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DATA QUALITY OBJECTIVES FOR REGULATORY REQUIREMENTS FOR HAZARDOUS AND RADIOACTIVE AIR EMISSIONS SAMPLING AND ANALYSIS

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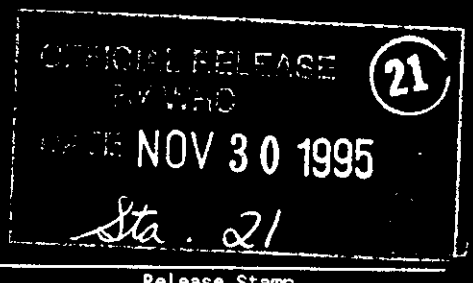

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Data Quality Objectives for Regulatory Requirements for Hazardous And Radioactive Air Emissions Sampling and Analysis

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CERCLA	*Comprehensive Environmental Response, Compensation and Liability Act of 1980*
CFR	Code of Federal Regulations
DCRT	double contained receiver tank
DQO	data quality objectives
DST	double-shell tank
EDE	effective dose equivalent
EPA	Environmental Protection Agency
EPCRA	*Emergency Planning and Community Right-to-Know Act of 1986*
HEPA	high-efficiency particulate air (filter)
IMUST	inactive miscellaneous underground storage tanks
NESHAPS	National Emission Standards for Hazardous Air Pollutants
QA/QC	quality assurance/quality control
RCRA	*Resource Conservation and Recovery Act of 1976*
RMCS	rotary mode core sampling
SQE	small quantity emission
SST	single-shell tank
TAP	toxic air pollutant
TFTP	Tank Farm Transition Projects
TWRS	Tank Waste Remediation System
VOC	volatile organic compound
WAC	*Washington Administrative Code*
WHC	Westinghouse Hanford Company

GLOSSARY

Fugitive Emissions:	Emissions which do not pass and which could not reasonably pass through a stack, chimney, vent, or other functionally equivalent opening.
Major Stack:	A stack which hypothetically has the potential to expose an individual of the public to more than 0.1 mrem per year effective dose equivalent.
Minor Stack:	A stack which has the potential to emit radionuclides and which is not a major stack.
Process Knowledge:	Knowledge about a process derived from understanding what happens and has happened in the process and what could be expected to happen. Process knowledge could also include analytical results of varying quality.

1.0 INTRODUCTION

This data quality objective (DQO) was developed using the *TWRS Data Quality Objectives Strategy*, WHC-EP-0732 (Babad, 1994) which is based on the U.S. Environmental Protection Agency (EPA) DQO guidelines (EPA QA/G-4, 1994). This DQO identifies state and federal requirements associated with toxic hazardous and/or radiological air emissions under the jurisdiction of Hanford Tank Farm Transition Projects (TFTP). This document includes lists of analytes compiled from chemical inventories, process knowledge, vapor space characterization data, and gases that may be generated by chemical and/or radiological activity.

Users of this document will find a summary of required analyses in Section 8.0. A brief description of each covered regulatory driver is incorporated into Section 3.0. This document should not be used for determining overall compliance with regulations because the regulations are in constant change, and this document may not reflect the latest regulatory requirements. Regulatory requirements are also expected to change, as various permits are issued. It should also be noted that this document does not address health or safety regulations or requirements (i.e., Occupational Safety and Health Administration or the National Institute of Occupational Safety and Health) or continuous emission monitoring systems.

1.1 PURPOSE OF DATA QUALITY OBJECTIVES

There are a number of federal and state laws and regulations which require the reporting of emissions or which establish emission limits. Regulations also require that changes to emissions be determined whenever existing equipment is modified, or the installation of new equipment is planned. In many cases, the regulations allow the use of calculated emission rates instead of requiring actual analytical data. In most instances where emission calculations are allowed, it is still a best management practice to validate the calculated emission rates with actual emission measurement.

The purpose of this DQO is to identify the current data needs for complying with regulatory drivers for the measurement of air emissions from Tank Waste Remediation Systems (TWRS) facilities. These drivers include best management practices; similar analyses may have more than one regulatory driver. The data needs require samples for both radionuclide and nonradionuclide analytes in tank vapor spaces and samples of the stored liquid. Unless specified, this DQO is not intended be a driver in determining when a sample is obtained, but it is intended to be a driver in determining analyses whenever a sample is taken from one of the specified units. The analyses required by this document should be incorporated into any sampling and analytical plan for any of the specified TWRS units (see Appendix A). After emission estimates have been validated by analytical data, subsequent sampling can be reduced. To eliminate unnecessary sampling, the Environmental Cleanup and Compliance Project should be contacted to determine the need for an analysis if the same source is resampled within two years.

1.2 RELATED DATA QUALITY OBJECTIVES

Several DQOs pertaining to air sampling have been issued. These DQOs are related to health and safety or process control needs, and they do not necessarily address data needs rising from environmental regulations and requirements. These DQOs are discussed in the following subsections.

1.2.1 In-Tank Health and Safety

The *Data Quality Objectives for Generic In-Tank Health and Safety Vapor Issue Resolution* (Osborne 1995) was written as part of the safety vapor issue resolution program to address worker exposure to tank vapors. The document addressed the need to protect workers exposed to noxious vapors emitted by certain tank farms.

1.2.2 Organic Fuel Rich Tank Safety

The *Data Quality Objectives to Support Resolution of the Organic Fuel Rich Tank Safety Issue* (Babad 1995) identifies data needs for determining whether tanks should be listed on the Organic Watch List (Badad et al. 1994). It provides useful information for developing this document because most hazardous and toxic compounds generated in the tanks are derived from organic compounds.

1.2.3 242-A Evaporator

The *242-A Evaporator/Liquid Effluent Retention Facility Data Quality Objective* (Von Bargen 1995) 242-A Evaporator DQO primarily addresses process control needs required to support operations of the 242-A Evaporator. It includes requirements for the number of samples, sample locations, required analyses, and how sampling and analysis will be performed at the 242-A Evaporator.

1.3 STAKEHOLDERS

The major programs which will be impacted by the results of this DQO include the following: East and West Tank Farm Transition Projects, the Evaporator Project, the Environmental Cleanup and Compliance Project, the Characterization Project, and the 222S and 325 Laboratories.

1.4 APPLICABILITY OF THIS DQO

This DQO (WHC-SD-WM-DQO-021) is applicable to all equipment, facilities, and operations under the jurisdiction of TFTP which emit or have the potential to emit regulated air pollutants. See Section 5.0 for specified emission sources.

2.0 PROBLEM STATEMENT

This DQO (WHC-SD-DQO-021) identifies air sampling and analysis requirements for the TFTP facilities needed to address environmental regulatory needs. Previous studies indicate that hazardous vapors are generated and released from Hanford Site single-shell (SST) and double-shell (DST) storage tanks and waste processing facilities (Huckaby and Story 1994, Jansky and Meissner 1983, and Van Slyke 1994). Two tank vapor data quality objectives studies have been conducted to address health and safety (Osborne 1995 and Turner 1995). None of these studies have considered regulatory requirements and needs. Some of the specific regulatory drivers include the following: 40 *Code of Federal Regulations* (CFR) 50, 40 CFR 52, 40 CFR 264 and 265, 40 CFR 372, Section 313 of the *Emergency Planning and Community Right-to-Know Act* (EPCRA-Title III of the *Superfund Amendments and Reauthorization Act of 1986*), and *Washington Administrative Code* (WAC)-173-400 and -460 for nonradioactive air emissions; and 40 CFR 61, Subpart H; and WAC 246-247 for radioactive air emissions.

TFTP facilities that emit or have the potential to emit toxic hazardous or radioactive compounds are listed in Appendix A. Many of the regulations that require quantification of emissions do not specifically require analysis. This allows the opportunistic approach to be used for measuring emissions from many of these facilities. The data obtained from opportunistic sampling is used to validate emission calculations. The Vapor Sampling Program has sampled several tank vapor spaces for safety-related issues, but differences between safety drivers and environmental regulations may require additional sampling and analyses. This document provides guidance for sampling and analysis that are needed to meet environmental regulatory drivers of regulated air pollutants emitted from TFTP facilities.

This document identifies the environmental regulatory drivers for air sampling, when analysis should be obtained, and the facilities where sampling or monitoring is required or should be conducted. It also identifies specific analytes and quality assurance/quality control (QA/QC) procedures and emission limits. This document should complement and be consistent with *Data Quality Objectives for Generic In-Tank Health and Safety Vapor Issue Resolution* (Osborne 1995) and *Data Quality Objectives to Support Resolution of the Organic Complexant Tank Safety Issue* (Turner 1995), while still satisfying air emission regulatory requirements and data needs.

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3.0 DECISION IDENTIFICATION

A decision needs to be made about whether sampling and analysis of a particular piece of equipment is required and/or desired to quantify airborne emissions from TFTP facilities. Emissions may need to be quantified or estimated for reporting air emissions to regulatory agencies; to determine compliance with emission standards and whether a specific environmental requirement applies to the emission point, or to establish an emissions baseline which can be used for emission trading or to offset increased emissions from a new or modified source. TFTP is only required to quantify emissions in certain instances. In other instances, analysis is not required but is a best management practice used to verify calculated emission rates or to prepare for a future activity which will require a determination of emission changes. Each specific regulatory issue must be evaluated separately to determine analytical requirements.

Each of the following sections addresses a specific regulatory issue. An issue contains a short description, a requirement section, a decision logic diagram, and a section which explains the result of following the decion logic. The results for most equipment have been written as a decision statement. The implementation of the decision statements for each type of equipment has been used to produce the sampling and analysis designs in Section 7.0.

3.1 NONRADIOACTIVE AIR EMISSIONS

The following subsections discuss different regulatory drivers for the measurement of nonradioactive compounds. A decision flowchart, which diagrams the decision process, follows each section. The issuance of air permits is expected to increase regulatory requirements for quantifying emissions. These requirements should be incorporated into revisions of this document.

