatile organic compounds (VOC). The technical feasibility of each is
24 discussed in this section, as well.

25 26 27 **A4.1.1 Adsorption**

28
29 This technology has been used widely to capture VOC from emission
30 sources. The stream is passed through a fixed bed of granular activated
31 carbon, and adsorbed onto the carbon, or another adsorbent, such as a resin.
32 This eventually depletes the available sites for adsorption, and the adsorbent
33 must be either regenerated or discarded. This option appears to be
34 technically feasible and will be discussed further in Section A5.0.

35 36 37 **A4.1.2 Thermal Incineration**

38
39 In this technology, the air stream is heated to about 816 to 1,093°C
40 (1,500 to 2,000°F) for about a 1 second residence time. This chemically
41 oxidizes the VOCs. Due to the relatively low heat content of the air stream,
42 and the variability from tank to tank in vapor space composition, large
43 quantities of fuel would be required for incineration, adding another large
44 component (the fuel tank) to the RMCS system. Because of the potential
45 presence of hydrogen in the vapor space of some of the tanks to be rotary mode
46 core sampled this technology would not be considered inherently safe.
47 Additionally, any system which would remove the incineration source from the
48 proximity of the tank to minimize safety concerns would not be feasible,
49 because the exhaust system cannot be outside of the fence line of the tank
50 farm being exhausted. Consequently, installation is not technically feasible
51 on any Hanford Site waste storage tank.

A4.1.3 Catalytic Incineration

Catalytic incineration operates in the same manner as thermal incineration, with the exception that a catalyst is used in the reaction bed to reduce the temperature required to oxidize the VOCs. The presence of chlorinated compounds in the air stream will degrade the capability of the catalyst. Additionally, the temperatures required for this control technology are not sufficiently low that the inherent safety of the system can be ascertained. Therefore, catalytic incineration is not technically feasible for this application.

A4.1.4 Vapor Condensation

This technology is used to recover and recycle volatilized solvents from industrial processes and in some cases has been used for VOC emission control, if the VOC concentration is extremely high. The air stream to be treated is cooled to below the dewpoint temperature of the VOC to be collected, and the condensed VOCs are decanted and recovered. This technology is not applicable to air streams with widely varying composition or concentration, because of the difficulties in designing the condenser for an uncertain process stream. Also, this technology is not well suited to air streams where the VOC concentration is less than the water vapor concentration, because the air coolers will become clogged with condensed ice. The tanks to be exhausted with this system are of highly varying composition, and some of the tanks are expected to have extremely high relative humidities. Therefore, this technology is not technically feasible.

A4.2 CONTROLS FOR INORGANIC COMPOUNDS

Only a limited quantity of methods have developed to control inorganic vapor emissions from point sources. The two most commonly used control methods are adsorption and absorption (or scrubbing).

A4.2.1 Adsorption

Adsorption of inorganic compounds is performed in the same way the adsorption of organic compounds is performed on granular activated carbon, however the adsorbent is different. For the control of ammonia (by far the inorganic compound of highest concentration in the vapor space), impregnated carbon has been shown to be an effective control device. This option appears to be technically feasible and will be discussed further in Section A5.0.

A4.2.2 Absorption

Absorption, or scrubbing, is used quite extensively in the control of inorganic compounds. In this technology, the air stream is contacted with a solvent, in which the inorganic compounds are highly soluble. The ideal solvent should be nonvolatile, noncorrosive, nonflammable, nontoxic,

1 chemically stable, readily available, and inexpensive. Water is the most
2 commonly used solvent, and is used on a once-through basis. Unfortunately,
3 there is no wastewater disposal system in the tank farms that can handle the
4 quantity of wastewater that will be generated by this process. Additionally,
5 there is a restriction on the water brought into the SST farms. This
6 restriction does not allow water to be brought into a tank farm to be used as
7 the solvent to scrub an air stream, nor does it allow water to be removed from
8 tank farms for treatment elsewhere on site. Therefore, this technology is not
9 technically feasible.

10 11 12 A4.2.3 Incineration

13
14 Thermal or catalytic incinerators can be used to control the emission of
15 some inorganic compounds. However, a technically infeasible situation exists
16 when applying these high temperature devices on tanks potentially containing
17 concentrations of hydrogen in excess of the lower explosive level.