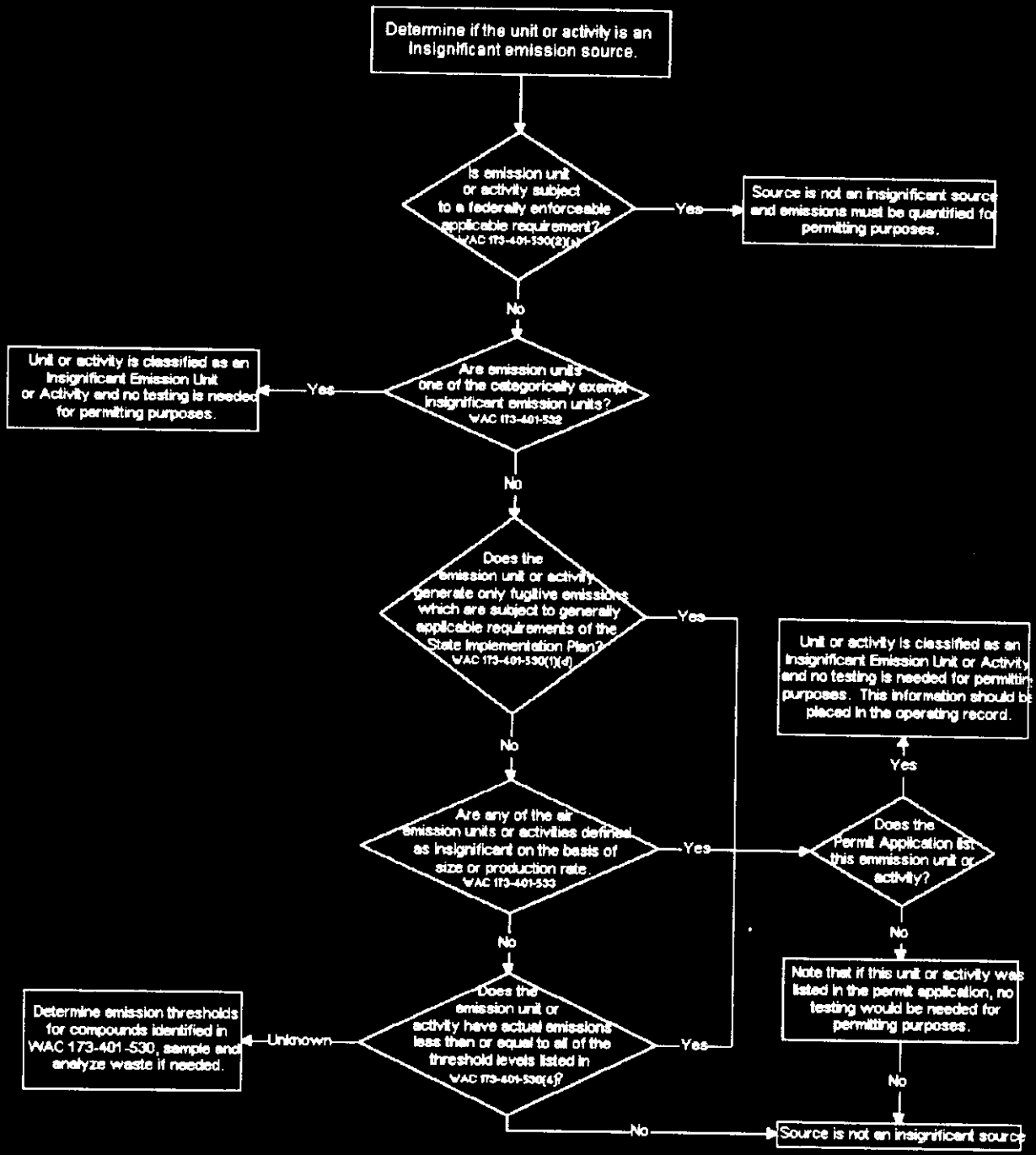
3.1.1 Insignificant Emission Units

The requirements for the air permit applications include the requirement that emitting sources quantify air emissions unless an exemption has been granted. One exemption was granted for existing insignificant emission units. However, sampling may be needed to determine whether an emission unit qualifies as an insignificant emission unit. The following decision logic should be used to determine whether a specific unit qualifies for this exemption.

Decision Logic

Decision steps are organized by priority and in the most logical and efficient sequence for analyzing and solving the problem. A flowchart of the decision logic is shown in Figure 3-1.

Figure 3-1. Decision Logic - Insignificant Emission Units.



Requirement: Determine whether the source is an insignificant emission unit. To be insignificant, the unit or activity can only be subject to the generally applicable sections of the State Implementation Plan and must meet at least one criteria in WAC 173-401, Section 530. The criteria include the following:

1. Determine whether actual emissions of all regulated air pollutants from an emission point, are below all emission thresholds listed in WAC 173-401, Section 530(4) and determine whether the unit or activity is listed in the Air Permit Application (Moon 1995). Refer to WAC 173-401, Section 530(1)(a) for specific requirements. Note that specific thresholds for hazardous air pollutants are contained in WAC 173-401, Section 531.

2. Determine whether the source is a categorically exempt insignificant emission unit as listed in WAC 173-401, Section 532.

3. Determine whether the air emission unit or activity is insignificant on the basis of size or production rate as stated in WAC 173-401, Section 533, and whether it is listed in the Air Permit Application.

4. Determine whether the emission unit or activity generates only fugitive emissions subject to applicable requirements in WAC 173-401, Section 530(1)(d), other than the generally applicable requirements of the state implementation plan. Ensure that these units or activities are listed in the permit application.

Result:

1. If the unit or activity qualifies as an insignificant emission unit, and if analytical results and/or other documentation can substantiate this determination, sampling is not required for permitting purposes.

2. If the unit does not qualify as an insignificant emission unit, or if insufficient data exists to support this determination, quantification of emissions is required. Calculated emission rates should be verified by sampling when feasible.

3.1.2 Quantification of Toxic/Hazardous Air Emissions

WAC 173-460, Section 050 requires that emissions of toxic and hazardous pollutants be quantified prior to modifying an existing source or constructing a new source. Modifications to an existing source include any action that may increase the amount of a pollutant emitted or that results in emission of an air pollutant not previously emitted. Modifications do not include variations in emission rates resulting from normal and historical operation unless it is not in accordance with a specific permit limit.

Toxic/hazardous air pollutants, which may be emitted from TFTP facilities, have been identified in Table 3-1. The table identifies which regulations pertain to each chemical. The specific chemicals which are regulated as toxic and hazardous air pollutants are listed in WAC 173-460, Section 150, WAC 173-460, Section 160, and WAC 173-401, Section 531. It is difficult to

Table 3-1. Potential Nonradionuclide TFTP Emissions by Regulatory Driver. (3 sheets)

Compound	EPCRA Section 313 toxic chemical list (40 CFR 372)	Toxic air pollutants (WAC 173-460)	Hazardous air pollutants (WAC 173-401) and primary pollutants (40 CFR 50)
Acetone [1,2]	*	*	
Acetonitrile [2]	*	*	*
Ammonia [2]	*	*	
Benzene [2]	*	*	*
1,3-Butadiene [2]	*	*	*
Butane		*	
2-Butoxyethanol [1]		*	*
n-Butyl acetate [1]		*	
n-Butyl alcohol (n-Butanol) [1,2]	*	*	
Carbon disulfide	*	*	*
Carbon monoxide [2]			
Chloroform [2]	*	*	*
Dipropyl ketone (4-heptanone)		*	
Ethyl acetate		*	
Ethyl butyl ketone (3-heptanone)		*	
Ethyl ether [3]		*	
n-Heptane [2]		*	
n-Hexane [1,2]	*	*	
Methyl n-amyl ketone (2-heptanone) [1]		*	
Methyl butyl ketone (2-hexanone) [2]			
Methyl ethyl ketone (2-butanone) [1]	*	*	*
Methyl propyl ketone (2-pentanone) [2]		*	

Table 3-1. Potential Nonradionuclide TFTP Emissions by Regulatory Driver. (3 sheets)

Compound	EPCRA Section 313 toxic chemical list (40 CFR 372)	Toxic air pollutants (WAC 173-460)	Hazardous air pollutants (WAC 173-401) and primary pollutants (40 CFR 50)
Methylene chloride [2]			*
Napthalene	*	*	*
Nitric oxide [2]		*	
Nitrogen dioxide [2]			
Nonane [2]		*	
Octane [2]		*	
Ozone [2]			*
Particulates (including PM10)			*
Pentane [2]		*	
Sulfur dioxide [2]			*
Tetrahydrofuran [1]		*	
Toluene [1,2]	*	*	*
Tributyl phosphate (phosphoric acid, tributyl ester) [2]	*	*	
Trichlorofluoromethane [1,2]	*	*	
Vinylidene chloride [2]	*	*	*
Xylenes [1,2]	*	*	*
Other organic TAPs which are detected above the quatification levels indicated in Appendix C			

Notes:

[1]Regulatory analytes present in sprays and cleaners used in TFTP maintenance shops (Van Slyke 1994).

[2]Regulatory analytes detected or suspected of being present in TFTP tank headspaces (Huckaby 1994).

[3]Present on the Inventory of Chemicals used at Hanford Site Production Plants and Support Operations document (Klem 1988).

*Subject to specified regulation.

establish concentration limits for these chemicals because regulations limit mass emissions which make concentration limits a function of the emission flowrate. Concentration limits are also difficult to establish because the allowed emission rates are either hourly or annual averages (see WAC 173-460, Section 080). Section 8.0 discusses how a detection limit was derived for toxic organic compounds.

The toxic/hazardous air pollutants listed in Table 3-1 need to be sampled/analyzed unless emissions have already been determined. This sampling can be limited if process knowledge or some other defendable method can be used to support particular pollutants are not present. The rationale for identifying and quantifying air pollutants is threefold: (1) to establish a baseline for emission trading/offsets, (2) to perform a best available control technology analysis when a change is proposed for the effluent flowrate, and (3) to determine changes in emissions due to modifications. To determine whether analytical data are needed, the following decision logic should be used for each TFTP unit.

Decision Logic

Decision steps are organized by priority and in the most logical and efficient sequence for analyzing and solving the problem. A flowchart of the decision logic is shown in Figure 3-2.

Requirement: Determine whether analytical data have been obtained for all toxic/hazardous air pollutant compounds listed in Table 3-1 for emission sources which have been modified or may be modified or constructed.

1. Determine whether data is available for all compounds listed in Table 3-1 using process knowledge, past sample analyses, or another defendable method.

2. Examine the data and determine whether changes in operations or other factors might have caused a significant change in emissions. Items which could trigger significant changes include the following: data older than two years, new waste types being processed or stored, and changes in storage or operating conditions. If it can be substantiated that the data are representative of the source, that data can be used rather than taking additional data. If emissions may have changed, new emission data should be obtained.