18 19 20 21 A5.0 RANKING OF CONTROL TECHNOLOGIES

22
23
24 Adsorption is the only technically feasible control technology available
25 for organic or inorganic compounds. Therefore adsorption is ranked first, in
26 order of effectiveness, and "no controls" is ranked second.

27 28 29 A6.0 ENVIRONMENTAL, ECONOMIC, AND ENERGY IMPACTS

30
31
32 The proposed RMCS System Three and Four were developed to be essentially
33 identical to the approved System Two, with the primary goal of sampling the
34 waste in the SSTs as efficiently, rapidly, and thoroughly as possible, while
35 maintaining the integrity of the samples. Determining the contents of the
36 tanks is the first step in retrieval, treatment, and eventual disposal of the
37 wastes, which is required for clean-up of the Hanford Site.

38
39 At the flow rate selected for this exhaustor, the technical feasibility
40 of adsorption systems is questionable. EPA handbook 625/6-91/014³ does not
41 recommend adsorption for flows less than 8.5 m³/min (300 ft³/min) or
42 temperatures greater than 54.4°C (130°F). To install these controls the flow
43 rate would have to be increased and a chiller installed to ensure that the air
44 stream was within the design parameters of the adsorption systems.
45 Additionally, the pressure drop through the control technologies would cause
46 the pressure in the tank to fall below acceptable safety criteria
47 (<-7.62 cm w.g. [<-3 in. w.g.]). Addition of a chiller and use of a higher
48 flow rate are technically feasible and are required for adsorption to be

49 ³ EPA, 1991, *Control Technologies for Hazardous Air Pollutants*, EPA/625/6-
50 91/014, U.S. Environmental Protection Agency, Washington, D.C.

feasible. Consequently, the following discussion of impacts includes the use of a higher flow rate and chiller system.

A6.1 ENVIRONMENTAL IMPACTS

A system designed with the adsorption units would be extremely large, and would place the sampling of SSTs on a much slower track. Actual RMCS activities can take up to 21 days per tank. With the exhauster using VOC and ammonia adsorption, set-up and break-down could take up to another 21 days. Therefore, less than 9 tanks per unit could be sampled in a year. Delaying the schedule and increasing the time required to sample SSTs provides an environmental impact to the clean-up of the Hanford Site.

An adsorption system for the VOC was identified. This system used in-place regeneration with nitrogen and therefore did not have a significant secondary waste generation problems. However, there is an environmental impact in the generation of spent impregnated carbon from the ammonia adsorption system.

A6.2 ECONOMIC IMPACTS

An adsorption system on the exhauster would add \$185,000 to the operating cost to obtain one core sample. At a sampling rate of 30 cores per year (i.e., 15 tanks per year, 2 cores per tank), \$5,550,000/year, would be spent to include adsorption on the RMCS system (this does not include the capital cost of an adsorption system). At 99 percent efficiency, this unit could remove up to 34.2 kg (75.3 lb) of TAPs per year (i.e., assuming the vapor space results from Tank 241-BY-110 are used to illustrate an annual average emissions rate). Therefore, the operating cost of the adsorption systems is \$147 million/ton of TAPs (i.e., \$162,000/kg [\$73,700 lb] of TAPs).

Using a 300 hp diesel engine to power the adsorption system at approximately \$10/h, 24 h/day, 14 d/tank, and 15 tanks/year, would cost more than \$50,000/year (see Section A6.3). The total economic impact of operating an adsorption system with the RMCS exhauster is more than \$5.6 million/year. Thus, the economic impact of the adsorption control technology is not efficient and does not justify its use.

A6.3 ENERGY IMPACTS

The operation of the previously designed system (including the VOC adsorber regeneration) required approximately 175 kVa additional power. The power to the RMCS exhaust system is supplied by a diesel generator, and an additional diesel generator, of 300 hp or less, would be required to supply power to the adsorption system. The economic impact of the additional energy requirements to support the adsorption technology, to remove less than 35 kg (76 lb) of toxics from the air stream, would cost more than \$50,000/year (i.e., more than \$1,400/kg [\$669/lb]). Thus, the energy impact does not justify the added cost to control insignificant TAP emissions.

A7.0 CONCLUSION

Based on the previous assessment, the unabated emissions, as a result of the planned activity do not represent significant emissions to the atmosphere. Exhauster operation time will be limited such that actual emissions are less than the SQERs for those TAPs that have SQERs and less than the substitute SQERs or substitute ASILs for the specific TAPs described in the text, Section 6.2. Additionally, the impacts of the control technology are not justified in the removal of an insignificant quantity of pollutants. Therefore, the T-BACT assessment recommends that no controls for TAPs be installed.

APPENDIX B

TOTAL ORGANIC CARBON AND AMMONIA MONITORING REQUIREMENTS
FOR THE ROTARY MODE CORE SAMPLING SYSTEM

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APPENDIX B

TOTAL ORGANIC CARBON AND AMMONIA MONITORING REQUIREMENTS
FOR THE ROTARY MODE CORE SAMPLING SYSTEM

B1.0 INTRODUCTION

A sample of the vapor space of each passively ventilated tank scheduled for rotary mode core sampling (RMCS) will be obtained as part of the preoperational steps. As discussed in the text, Section 6.0, a calculation for all TAPs listed in the TWINS database for each tank will be performed as described in this Appendix before RMCS. Results of this analysis will be used to determine the acceptability of performing RMCS on any given tank and the extra requirements and limitations such as limiting exhauster operation or stack monitoring that might be imposed.

Figure B1 represents the logic for determining the extra requirements such as monitoring or limiting the number of hours of exhauster operation to ensure emissions do not exceed the SQER.

Figure B1. Total Organic Carbon and Ammonia Monitoring Requirements.

B2.0 DETERMINATION OF ACCEPTABILITY FOR ROTARY MODE CORE SAMPLING

The following method will be used to determine whether a waste tank's vapor space is acceptable for RMCS:

- Convert ammonia and each organic species regulated as a class A or class B toxic air pollutant (TAP) from parts per million (p/M) by volume to milligrams per cubic meter using Equation 1:

$$\frac{(p/M) (\text{gram molecular weight})}{24.45} = \frac{\text{mg}}{\text{m}^3} \quad (1)$$

- Convert ammonia and each organic species regulated as a class B TAP from milligrams per cubic meter to pounds per hour at 5.7 m³/min (200 ft³/min) using Equation 2:

$$\left(X \frac{\text{mg}}{\text{m}^3} \right) \left(\frac{339.8 \text{ m}^3}{\text{hr}} \right) \left(\frac{1 \text{ lb}}{453,593 \text{ mg}} \right) = X \frac{\text{lb}}{\text{hr}} \quad (2)$$

- Convert each organic species regulated as a class A TAP from milligrams per cubic meter to pounds per year at 5.7 m³/min (200 ft³/min) using Equation 3:

$$\left(X \frac{\text{mg}}{\text{m}^3} \right) \left(\frac{339.8 \text{ m}^3}{\text{hr}} \right) \left(\frac{1344 \text{ hr}}{\text{yr}} \right) \left(\frac{1 \text{ lb}}{453,593 \text{ mg}} \right) = X \frac{\text{lb}}{\text{yr}}$$

where $\frac{672 \text{ hr}}{6 \text{ mo.}}$ is the maximum operating time (3)

in any tank as required by

technical safety requirements (HNF-SD-WM-TSR-006).

If the calculated emission rate for any TAP exceeds its established SQER, the actual hours of RMCS exhauster operation will be reduced to maintain TAP emission estimates below permit limits.

B3.0 DETERMINATION OF MONITORING REQUIREMENTS

If the calculated emission rate for any of the TAPs exceeds 50% of that TAP's established SQER, TOC monitoring is required during RMCS sampling. If ammonia exceeds 50 percent of its SQER, ammonia monitoring will be performed during RMCS sampling. Monitoring will be accomplished through the routine health and safety monitoring currently performed to ensure protection of personnel from TAP vapors. This approach to environmental compliance monitoring was approved by Ecology in DOE/RL-95-62.

If monitoring is the chosen option, the following criteria will be used to determine monitoring requirements:

- Establishment of a TOC limit as described in Section B4.0 and/or establishment of an ammonia limit setpoint as described in Section B5.0.
- The frequency of TOC monitoring will be as follows:
 - Once before starting the rotation of the drill string, with the exhauster operating
 - Hourly during RMCS operations.