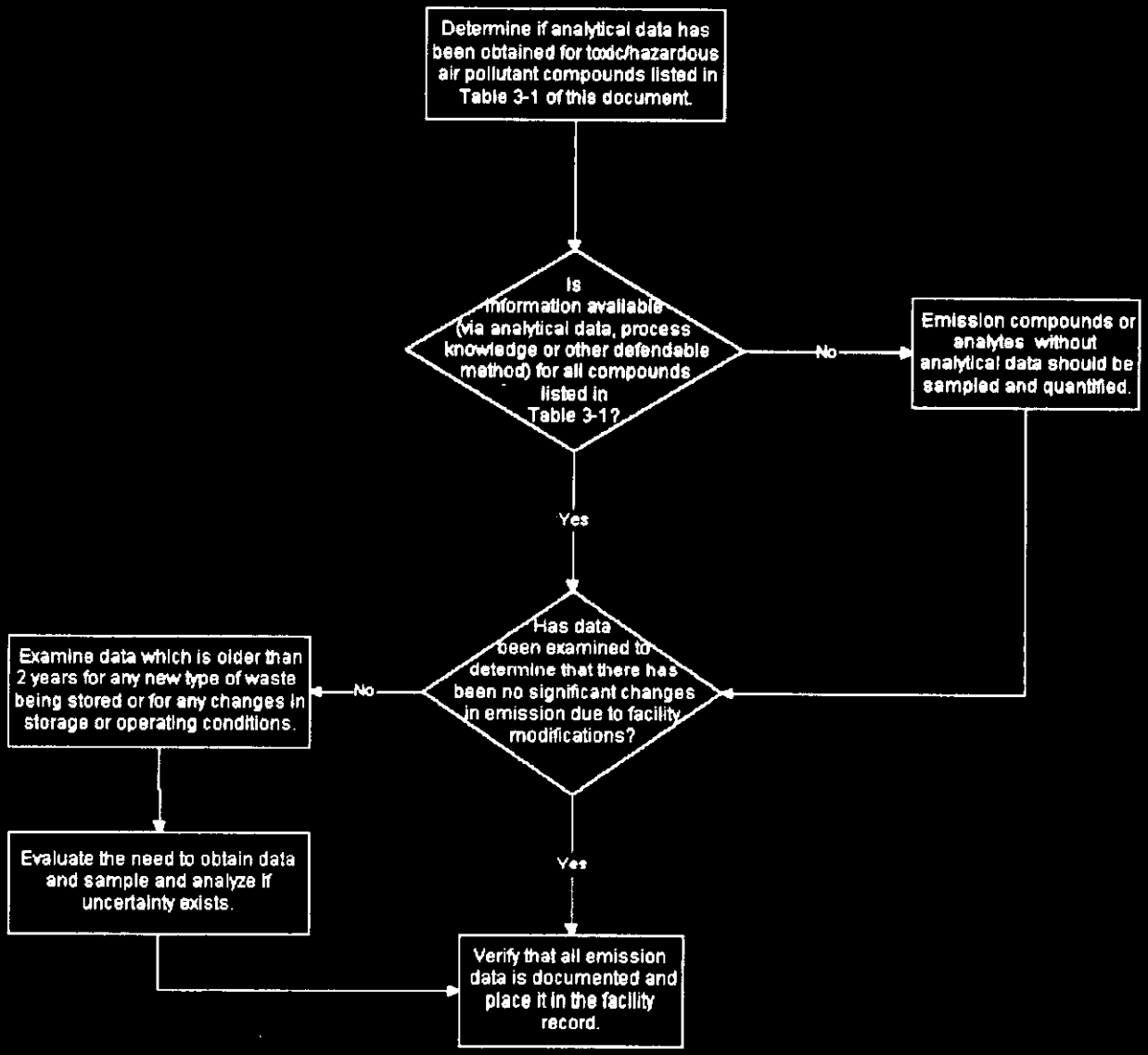
3. Verify that emission data is documented and inserted in the facility operating record [WAC 173-400, Section 105(1)].

Result:

1. If analytical data have been obtained previously for all compounds listed in Table 3-1, no further analysis is needed for reports.

2. If analytical data have not been obtained for all compounds, emission sources with missing analytical data should be sampled and emissions quantified.

Figure 3-2. Decision Logic - Release of Toxic Chemicals.



3.1.3 Release of Toxic Chemicals

Emissions of toxic chemicals must be reported annually under Section 313 of the *Emergency Planning and Community Right-to-Know Act* (EPCRA). EPCRA requires reporting certain chemical emissions when they exceed a specified threshold. Emissions from each facility are aggregated to determine whether a threshold has been exceeded. Because the Hanford Site is considered an EPCRA facility, emission thresholds could be exceeded because of the number of units handling relatively small amounts of the same chemical. This makes it necessary to track even very low levels of specified chemicals.

EPCRA does not require additional monitoring or measurement of the quantities or concentrations of any toxic chemical beyond that required by other laws or regulations, but it does require that emissions over a certain threshold be reported and quantified. This quantification does not have to be based on analysis; it can use other methods such as emission calculations. Generally, it is desirable to obtain at least limited sample data to support calculated numbers. This is especially true if information can be obtained at little or no additional cost, or if cumulative emissions are near the reporting threshold.

The following decision logic should be followed to determine whether additional information should be obtained.

Decision Logic

Decision steps are organized by priority and in the most logical and efficient sequence for analyzing and solving the problem. A flowchart of the decision logic is shown in Figure 3-3.

Requirement: Determine whether additional information should be obtained to support the reporting required by EPCRA (40 CFR 372, Part 65).

1. From each emission unit, evaluate adequacy of engineering calculations and available data for quantifying emissions of compounds listed in Table 3-1.

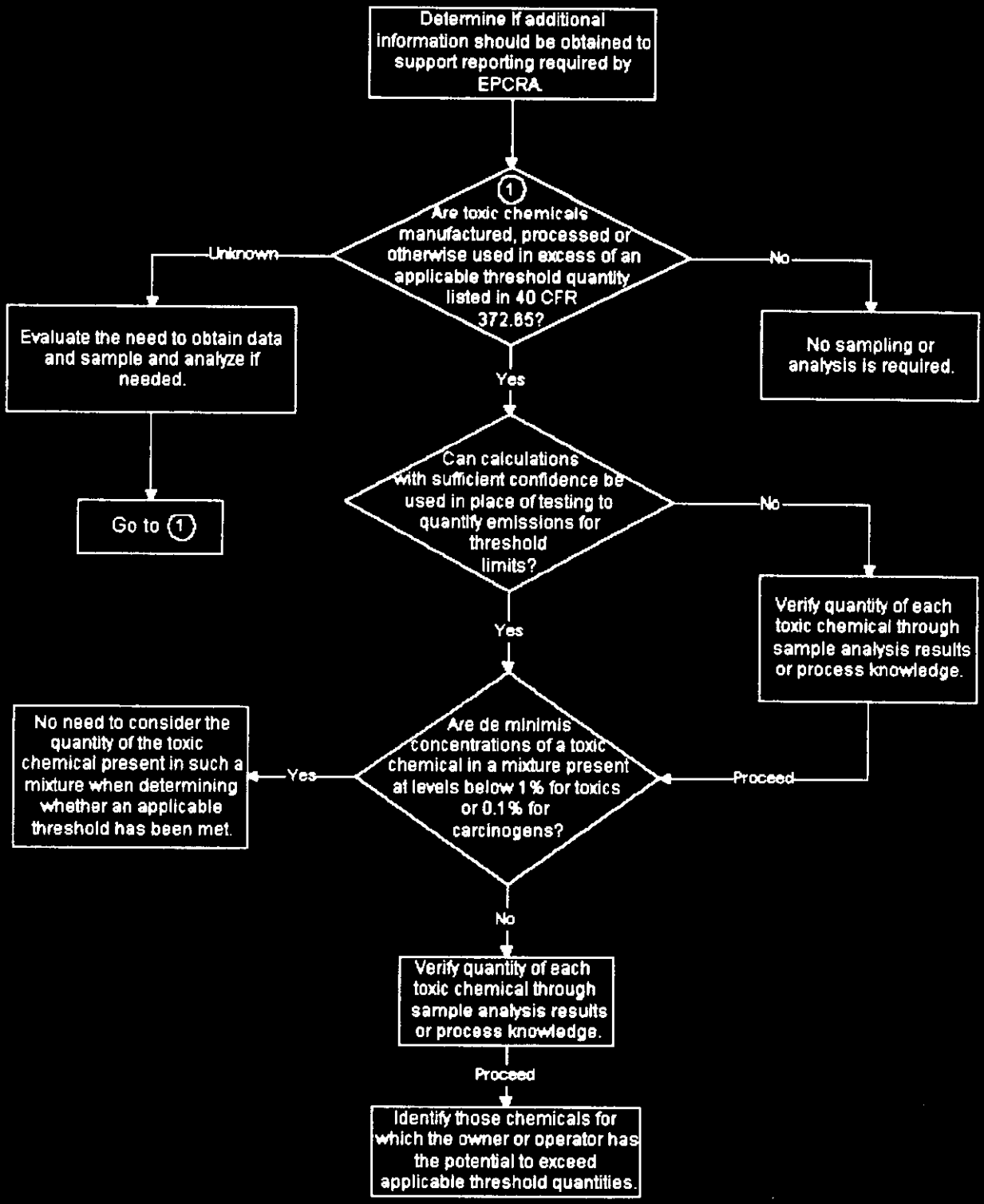
2. If necessary, obtain analytical data for compounds listed in Table 3-1.

Results:

1. If chemical emissions can be accurately estimated using existing data, sampling may not be required.

2. If analytical data or documentation is not available, obtain sufficient information on each appropriate chemical so that emission data can be calculated. Information obtained by sampling/analysis is preferred, but it may be obtained by engineering estimates, mass balances, or other means.

Figure 3-3. Decision Logic - Release of Toxic Chemicals.



3. If chemical concentrations are present below the de minimis levels listed in Table 3-1, there is no requirement to consider the quantity of the toxic chemical present in such a mixture when determining whether an applicable threshold has been met under 40 CFR 372, Part 25 or when determining the amount of release to be reported under 40 CFR 372, Part 30.

3.1.4 Air Emission Standards for Process Vents

Air emissions from process vents associated with distillation, fractionation, solvent extraction, or air or steam stripping operations that manage waste with organic concentrations greater than 10 parts per million by weight (ppmw) are subject to emission controls and limits (40 CFR 265, Subpart AA). The only TFTP equipment which currently should be subject to this regulation are the operating evaporators. To determine whether air emissions from process vents are subject to this regulation, the following decision logic should be used.

Decision Logic

Decision steps are organized by priority and in the most logical and efficient sequence for analyzing and solving the problem. A flowchart of the decision logic is shown in Figure 3-4.

Requirement: Determine whether the combined emissions from process vents on the Hanford Site are subject to air emission standards outlined in 40 CFR 265, Subpart AA.

1. Determine whether a process vent is associated with distillation, fractionation, solvent extraction, or air or steam stripping operations managing hazardous waste.

2. Determine from analytical data or process knowledge whether the operating units contain or come in contact with waste containing organic concentrations of 10 ppmw or greater.

3. Determine how to reduce total organic emissions from all vents subject to 40 CFR, Subpart AA below a cumulative total of 3 pounds per hour and 3.1 tons per year, or by 95 percent by weight (40 CFR 265, Part 1032[a] and [b]).