B4.0 DETERMINATION OF MONITORING REQUIREMENTS FOR TOTAL ORGANIC CARBON

Assuming TOC monitoring is required, the following method will be used to determine a TOC limit setpoint:

- Determine a TOC limit for each organic Class B TAP that exceeds 50 percent of its SQER and is fully detectable with the TOC monitor using equation 4:

$$\frac{(\text{sample [TOC]}) (\text{SQER of chemical X})}{(\text{chemical X rate})} = \text{Limit [TOC]} \quad (4)$$

where: [TOC] = concentration of TOC in p/M
SQER of chemical X = SQER in lbs/hr
chemical X rate = result of Equation 2 in lbs/hr

- Determine a TOC limit for each organic Class A TAP that exceeds 50 percent of its SQER and is fully detectable with the TOC monitor using equation 5:

$$\frac{(\text{sample [TOC]}) (\text{SQER of chemical X})}{(\text{chemical X rate})} = \text{Limit [TOC]} \quad (5)$$

where: [TOC] = concentration of TOC in p/M
SQER of chemical X = SQER in lbs/yr
chemical X rate = result of Equation 3 in lbs/yr

Monitoring instrumentation must be capable of detecting TOC concentrations as determined by equations (4) and (5). Actual RMCS operational activities may be conducted above equations (4) and (5) concentrations as long as a safe shutdown of the RMCS equipment is initiated before emissions exceed the SQER.

B5.0 DETERMINATION OF MONITORING REQUIREMENTS FOR AMMONIA LIMIT SETPOINT

Assuming ammonia monitoring is required, the following method will be used to determine an ammonia limit setpoint:

- Convert the SQER for ammonia to milligrams per cubic meter at 5.7 m³/min (200 ft³/min) using equation 6:

$$\left(\text{SQER} \frac{\text{lb}}{\text{hr}} \right) \left(\frac{\text{hr}}{339.8 \text{ m}^3} \right) \left(\frac{453,593 \text{ mg}}{\text{lb}} \right) = X \frac{\text{mg}}{\text{m}^3} \quad (6)$$

- Convert from milligrams per cubic meter to p/M using equation 7:

$$\left(X \frac{\text{mg}}{\text{m}^3} \right) \left(\frac{24.45}{17.03} \right) = \text{Ammonia Limit (p/M)} \quad (7)$$

Monitoring instrumentation must be capable of detecting ammonia concentrations determined by equations (6) and (7). Actual RMCS operational activities may be conducted above equation (6) and (7) concentrations as long as a safe shutdown of the RMCS equipment is initiated before emissions exceed the SQER.

APPENDIX C

UNIT CONCENTRATION FACTORS FROM ISC3

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DON'T SAY IT -- Write It!

September 27, 1996

To: John S. Hill
H6-25 372-1617From: Paul D. Rittmann
H0-31 376-8715

Subject: Unit Concentration Factors from ISC3

The ISC3 program (EPA-454/B-95-003a, "User's Guide for the Industrial Source Complex (ISC3) Dispersion Models", September 1995) was used to compute unit concentration factors for the Hanford Site boundary for 24 hour and annual releases from the 100-N (or 100-K), the 200 West, the 200 East, and 300 Areas. Hanford site wind data is used for these calculations. The data for each area was collected in that area. For the 24 hour releases, hourly data from 1992, 1993, 1994, and 1995 was used. For the annual releases the joint frequency summary for each area for the years 1986 to 1995 was used. Results are summarized in the first table below. These are the worst-case values for ground level releases from each area.

Table 1. Summary of Unit Concentration Factors for
Ground Level Releases from Hanford Facilities

Release Locations	24 Hour Average		Annual Average	
	Concen. Factor	Site Boundary Location	Concen. Factor	Site Boundary Location
100-N & KW	4.17	8.5 km WNW	0.125	8.5 km WNW
200 West Area	3.46	12.6 km S	0.0585	22.0 km SE
200 East Area	2.79	17.1 km ESE	0.0793	17.1 km ESE
300 Area	38.1	1.1 km E	1.56	1.3 km NE
Note: Units for the Concentration Factors are $\mu\text{g}/\text{m}^3$ per g/s. Peak values are given. Note: Annual averages are based on Hanford Site wind data collected over the years 1986 to 1995. 24 hour averages are based on hourly Hanford Site wind data for the years 1992, 1993, 1994, and 1995.				

To use these factors, the rate at which a chemical is released into the air must be computed. To do this, the total amount (in grams) of the chemical released is divided by either 86,400 seconds (24 hours) or 31,557,600 seconds (1 year). This release rate is then multiplied by one of the factors on Table 1 to compute the average concentration at the Hanford site boundary in $\mu\text{g}/\text{m}^3$. The formula below summarizes the calculation.

$$\text{Air Conc } (\mu\text{g}/\text{m}^3) = \frac{(\text{Total Release, grams}) * (\text{Concen. Factor})}{\text{Release Period, seconds}}$$

As an example, suppose that 10 grams of ammonia is released over a 24 hour period from the 200 West Area. Then the largest observed air concentration at the Hanford site boundary over the past four years is $0.0004 \mu\text{g}/\text{m}^3$ at a location 12.6 km south of the 200 West Area.

$$\frac{(10 \text{ grams}) * (3.46 \mu\text{g}/\text{m}^3 \text{ per g/s})}{86,400 \text{ seconds}} = 4.0 \times 10^{-4} \mu\text{g}/\text{m}^3 \text{ (12.6 km S)}$$

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Method of Calculating the Concentration Factors

The first step was to estimate distances to the Hanford Site boundary from each of the areas of interest in all 16 wind transport directions. Table 2 shows the facilities selected and the distances obtained from the Hanford Map Distance (HMD) software by P.D. Rittmann.

Table 2. Distances (meters) to the Hanford Site Boundary

Dir	100-N and -K		200 West		200 East		300 Area	
	100 N	100 KW	CWC	REDOX	PUREX	WESF	324	333
N	9600	11000	17300	20300	24600	19400	7000	8700
NNW	8700	8900	15500	18100	21200	16700	46000	45500
NW	8300	8700	14600	17200	21300	18100	48600	48100
WNW	8500	10100	11800	13200	21200	19300	28500	28200
W	11500	12100	11500	13000	20700	18900	6000	6700
WSW	17300	15700	11800	13300	21100	19400	3500	4200
SW	20500	17400	13800	15500	17100	19900	2400	2900
SSW	28600	25600	15100	12800	16800	19600	2000	2700
S	28600	25200	14700	12600	19600	22800	1900	2400
SSE	34100	31000	19200	18200	19800	25500	1900	2400
SE	27300	32100	24700	22000	24300	19900	1500	1700
ESE	19100	21700	29900	28700	20200	17100	1200	1400
E	17300	20600	24300	25000	16000	16900	1100	1300
ENE	17300	20400	24600	23200	15300	21900	1100	1300
NE	16300	19900	27400	26400	18100	26400	1300	1500
NNE	13800	15200	25000	28800	23600	21100	1800	2200

The second step was to obtain Hanford Site wind data from Kenneth W. Burk at PNNL. The wind data for each area is then used in the ISC3 calculations.

The third step is to create input files for the ISC3 software. Two of the input files are attached for reference. The first is an annual average calculation using ISCLT, while the second is a 24 hour calculation using ISCST. Both use a release height of 2 meters, with an exhaust flow rate of 2000 cfm at a temperature of 20°C. These conditions model ground level releases.

The final step was to arrange the ISC3 results into Tables 3 and 4. The worst case concentration factor was taken for each area. These worst-case results are listed in Table 1.

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Table 3. Annual Average Concentration Factors ($\mu\text{g}/\text{m}^3$ per g/s)
from Ground Level Releases

Dir	100-N and -K		200 West		200 East		300 Area	
	100 N	100 KW	CWC	REDOX	PUREX	WESF	324	333
N	0.0500	0.0410	0.0249	0.0200	0.0136	0.0187	0.145	0.106
NNW	0.0656	0.0635	0.0311	0.0251	0.0216	0.0300	0.011	0.012
NW	0.1064	0.0993	0.0381	0.0303	0.0220	0.0276	0.014	0.014
WNW	0.1252	0.0973	0.0351	0.0299	0.0173	0.0197	0.017	0.017
W	0.0863	0.0803	0.0290	0.0243	0.0150	0.0171	0.059	0.050
WSW	0.0373	0.0427	0.0233	0.0196	0.0112	0.0126	0.079	0.060
SW	0.0234	0.0293	0.0212	0.0179	0.0154	0.0124	0.157	0.117
SSW	0.0126	0.0146	0.0246	0.0312	0.0153	0.0123	0.403	0.255
S	0.0136	0.0161	0.0366	0.0457	0.0147	0.0119	0.992	0.696
SSE	0.0131	0.0148	0.0368	0.0396	0.0189	0.0133	1.171	0.823
SE	0.0230	0.0186	0.0500	0.0585	0.0289	0.0380	1.248	1.036
ESE	0.0504	0.0423	0.0532	0.0562	0.0629	0.0793	1.142	0.917
E	0.0661	0.0520	0.0505	0.0486	0.0585	0.0542	1.184	0.933
ENE	0.0555	0.0442	0.0306	0.0331	0.0366	0.0224	1.382	1.082
NE	0.0389	0.0295	0.0182	0.0191	0.0207	0.0124	1.558	1.256
NNE	0.0318	0.0277	0.0153	0.0127	0.0117	0.0136	0.975	0.719