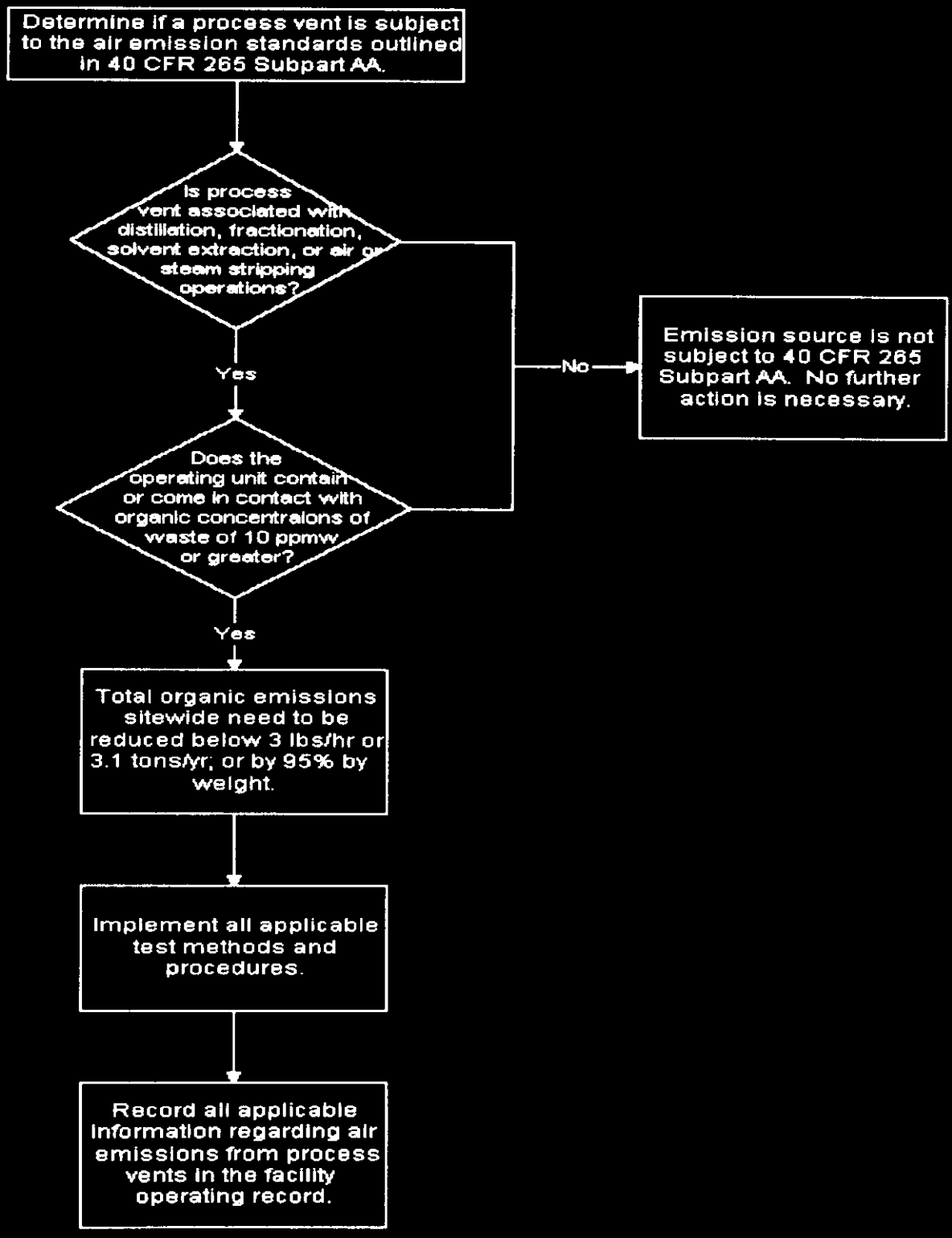
4. Implement all applicable test methods and procedures outlined in 40 CFR 265, Part 1034.

5. Record all applicable information regarding air emissions from process vents in the facility operating record (40 CFR 265, Part 1035[b]).

Result:

1. If analytical data or process knowledge is available, determine whether organic concentrations are present at 10 ppmw or greater.

Figure 3-4. Decision Logic - Air Emission Standards for Process Vents.



2. If analytical data or process knowledge is not available, sample the source and analyze the sample to obtain the necessary information.

3. If on subject sources, concentrations are 10 ppmw or greater, reduce total organic emissions from all affected process vents on the Hanford Site below 3 pounds per hour or 3.1 tons per year; or reduce total organic emissions by 95 percent by weight (40 CFR 265, Part 1032[a][1-2]) on affected vents using control devices.

3.1.5 Air Emission Standards for Equipment Leaks

Fugitive emission controls and monitoring are required for specified equipment which handles hazardous waste with an organic content greater than 10 percent by weight (in 40 CFR 265, Subpart BB). Requirements include monitoring the equipment for leaks through visual and/or instrumentation inspection and specified repair requirements. Requirements vary according to the type of equipment and the organic content of the waste. To determine whether a piece of equipment is subject to this regulation, the following decision logic should be used.

Decision Logic

Decision steps are organized by priority and in the most logical and efficient sequence for analyzing and solving the problem. A flowchart of the decision logic is shown in Figure 3-5.

Requirement: Determine whether an equipment leak is subject to air emission standards outlined in 40 CFR 265, Subpart BB.

1. Determine whether equipment is or contains a pump, pressure relief device, compressor, sampling connector, or valve.

2. Obtain available analyses results or use process knowledge to determine whether the waste in the equipment contains organic concentrations greater than 10 percent by weight.

3. Determine whether equipment handling organic liquids is in light or heavy liquid service.

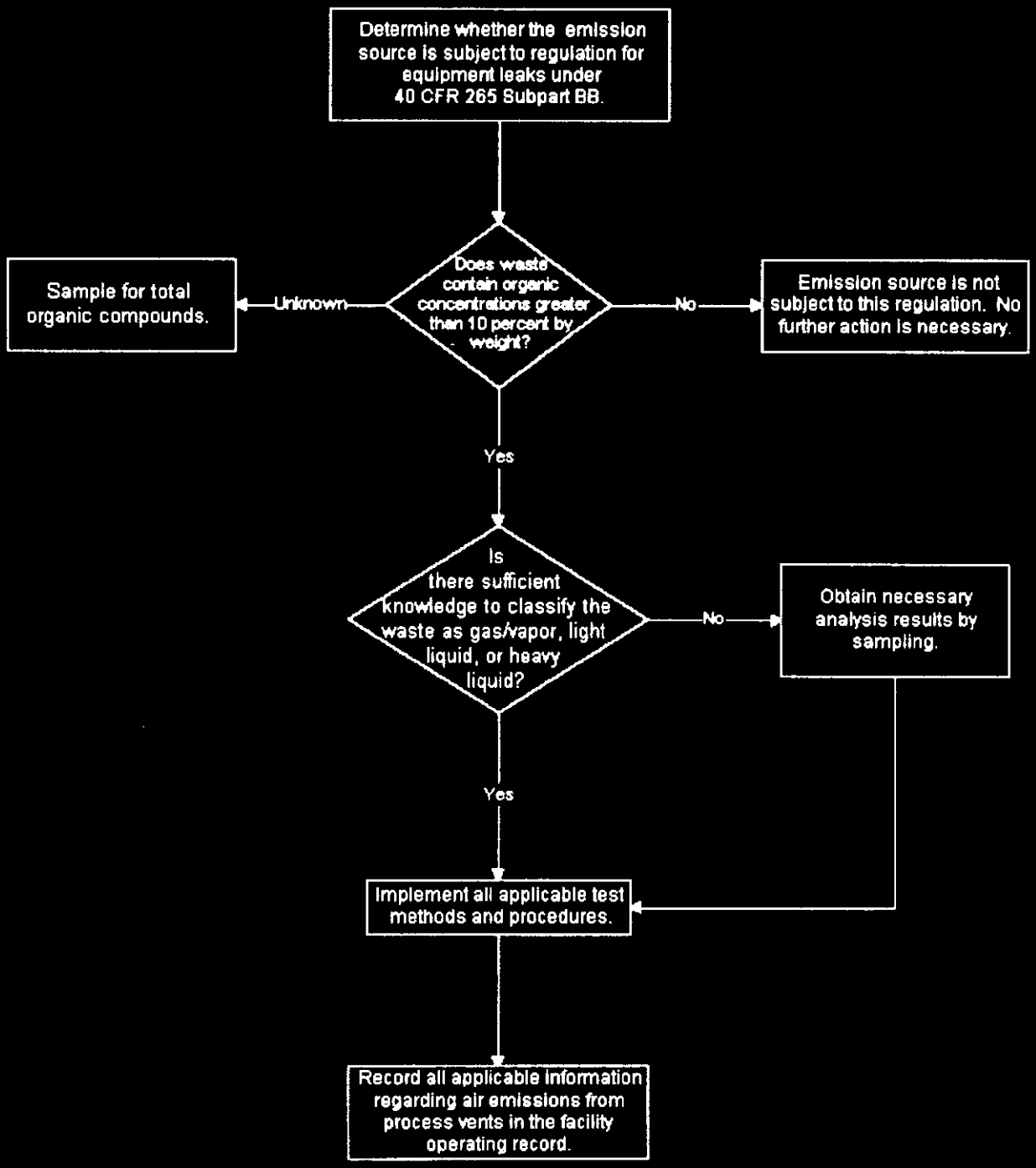
Result:

1. If analyses results or process knowledge are available, determine whether the waste contains greater than 10 percent organic concentration by weight. Document the information. No further analysis is required.

2. If analyses results or process knowledge is not available, sample the source to obtain necessary analytical information.

3. If the waste contains organic concentrations that exceed 10 percent by weight, perform any required monitoring.

Figure 3-5. Decision Logic - Air Emission Standards for Equipment Leaks.



3.1.6 Air Emission Standards for Tanks, Surface Impoundments, and Containers

This regulation controls organic emissions from tanks, surface impoundments, and containers at facilities that treat, store, or dispose of hazardous waste (40 CFR 265, Subpart CC). Equipment that solely handles mixed waste is exempted from this regulation. Equipment is not subject to some of the requirements of this regulation if the average volatile organic concentration of the hazardous waste at the point of waste origination is less than 100 ppmw; or if the organic content of the waste has been as specified in 40 CFR 265, Part 1083(2). To determine whether analyses are needed to decide whether equipment is subject to this regulation, the following decision logic should be used.

Decision Logic

Decision steps are organized by priority and in the most logical and efficient sequence for analyzing and solving the problem. A flowchart of the decision logic is shown in Figure 3-6.

Requirement: Determine whether the tank, surface impoundment, or container is subject to regulation under 40 CFR 265, Subpart CC.

1. Determine whether the waste management unit qualifies under any exemption listed in 40 CFR 265, Part 1080(b).

2. Determine whether the average volatile organic concentration at the point of waste origination is less than 100 ppmw using the procedure specified in 40 CFR 265, Part 1084(b) or through process knowledge or analysis.

Result:

1. If the waste management unit qualifies under the exemptions outlined in 40 CFR 265, Part 1080(b), no analysis is required.

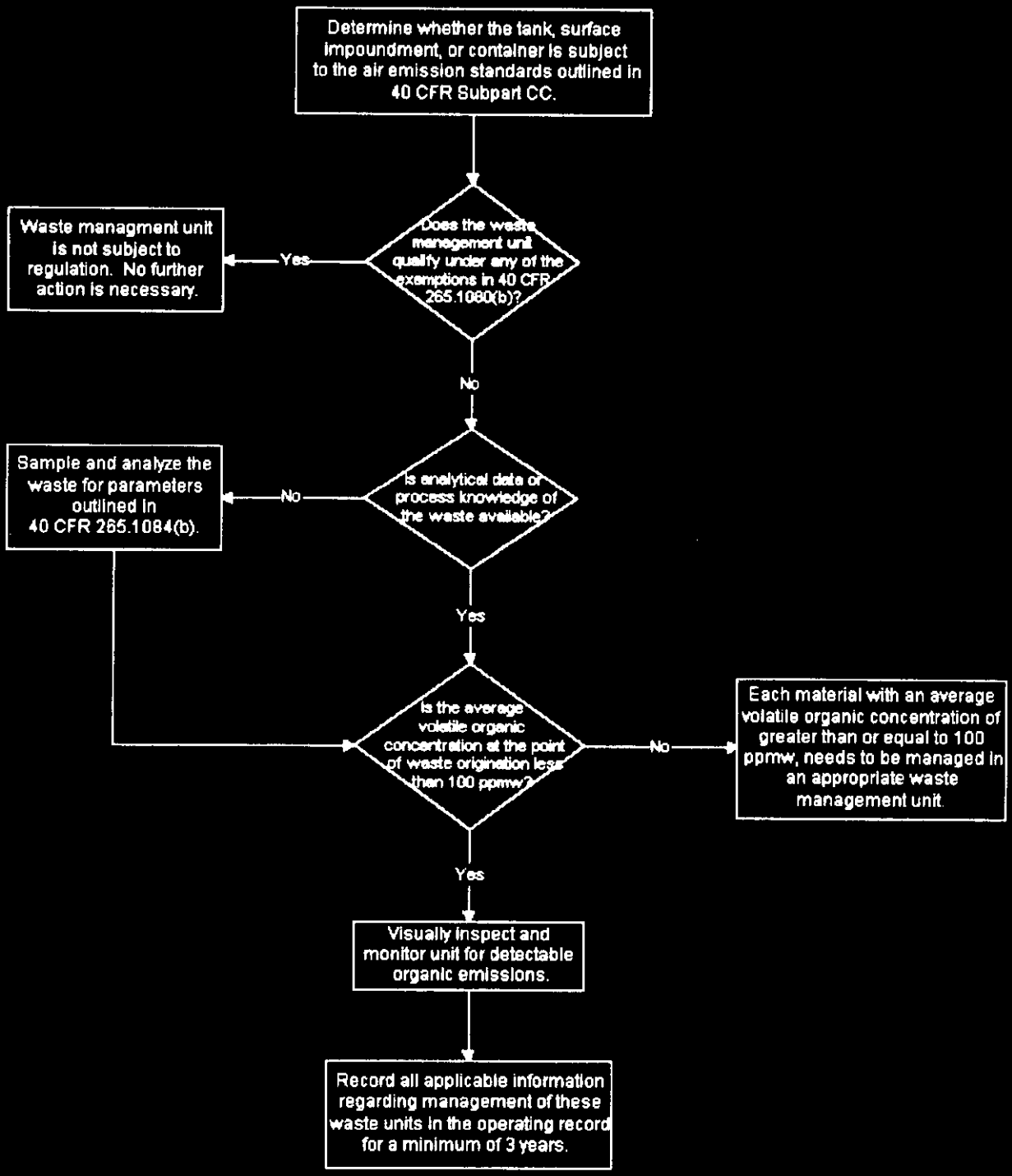
2. If the unit does not qualify for an exemption but is thought to have an organic content less than 100 ppmw, conduct analyses when the organic content may have changed.

3. If the unit is subject to this regulation, no continuing analyses are required as long as specified controls are in place.

3.1.7 Rotary Mode Core Sampling Air Emissions

As discussed in Section 3.1.2, permits are required for changes which could increase emissions. Because the construction of rotary mode core sampling (RMCS) systems 3 and 4 and the modification of system 2 could increase emissions a permit was required. The agencies approval of these modifications requires that toxic air pollutant (TAP) emissions (see WAC 173-460, Section 080) be determined prior to sampling activities at any waste tank. These approvals require sampling of the tank vapor space for TAPs to determine expected emissions during RMCS operation. Continuous monitoring is required for TAPs which may be emitted at a rate equal to or greater than 50 percent of

Figure 3-6. Decision Logic - Air Emission Standards for Tanks, Surface Impoundments, and Containers.



the small quantity emission (SQE) rate. The approval prohibits exceeding the SQE without prior agency approval. In addition to restricting TAP emissions, the approval also limits volatile organic compound (VOC) emissions from the RMCS Exhauster to 3 pounds per day on a daily average.

To determine whether analytical data is needed, the following decision logic should be used for each sampling activity. Decision steps are organized by priority and in the most logical and efficient sequence for analyzing and solving the problem. A flowchart of the decision logic is shown in Figure 3-7.

Requirement: Determine the monitoring required during RCMS activities and the concentration of VOCs in the tank vapor space.

1. Determine whether data is available for total VOC content and for all compounds listed in WAC 173-460, Sections 150 and 160 which may exceed the quantification limit given in Section 6.0.

2. Examine the data and determine whether changes in operations or other factors might have caused a significant change in gas composition. Significant changes could be caused by data being older than 2 years, new waste types being processed or stored, and changes in storage or operating conditions. If it can be substantiated that the data are representative of the source, that data can be used rather than taking additional data. If the gas composition may have changed significantly, new samples should be taken.

3. Verify that the emission estimate calculations have been completed prior to RMCS activities being initiated on each waste tank and that calculations are documented and inserted in the facility operating record.

Result:

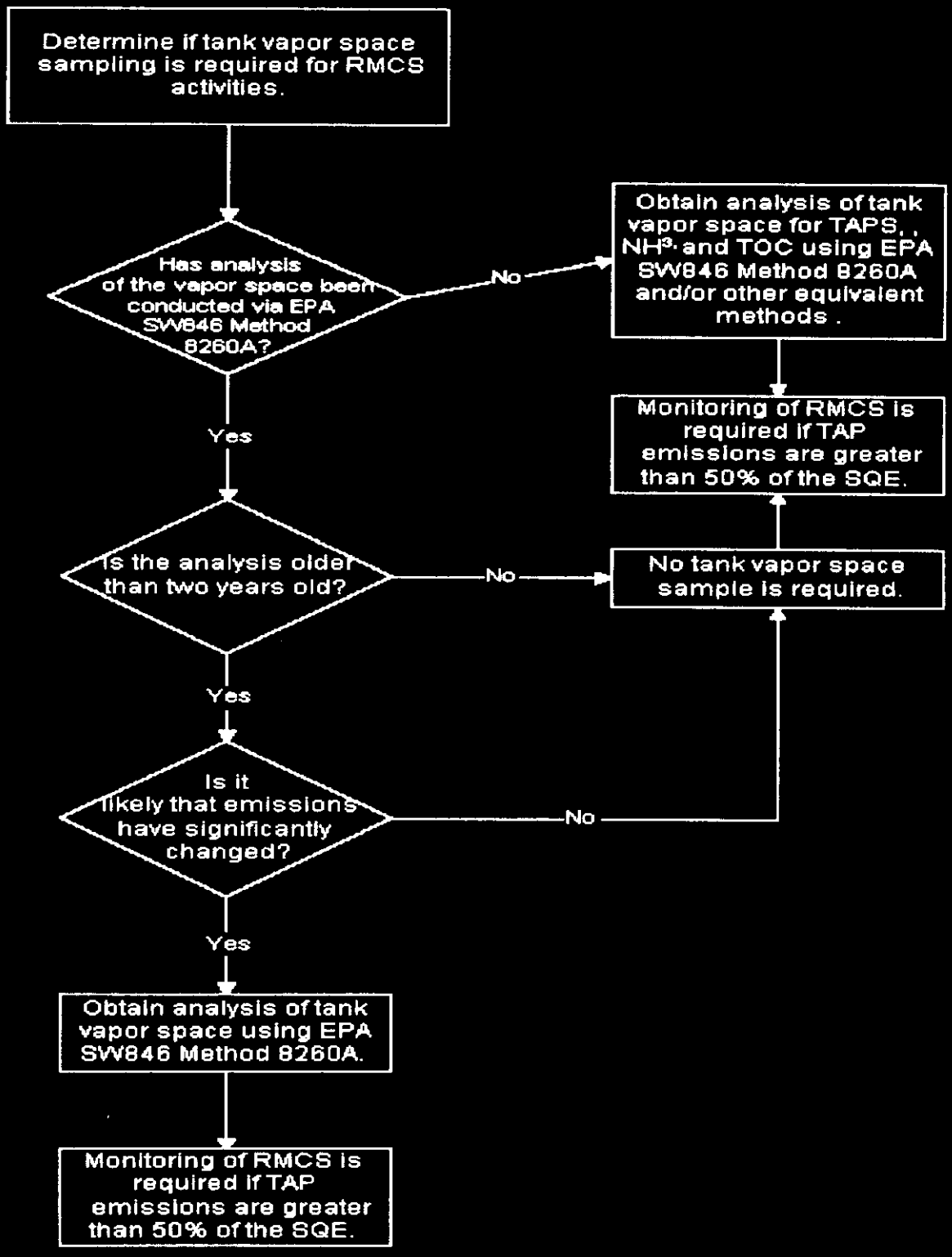
1. No sampling for TAPS is required if data has been obtained for all compounds listed in WAC 173-460, Sections 150 and 160 which may exceed the quantification limits given in Appendix B, and no TAP will exceed 50 percent of its SQE.

2. If analytical data has not been obtained, sample the tank vapor space and quantify any organic TAPs which may exceed the levels indicated in Section 6.0.

3.2 RADIOACTIVE AIR EMISSIONS

Standards and requirements for the emission of radionuclides are contained in WAC 246-247 and 40 CFR 61, Subpart H. Since requirements depend on the level of emissions radionuclide emissions from TFTP units must be quantified. Permissible quantification methods are outlined in 40 CFR 61, Method 114.

Figure 3-7. Decision Logic - Rotary Mode Core Sampling.



Federal regulations, 40 CFR 61, Subpart H, require that

> "Radionuclide emission measurements in conformance with the requirements of paragraph (b) (i.e, continuous monitoring) of this section be made at all release points which have a potential to discharge radionuclides into the air in quantities which could cause an effective dose equivalent (EDE) in excess of one percent of the standard."

The standard referred to is 10 millirem per year (mrem/yr); 1 percent of that is 0.1 mrem/yr EDE. The potential to discharge is defined as emissions in the absence of all controls during normal facility operation. At the Hanford Site, these controls may consist of one or more banks of high-efficiency particulate air (HEPA) filters. The National Emission Standards for Hazardous Air Pollutants (NESHAPs) determinations have been performed and are documented in Crummel (1995), but the determinations may have been overly conservative because of the lack of radionuclide vapor space data. It is necessary to improve quantifications of radionuclide emissions to prevent any unnecessary upgrades to existing effluent measuring/monitoring systems to comply with NESHAPs. Table 3-2 lists the analytes which should be measured in order to quantify radioactive air emissions. The table includes gross alpha and gamma which are used to verify that a source is not emitting large quantities of a radionuclide other than americium 241, plutonium 239/240, cesium 137, or strontium 90.

Table 3-2. Radioactive Air Analytes Detected or Suspected of Being Released From TFTP Facilities.

Radioactive air analytes
Gross alpha
Gross beta
Cesium 137
Americium 241
Plutonium 239/240
Strontium 90

Radionuclide emission units having the potential to emit more than 0.1 mrem/yr of the potential EDE are considered major stacks. Speciation of radionuclides is required for all major stacks and is subject to NESHAP requirements. Minor stacks are emission sources that having potential to emit $\leq$0.1 mrem/yr EDE. Individual speciation is not required for minor stacks; however, periodic confirmation measurements are required. Regulations do not specify what constitutes periodic confirmation measurements; however, a definition is being considered with affected regulatory agencies.

To determine the analytical requirements for radionuclides, the following decision logic should be used.

Decision Logic

Decision steps are organized by priority and in the most logical and efficient sequence for analyzing and solving the problem. A flowchart of the decision logic is shown in Figure 3-8.

Requirements: Determine whether radionuclides are potentially emitted to the air from TFTP facilities.