Table 4. 24 Hour Average Concentration Factors ($\mu\text{g}/\text{m}^3$ per g/s)
from Ground Level Releases

Dir	100-N and -K		200 West		200 East		300 Area	
	100 N	100 KW	CWC	REDOX	PUREX	WESF	324	333
N	3.75	3.30	1.96	1.70	1.29	1.71	5.91	4.47
NNW	3.20	3.13	3.30	2.84	1.95	2.45	0.52	0.53
NW	2.29	2.17	0.78	0.64	0.53	0.62	0.29	0.30
WNW	4.17	3.51	2.16	1.94	1.16	1.28	1.12	1.13
W	2.51	2.35	3.24	2.91	1.74	1.89	4.25	3.66
WSW	1.42	1.57	1.90	1.69	0.29	0.32	6.05	5.08
SW	0.81	0.96	0.79	0.71	1.31	1.13	4.79	3.97
SSW	0.92	1.02	1.92	2.30	1.39	1.20	1.91	8.91
S	0.90	1.01	3.02	3.46	1.69	1.48	7.25	9.85
SSE	0.81	0.90	2.64	2.78	1.31	1.02	0.01	5.84
SE	0.51	0.41	0.99	1.12	1.00	1.29	6.44	3.08
ESE	1.62	1.44	2.51	2.61	2.36	2.79	8.42	4.65
E	3.23	2.76	2.44	2.38	1.73	1.64	8.11	0.78
ENE	2.71	2.30	1.69	1.78	1.10	0.73	7.63	2.98
NE	0.61	0.48	0.91	0.95	0.41	0.26	1.38	8.12
NNE	2.36	2.15	1.96	1.70	0.97	1.08	6.36	3.08

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ISCLT Input File for 100-N Area

```

CO STARTING
  TITLEONE Ground Level Emissions from 100-N Area
  MODELOPT OFAULT CONC RURAL
  AVERTIME annual
  POLLUTID Unknown
  RUNORNOT RUN
CO FINISHED

SO STARTING
  LOCATION Exhaust1 POINT 0.0 0.0 0.0
  ** 2000 cfm g/sec ht,m temp*K m/sec diam,m
  SRCPARAM Exhaust1 1.0 2.0 293.0 2.0 0.775
  SRCGROUP ALL
SO FINISHED

RE STARTING
  ** These are the CAP88 order -- counter-clockwise from N
  ** Distances from 100-N are 1,3,5,...; Distances from 100-KW are 2,4,6,...
  DISCPOLR Exhaust1 9600 0.0
  DISCPOLR Exhaust1 11000 0.0
  DISCPOLR Exhaust1 8700 337.5
  DISCPOLR Exhaust1 8900 337.5
  DISCPOLR Exhaust1 8300 315.0
  DISCPOLR Exhaust1 8700 315.0
  DISCPOLR Exhaust1 8500 292.5
  DISCPOLR Exhaust1 10100 292.5
  DISCPOLR Exhaust1 11500 270.0
  DISCPOLR Exhaust1 12100 270.0
  DISCPOLR Exhaust1 17300 247.5
  DISCPOLR Exhaust1 15700 247.5
  DISCPOLR Exhaust1 20500 225.0
  DISCPOLR Exhaust1 17400 225.0
  DISCPOLR Exhaust1 28600 202.5
  DISCPOLR Exhaust1 25600 202.5
  DISCPOLR Exhaust1 28600 180.0
  DISCPOLR Exhaust1 25200 180.0
  DISCPOLR Exhaust1 34100 157.5
  DISCPOLR Exhaust1 31000 157.5
  DISCPOLR Exhaust1 27300 135.0
  DISCPOLR Exhaust1 32100 135.0
  DISCPOLR Exhaust1 19100 112.5
  DISCPOLR Exhaust1 21700 112.5
  DISCPOLR Exhaust1 17300 90.0
  DISCPOLR Exhaust1 20600 90.0
  DISCPOLR Exhaust1 17300 67.5
  DISCPOLR Exhaust1 20400 67.5
  DISCPOLR Exhaust1 16300 45.0
  DISCPOLR Exhaust1 19900 45.0
  DISCPOLR Exhaust1 13800 22.5
  DISCPOLR Exhaust1 15200 22.5
RE FINISHED

ME STARTING
  INPUTFIL JF100N10.STA FREE
  ANEMHGT 10.0
  SURFDATA 67656 1995 HANFORD100
  UAIROATA 67656 1995 HANFORD100
  STARDATA ANNUAL
  ** WINDCATS 1.341 3.576 5.364 8.494 10.729
  AVESPEED 1.00 2.682 4.694 7.153 9.835 14.304
  AVETEMPS ANNUAL 6*285.3
  AVEIXHT ANNUAL A 6*1000.0
  AVEIXHT ANNUAL B 6*1000.0
  AVEIXHT ANNUAL C 6*1000.0
  AVEIXHT ANNUAL D 6*1000.0
  AVEIXHT ANNUAL E 6*1000.0
  AVEIXHT ANNUAL F 6*1000.0
ME FINISHED

OU STARTING
  RECTABLE SRCGRP
  MAXTABLE 10 INDSRC SOCONT
OU FINISHED