1. Obtain sufficient information to classify the emission unit as major. (> 0.1 mrem/yr EDE) or minor (≤0.1 mrem/yr EDE) (WAC 246-247, Section 075).

2. Identify all specific radionuclides which could contribute greater than 10 percent of the total EDE if the stack is designated as a major stack. For further information refer to WAC 246-247, Section 110(8).

3. Determine whether continuous monitoring is being performed for major stacks.

4. Verify that emissions from minor stacks are undergoing periodic confirmation measuring as required.

Results:

1. If characterization data from the tank vapor space or upstream of the HEPA filters is available to classify the emission unit as major or minor, no measuring or testing is required unless speciation is needed to be identified for major stacks.

2. If characterization data from the tank vapor space or upstream of the HEPA filters is not available to classify emission units as major or minor, measuring or testing for radionuclides as outlined in Table 3-2 is required.

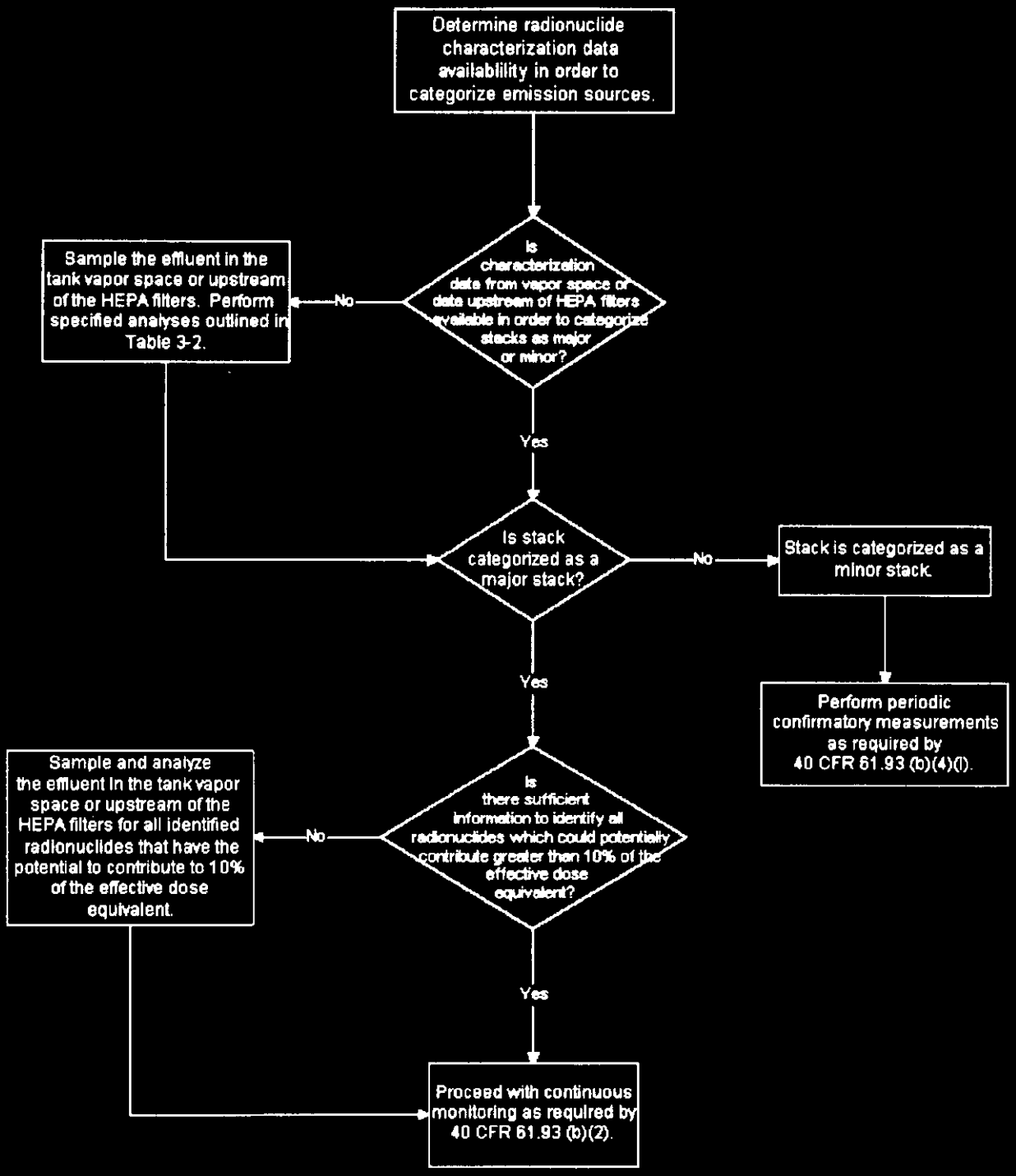
3. If information is available for major stacks or vents only to identify all radionuclides which could contribute greater than 10 percent of the EDE, additional measuring is not required.

4. If information is not available to calculate the EDE, measuring tank vapor space or upstream of the HEPA filter to obtain identified radionuclides that have the potential to contribute to 10 percent of the EDE is required.

5. If a major stack is being continuously monitored in compliance with the NESHAP continuous emission measurement criteria, no additional analysis is required.

6. If minor stacks are not being continuously monitored, perform the required periodic confirmation measurement.

Figure 3-8. Decision Logic - Radiation Protection from Air Emissions.



4.0 DECISION INPUTS

This section addresses the selection of analytes for analyses which are needed according to the logic contained in Section 3.0. In deciding which analyte should be selected for determination, a master list of regulated chemicals was prepared. This list was compiled from the following:

1. *Clean Air Act of 1990* and the *Emergency Planning and Community Right-to-Know Act of 1986* (Appendix C of the regulation)

2. WAC 173-460, Section 150 (Class A hazardous air pollutants: known, probable, and potential human carcinogens and acceptable source impact levels)

3. WAC 173-460, Section 160 (Class B hazardous air pollutants and acceptable source impact levels)

4. Section 313 of the *Emergency Planning and Community Right-to-Know Act of 1986*

5. WAC 173-401, Section 531 (thresholds for hazardous air pollutants).

The master list was compared with chemicals which are known or suspected of being present on the Hanford Site. These sources include the following:

1. Facility process knowledge taken from the most recent *Inventory of Chemicals used at Hanford Site Production Plants and Support Operations (1944-1980)* (Klem 1988).

2. Analytical data from tank headspace vapors (Clauss et al. 1994; Goheen 1994; Huckaby and Story 1994; Jenkins 1994a and 1994b; McVeety et al. 1994; Rasmussen 1994a, 1994b, and 1994c; Sharma et al. 1994). Analyses included several underground storage tanks (241-C-103, 241-C-104, 241-C-105, 241-C-106, 241-BY-104, 241-BY-107, and 241-BY-108) that are considered worst case tanks based on their relatively high organic content. The studies have identified compounds formed from chemical and radiolytic breakdown of organic compounds used in Hanford plant processes and added to tank farms.

3. Chemicals used at paint and maintenance shops (Van Slyke 1994). These chemicals, in addition to expected degradation products, were assembled and compared to the list of regulated chemicals. The compilation of these two lists was used to identify the universe of chemicals which may require analysis by this document. This combined list is in Table 3-1.

4. An unpublished list of organics which have been identified in tank vapor spaces. The list is supposed to represent a master summary of the chemicals found (positively or tentatively identified) and reported in a series of tank vapor characterization reports which were issued in October 1995.

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5.0 STUDY BOUNDARIES

The scope of this document covers all TFTP facilities that release or have the potential to release hazardous or radioactive air pollutants to the ambient atmosphere. These include DSTs, double-contained receiving tanks (DCRTs), SSTs, inactive miscellaneous underground storage tanks (IMUSTs), tank farms maintenance and paint shops, and the 242-A Evaporator. The following paragraphs discuss each of the facilities.

5.1 DSTS, DCRTS, SSTS AND IMUSTS

There are 47 tanks (28 DSTs and 19 SSTs) actively ventilated by 8 exhausters, 2 backup exhausters, and 7 tank (or tank farm) annulus exhausters. There are 130 passively vented tanks. Waste stored in the DST system includes waste from PUREX, Z Plant (Plutonium Finishing Plant), B Plant, T Plant, 222-S Laboratory, 100 Areas, 300 Areas, 400 Areas, and SSTs. DSTs use separate ventilation systems for the primary tank and annulus ventilation. The primary tank ventilation system provides a negative pressure in the tanks to prevent the escape of untreated hazardous and/or radioactive particulates to the atmosphere. DST headspaces are typically saturated or nearly saturated with water vapor and contain trace levels of organics. Substantial levels of ammonia (NH_3) have been measured in some tanks.

The DCRTs function as receiver tanks, lift stations, and vent stations for SST or DST waste. DCRTs have tank ventilation systems. The exhausted air passes through a heater, prefilter, and HEPA filters; then it is monitored for radiation. DSTs and DCRTs are classified as emission units according to the definition of emissions unit in WAC 173-401, Section 200(11). Section 6.0, Decision Rules, and Section 8.0, Sampling and Analysis Designs for Obtaining Data, provide strategy for sampling efforts.

SSTs may be actively ventilated in the future. Radionuclide and nonradionuclide concentrations will be necessary to obtain in order to perform best available control technology and Toxic Best Available Control Technology evaluations. SSTs are required to use reasonably available control technology according to WAC 173-400, Section 040, General Standards for Maximum Emissions.

The 50 IMUSTs, identified to date, are located in the 200 East and West Areas of the Hanford Site. These tanks may contain chemical and radiological hazardous materials and represent a potential hazard. The condition of these tanks and the volume of waste contained in each lack a high degree of accuracy and certainty (Farley 1995). IMUSTs containing waste should undergo sampling efforts similar to the DSTs. Sampling requirements for IMUSTs will not be addressed.

5.2 MAINTENANCE AND PAINT SHOPS

There are nine maintenance and paint shops in TFTP. Maintenance and paint shops can be classified as categorically exempt insignificant emission units

according to WAC 173-401, Section 532(33). Quantification of emissions from these units is not required, and the activities occurring in these units are exempt from operating regulations (WAC 173-401).

5.3 242-A EVAPORATOR

The 242-A Evaporator is used for waste volume reductions. The evaporator takes feed from the DST system and returns the concentrated product (slurry) to the DST system. Emissions associated with the evaporator are fugitive with the exception of the vessel vent and building ventilation stack.

6.0 DECISION RULES

Decision rules for needed analyses were formed by applying the regulatory drivers discussed in Section 3.0 and 4.0 to the equipment subject to these requirements (described in Section 5.0). The rules are based on the combination of best management practice and specific regulatory requirements and are grouped by equipment type. The rules are based on the assumption that process knowledge should be confirmed by actual analytical results. There is limited existing emission data for some emission sources, but the data is often incomplete or may not represent current operations. Once process knowledge has been confirmed by analytical information, continuing analyses can be reduced and/or eliminated. Decision rules for these situations cannot be addressed because the reliability of process knowledge has not been verified.

In applying the decision rules the following considerations should be used:

1. The stated analyses should be performed the next time one of the listed sources is sampled.

2. If there is already analytical data on a particular source, and the analyses indicated by this document are not thought to be needed, obtain concurrence from the Environmental Cleanup and Compliance Project that additional data is not required.