```

September 27, 1996

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ISCST Input File for 200 West Area

```
CO STARTING
TITLEONE Ground Level Emissions from 200 West Area
MODELOPT MSGPRO CONC RURAL
AVERTIME 24
POLLUTID Unknown
RUNORNOT RUN
CO FINISHED

SO STARTING
LOCATION Exhaust1 POINT 0.0 0.0 0.0
** 2000 cfm g/sec ht,m temp*K m/sec diam,m
SRCPARAM Exhaust1 1.0 2.0 293.0 2.0 0.775
SRCGROUP ALL
SO FINISHED

RE STARTING
** Distances from CWC are 1,3,5,...; Distances from REDOX are 2,4,6,...
DISCPOLR Exhaust1 17300 0.0
DISCPOLR Exhaust1 20300 0.0
DISCPOLR Exhaust1 15500 337.5
DISCPOLR Exhaust1 18100 337.5
DISCPOLR Exhaust1 14600 315.0
DISCPOLR Exhaust1 17200 315.0
DISCPOLR Exhaust1 11800 292.5
DISCPOLR Exhaust1 13200 292.5
DISCPOLR Exhaust1 11500 270.0
DISCPOLR Exhaust1 13000 270.0
DISCPOLR Exhaust1 11800 247.5
DISCPOLR Exhaust1 13300 247.5
DISCPOLR Exhaust1 13800 225.0
DISCPOLR Exhaust1 15500 225.0
DISCPOLR Exhaust1 15100 202.5
DISCPOLR Exhaust1 12800 202.5
DISCPOLR Exhaust1 14700 180.0
DISCPOLR Exhaust1 12600 180.0
DISCPOLR Exhaust1 19200 157.5
DISCPOLR Exhaust1 18200 157.5
DISCPOLR Exhaust1 24700 135.0
DISCPOLR Exhaust1 22000 135.0
DISCPOLR Exhaust1 29900 112.5
DISCPOLR Exhaust1 28700 112.5
DISCPOLR Exhaust1 24300 90.0
DISCPOLR Exhaust1 25000 90.0
DISCPOLR Exhaust1 24600 67.5
DISCPOLR Exhaust1 23200 67.5
DISCPOLR Exhaust1 27400 45.0
DISCPOLR Exhaust1 26400 45.0
DISCPOLR Exhaust1 25000 22.5
DISCPOLR Exhaust1 28800 22.5
RE FINISHED

ME STARTING
INPUTFIL EPA92-95.2W
ANEMNGMT 10.0
SURFDATA 67656 1992 Hanford-200
UATRODATA 67656 1992 Hanford-200
ME FINISHED

OU STARTING
RECTABLE ALLAVE FIRST
MAXTABLE ALLAVE 20
OU FINISHED
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