3. In most cases, the analyses required by this document will be used to confirm process knowledge and to document actual versus worst case emission rates. Therefore, it is not necessary to obtain large quantities of samples and adhere to specific QA/QC standards.

4. The quantification limits for TAPs should be based on the approval for the RMCS.

Currently available analytical data should be examined to determine whether changes in operations or other factors might have triggered a need to verify emissions. Items which could trigger changes include the following: data older than two years, new waste types being processed or stored, and changes in storage or operating conditions. These analytical requirements are not intended to instigate an additional sampling event, but they are intended to be implemented whenever any other driver triggers a sampling event. The following decision rules are used to determine if analyses are needed.

Whenever "quantify" is used, both chemical composition and flowrate are required, otherwise, a concentration measurement only is required. Whenever a sampling event is planned for any equipment listed below, the indicated analyses should be conducted.

The following sections discuss the testing requirements for each type of equipment. Table 6-1 contains a summary of these analytical requirements.

Table 6-1. Analytical Requirements.

Equipment or source		Type of analysis				Sampling timing requirement
		Toxic air pollutants		Radionuclides		
Emission Unit	Category	Sample type	Sample location	Sample type	Sample location	
SST, DST DCRT,	Major	T3-1, TOC	VS or ST, TLL	T3-2, Rad-10	VS or ST	OP
	Minor	T3-1, TOC	VS or ST, TLL	T3-2, Rad-10	VS or ST	OP
RMCS		T3-1, TOC	VS or ST, TLL	T3-2, Rad-10	VS or ST	BT
Shops		None		None		None

Notes:

T3-1 Table 3-1 analytes
TOC Total Organic Compounds
VS Vapor Space
ST Stack
OP Opportunistic (when the source is being sampled for another purpose)
BT Before the tank is sampled with the RMCS system

6.1 MAJOR STACKS

These stacks (see Appendix A) are determined to have a potential offsite impact greater than 0.1 mrem/year EDE. Radionuclide emissions from all stacks should be quantified. Quantification must include all compounds listed in Table 3-2 and speciation of all radionuclides which comprise 10 percent or more of the potential offsite EDE (WAC 246-247, Section 110(8) and 40 CFR 61, Part 93). A continuous monitoring system meeting regulatory requirements must also be maintained on these stacks.

6.2 MINOR STACKS CONNECTED TO TANKS OR OTHER PROCESS EQUIPMENT

These stacks (see Appendix A) are determined to have a potential offsite impact $\leq$0.1 mrem/year EDE. Radionuclide emissions from all stacks should be quantified. Quantification must include all constituents listed in Table 3-2, but additional speciation is not required. Periodic confirmation measurements are required, but this does not have to be continuous monitoring as required for major stacks. (Note the details of what constitutes periodic confirmation sampling is in the process of development.)

6.3 MINOR STACKS CONNECTED TO BUILDING VENTILATION SYSTEMS

These units are miscellaneous stacks associated with venting buildings and should have minimal emissions. See Table A-1 for a listing of minor stacks. Analysis of radionuclides is not necessary if the dispersible source term in the building is very low. Periodic confirmation measurements are required,

but this does not have to be continuous monitoring as required for major stacks. (Note the details of what constitutes periodic confirmation sampling is in the process of development.)

6.4 SINGLE-SHELL AND DOUBLE-SHELL TANKS

Single-shell tanks no longer receive new waste, but they are being used to store waste until the waste is retrieved. Double-shell tanks are used to store waste for extended periods and may continue to receive new shipments of waste. A sample must be taken of the surface layer of each tank and analyzed for total organic concentration. If a surface-layer grab sample has already been collected, an additional sample is not required. When a vapor sample is taken, analysis must include all chemicals listed in tables 3-1 and 3-2.

6.5 PAINT, METAL AND MAINTENANCE SHOPS

These units are buildings used for support purposes. Emissions are assumed to be mainly from chemical use, such as commercially purchased solvents. No analyses are needed as long as material safety data sheets specify the quantity of all EPCRA 313 constituents present in materials and chemical use records are kept. If the material safety data sheets do not have information on EPCRA constituents, analyze solvents for the chemicals listed in Table 3-1 having an asterisk in the column labeled EPCRA Section 313.

6.6 MISCELLANEOUS TANKS (INCLUDING DCRTS, FLUSH, SETTLING, DECONTAMINATION AND CATCH TANKS)

These units are small tanks used during waste shipments, but they do not store waste (other than tank heel) for extended periods of time. Emissions from these sources are thought to be variable; the greatest emissions occur during waste shipments or treatment. If current emission data is not available, exhausters associated with all DSTs and DCRTs in or through which waste is stored or transferred should be sampled for the chemicals listed in Tables 3-1 and 3-2. The exhausters in question are listed in Appendix A.

6.7 242-A EVAPORATOR VESSEL VENT STACK

No analyses of the 242-A Evaporator vessel vent stack is required for nonradionuclides because vessel vent vapor analyses of samples collected during Campaign 94-1 provided evidence that emission levels were approximately two orders of magnitude below regulatory limits (Von Bargen 1995). These analyses confirmed previous emission calculations. The Washington State Department of Ecology has agreed that the accuracies of engineering calculations using candidate feed tank and process control sample data provide sufficient assurance that regulatory limits will not be exceeded. However, the 242-A Evaporator should be sampled for radionuclides identified in Table 3-2 if current emission data is not available.

6.8 ROTARY MODE CORE SAMPLING EXHAUSTER

The Toxic Air Pollutants Notice of Construction for Rotary Mode Core Sampling systems 3 and 4 and modification of system 2 (DOE/RL-94-117) requires that emissions of VOC, ammonia, and organics which are toxic air pollutants be determined prior to sampling activities at any waste tank. Prior to using the RMCS, a tank vapor sample meeting the requirements contained in Section 6.4 must be completed.

7.0 DECISION ERROR LIMITS

This DQO document is not mandating that set decisions be made or actions be taken; therefore, this section of the DQO process is not applicable. This document is attempting to identify only data that needs to be collected where regulatory requirements apply. Optimization has been included by limiting analyses to those required by regulation or best management practice.

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8.0 SAMPLING AND ANALYSIS DESIGNS FOR OBTAINING DATA

The sampling and analysis as required by design is optimized using from Section 6.0. Section 8.0 describes the number of samples required and the sampling and analysis methods. Optimization may be implemented in the Tank Characterization Plan or Sampling and Analysis Plan as long as Tank Farm Environmental Engineering concurs with the optimization.

Further optimization of sampling can be performed once the analytical data is available and is validated against emission estimates.

8.1 NUMBER OF SAMPLES

A minimum of two samples should be collected. Additional samples would then be required if the analytical results did not correspond to estimated emissions. Power curves as described in Von Bargen (1995) can be used to determine the number of samples, but this is not required.

8.2 SAMPLING AND ANALYSIS METHODS

All analyses required by this document should be conducted according to agency-approved procedures such as those contained in SW-846 and the Title 40 of the *Code of Federal Regulations*. The Environmental Cleanup and Compliance Project should approve deviations from agency approved methods. The following subsections describe approved methods which can be used provided that all specified analytes are detected, or concurrence is obtained from Environmental Cleanup and Compliance Project. There is no need to analyze for a particular chemical.

8.2.1 Nonradionuclide Sampling and Analysis

Samples should be collected from two distinct headspace volumes per tank and at different heights to account for spatial variability. The preferred methods of sample collection involve sorbant traps with packing for polar volatiles, polar semivolatiles, and nonpolar compounds and SUMMA[1] canisters for compounds which are not captured efficiently in traps.

The sampling devices are lowered into the tank headspace to assure representative sampling. This method provides the ability to collect samples quickly and without a special sampling probe. The disadvantages of this method include a limited ability to sample some volatile organic vapors under certain circumstances (for example, acetone in a high-humidity tank) and the breaking of the tank containment with each sampling event.

The first round of sampling should include the waste surfaces of every DST, DCRT, SST and unloading facility (not previously characterized) that have the potential to emit hazardous vapors and employ an acceptable EPA sampling 1

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[1]SUMMA is a trademark of Molectrics, Inc., Cleveland, Ohio.

method. For example, for volatile organic compounds the samples should be analyzed using the heated headspace analytical method with flame ionization detection. The action level for this test is one percent volatile organic carbon. Because floating organic layers are not expected to be present in the DSTs, DCRTs, or unloading facilities, a minimum number of two samples are recommended for the first sampling event. If the upper 95 percent confidence interval of the mean total volatile organic carbon result is less than one percent, no further characterization of the subject waste will be required for regulatory purposes, as long as future waste shipments to the storage unit do not contain volatile organic material or organic material that could possibly degrade to volatile products.

The methods used must be based on agency-approved sampling methods such as those contained in EPA SW-846 (EPA 1986). The method used for TAPs must be capable of identifying the specific TAP at the quantification level stated in Appendix C. VOC measurement for any nonmixed waste must be by EPA Method 25D in 40 CFR 60, Appendix A. It is expected that most analyses required by this document will be performed in conjunction with *Data Quality Objective for Generic In-Tank Health and Safety Vapor Issue Resolution* (Osborne 1995) and the same analytical methods can be used.

8.2.2 Radionuclide Sampling and Analysis

Test methods for measuring radionuclide air emissions from stationary sources are outlined in 40 CFR 61, Appendix B, Method 114. This method provides requirements for the following: stack monitoring and sample collection methods appropriate for radionuclides; radiochemical methods which are used in determining the amounts of radionuclides collected by the stack sampling; and quality assurance methods which are conducted in conjunction with these measurements. All references to other materials described in Method 114 are adopted for incorporation into this section.

8.2.3 Detection Limits

Detection limits for analytes other than TAPs and VOCs are not specified. At a minimum the detection limit for all organic TAPs must be less than the TAP specific quantification limits contained in Appendix C. The quantification limits specified in Appendix C were derived from the Department of Ecology's approval of the RMCS system. Detection limits for VOC should be 5 parts per million which is 50 percent of the action level required by subsection CC of 40 CFR.

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APPENDIX A

TFTP UNITS EMITTING OR HAVING THE POTENTIAL TO EMIT HAZARDOUS OR RADIOACTIVE GASES

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Table A-1. TFTP Units Emitting or Having the Potential to Emit Hazardous and/or Radioactive Gases. (8 sheets)

Stack number or emission point	Facility
200E Paint	200 East Paint Shop
200W Paint	200 West Paint Shop
204AR	Waste Unloading Facility
213-W-TK-1	200 West Decontamination Tank - near 272-WA. Documentation is being researched to determine whether the tank has received waste in the past. It has and continues to receive rain water and is periodically pumped. Prior to being pumped, tank water was sampled and clean released.
216-BY-201	200 East Flush Tank - north of BY Tank Farm
216-TY-201	200 West Flush Tank - east of TY Tank Farm
231-W-151-001	200 West Vault/Tank - settling, out-of-service 1974
231-W-151-002	200 West Vault/Tank - settling, out-of-service 1974
241-A-302B	200 East Catch Tank - out-of-service 1980 (isolated 9/85 and stabilized 1990), monitored by leak detection
241-AX-151	200 East Diverter Station with several tanks inside, outside Tank Farm A - individual tanks will have separate entries
241-B-103	200 East Single-shell Tank Farm B
241-B-104	200 East Single-shell Tank Farm B
241-B-105	200 East Single-shell Tank Farm B
241-B-106	200 East Single-shell Tank Farm B
241-B-107	200 East Single-shell Tank Farm B
241-B-108	200 East Single-shell Tank Farm B
241-B-109	200 East Single-shell Tank Farm B
241-B-110	200 East Single-shell Tank Farm B
241-B-111	200 East Single-shell Tank Farm B
241-B-112	200 East Single-shell Tank Farm B
241-B-201	200 East Single-shell Tank Farm B
241-B-202	200 East Single-shell Tank Farm B
241-B-203	200 East Single-shell Tank Farm B
241-B-204	200 East Single-shell Tank Farm B
241-B-301	200 East Catch Tank - out-of-service 1984 and isolated
241-B-302B	200 East Catch Tank - out-of-service 1985 (May 6, 1985 interim stabilized and isolated)
241-BX-101	200 East Single-shell Tank Farm BX

Table A-1. TFTP Units Emitting or Having the Potential to Emit Hazardous and/or Radioactive Gases. (8 sheets)

Stack number or emission point	Facility
241-BX-102	200 East Single-shell Tank Farm BX
241-BX-103	200 East Single-shell Tank Farm BX
241-BX-104	200 East Single-shell Tank Farm BX
241-BX-105	200 East Single-shell Tank Farm BX
241-BX-106	200 East Single-shell Tank Farm BX
241-BX-107	200 East Single-shell Tank Farm BX
241-BX-108	200 East Single-shell Tank Farm BX
241-BX-109	200 East Single-shell Tank Farm BX
241-BX-110	200 East Single-shell Tank Farm BX
241-BX-111	200 East Single-shell Tank Farm BX
241-BX-112	200 East Single-shell Tank Farm BX
241-BX-302A	200 East Catch Tank - out-of-service 1985 (isolated and stabilized)
241-BX-302B	200 East Catch Tank - out-of-service 1985 (isolated and stabilized 1985)
241-BX-302C	200 East Catch Tank - out-of-service 1985 (isolated and stabilized)
241-BY-101	200 East Single-shell Tank Farm BY
241-BY-102	200 East Single-shell Tank Farm BY
241-BY-103	200 East Single-shell Tank Farm BY
241-BY-104	200 East Single-shell Tank Farm BY
241-BY-105	200 East Single-shell Tank Farm BY
241-BY-106	200 East Single-shell Tank Farm BY
241-BY-107	200 East Single-shell Tank Farm BY
241-BY-108	200 East Single-shell Tank Farm BY
241-BY-109	200 East Single-shell Tank Farm BY
241-BY-110	200 East Single-shell Tank Farm BY
241-C-101	200 East Single-shell Tank Farm C
241-C-102	200 East Single-shell Tank Farm C
241-C-103	200 East Single-shell Tank Farm C
241-C-104	200 East Single-shell Tank Farm C
241-C-105	200 East Single-shell Tank Farm C
241-C-106	200 East Single-shell Tank Farm C
241-C-107	200 East Single-shell Tank Farm C

Table A-1. TFTP Units Emitting or Having the Potential to Emit Hazardous and/or Radioactive Gases. (8 sheets)

Stack number or emission point	Facility
241-C-108	200 East Single-shell Tank Farm C
241-C-109	200 East Single-shell Tank Farm C
241-C-110	200 East Single-shell Tank Farm C
241-C-111	200 East Single-shell Tank Farm C
241-C-112	200 East Single-shell Tank Farm C
241-C-201	200 East Single-shell Tank Farm C
241-C-202	200 East Single-shell Tank Farm C
241-C-203	200 East Single-shell Tank Farm C
241-C-204	200 East Single-shell Tank Farm C
241-C-301	200 East Catch Tank - out-of-service 1983 (isolated), monitored by leak detector
241-ER-311	200 East Catch Tank - Southwest of B Plant
241-S-101	200 West Single-shell Tank Farm S
241-S-102	200 West Single-shell Tank Farm S
241-S-103	200 West Single-shell Tank Farm S
241-S-104	200 West Single-shell Tank Farm S
241-S-105	200 West Single-shell Tank Farm S
241-S-106	200 West Single-shell Tank Farm S
241-S-107	200 West Single-shell Tank Farm S
241-S-108	200 West Single-shell Tank Farm S
241-S-109	200 West Single-shell Tank Farm S
241-S-110	200 West Single-shell Tank Farm S
241-S-111	200 West Single-shell Tank Farm S
241-S-112	200 West Single-shell Tank Farm S
241-S-302A	200 West Catch Tank - out-of-service 1991 (isolated)
241-S-302B	200 West Catch Tank - out-of-service 1985 (isolated and stabilized)
241-SX-101	200 West Single-shell Tank Farm SX
241-SX-102	200 West Single-shell Tank Farm SX
241-SX-103	200 West Single-shell Tank Farm SX
241-SX-104	200 West Single-shell Tank Farm SX
241-SX-105	200 West Single-shell Tank Farm SX
241-SX-106	200 West Single-shell Tank Farm SX
241-SX-107	200 West Single-shell Tank Farm SX

Table A-1. TFTP Units Emitting or Having the Potential to Emit Hazardous and/or Radioactive Gases. (8 sheets)

Stack number or emission point	Facility
241-SX-108	200 West Single-shell Tank Farm SX
241-SX-109	200 West Single-shell Tank Farm SX
241-SX-110	200 West Single-shell Tank Farm SX
241-SX-111	200 West Single-shell Tank Farm SX
241-SX-112	200 West Single-shell Tank Farm SX
241-SX-113	200 West Single-shell Tank Farm SX
241-SX-114	200 West Single-shell Tank Farm SX
241-SX-115	200 West Single-shell Tank Farm SX
241-SX-302	200 West Catch Tank - out-of-service 1983 (isolated and stabilized 1984)
241-T-101	200 West Single-shell Tank Farm T
241-T-102	200 West Single-shell Tank Farm T
241-T-103	200 West Single-shell Tank Farm T
241-T-104	200 West Single-shell Tank Farm T
241-T-105	200 West Single-shell Tank Farm T
241-T-106	200 West Single-shell Tank Farm T
241-T-107	200 West Single-shell Tank Farm T
241-T-108	200 West Single-shell Tank Farm T
241-T-109	200 West Single-shell Tank Farm T
241-T-110	200 West Single-shell Tank Farm T
241-T-111	200 West Single-shell Tank Farm T
241-T-112	200 West Single-shell Tank Farm T
241-T-201	200 West Single-shell Tank Farm T
241-T-202	200 West Single-shell Tank Farm T
241-T-203	200 West Single-shell Tank Farm T
241-T-204	200 West Single-shell Tank Farm T
241-T-301B	200 West Catch Tank - out-of-service 1985 (isolated and stabilized July 1985)
241-TX-101	200 West Single-shell Tank Farm TX
241-TX-102	200 West Single-shell Tank Farm TX
241-TX-103	200 West Single-shell Tank Farm TX
241-TX-104	200 West Single-shell Tank Farm TX
241-TX-105	200 West Single-shell Tank Farm TX
241-TX-106	200 West Single-shell Tank Farm TX

Table A-1. TFTP Units Emitting or Having the Potential to Emit Hazardous and/or Radioactive Gases. (8 sheets)

Stack number or emission point	Facility
241-TX-107	200 West Single-shell Tank Farm TX
241-TX-108	200 West Single-shell Tank Farm TX
241-TX-109	200 West Single-shell Tank Farm TX
241-TX-110	200 West Single-shell Tank Farm TX
241-TX-111	200 West Single-shell Tank Farm TX
241-TX-112	200 West Single-shell Tank Farm TX
241-TX-113	200 West Single-shell Tank Farm TX
241-TX-114	200 West Single-shell Tank Farm TX
241-TX-115	200 West Single-shell Tank Farm TX
241-TX-116	200 West Single-shell Tank Farm TX
241-TX-117	200 West Single-shell Tank Farm TX
241-TX-118	200 West Single-shell Tank Farm TX
241-TX-302A	200 West Catch Tank - out-of-service 1982 (isolated and stabilized 1984)
241-TX-302B	200 West Catch Tank - (isolated and stabilized in 1954); monitored by leak detector
241-TX-302BR	200 West Catch Tank - out-of-service 1954 (isolated in 1954) Contents unknown
241-TX-302XB	200 West Catch Tank - out-of-service 1985 (isolated and stabilized June 1985)
241-TY-101	200 West Single-shell Tank Farm TY
241-TY-102	200 West Single-shell Tank Farm TY
241-TY-103	200 West Single-shell Tank Farm TY
241-TY-104	200 West Single-shell Tank Farm TY
241-TY-105	200 West Single-shell Tank Farm TY
241-TY-106	200 West Single-shell Tank Farm TY
241-TY-107	200 West Single-shell Tank Farm TY
241-TY-302A	200 West Catch Tank - out-of-service 1981 (isolated and stabilized June 1985)
241-TY-302B	200 West Catch Tank - out-of-service 1981 (isolated and stabilized)
241-U-101	200 West Single-shell Tank Farm U
241-U-102	200 West Single-shell Tank Farm U
241-U-103	200 West Single-shell Tank Farm U
241-U-104	200 West Single-shell Tank Farm U

Table A-1. TFTP Units Emitting or Having the Potential to Emit Hazardous and/or Radioactive Gases. (8 sheets)

Stack number or emission point	Facility
241-U-105	200 West Single-shell Tank Farm U
241-U-106	200 West Single-shell Tank Farm U
241-U-107	200 West Single-shell Tank Farm U
241-U-108	200 West Single-shell Tank Farm U
241-U-109	200 West Single-shell Tank Farm U
241-U-110	200 West Single-shell Tank Farm U
241-U-111	200 West Single-shell Tank Farm U
241-U-112	200 West Single-shell Tank Farm U
241-U-201	200 West Single-shell Tank Farm U
241-U-202	200 West Single-shell Tank Farm U
241-U-203	200 West Single-shell Tank Farm U
241-U-204	200 West Single-shell Tank Farm U
241-Z-8	200 West Settling Tank - out-of-service 1962 (isolated and stabilized), liquid removed
242-T-135	200 West Decontaminated Tank - Outside of 242-T Evaporator
242-TA-R1	200 West Receiver Tank for Z Plant, very hot radiologically
243S-TK-1	200 West Decontamination Tank - Can be added to IMUST list
244AR	Sludge Vault Storage and Processing
244-BXR-001	200 East Vault - Uranium recovery - out-of-service 1957 (isolated 1985)
244-BXR-002	200 East Vault - Uranium recovery - out-of-service 1957 (isolated 1985)
244-BXR-003	200 East Vault - Uranium recovery - out-of-service 1957 (isolated 1985), soft sludge in sump
244-BXR-011	200 East Vault - Uranium recovery - out-of-service 1957 soft sludge in sump
244-TXR-001	200 West Vault - Uranium recovery - out-of-service 1956; (accumulator tank stabilized in 1984 - questionable integrity) (isolated); minimum sludge in sump
244-TXR-002	200 West Vault - Uranium recovery - out-of-service 1956 (stabilized in 1984 and isolated)
244-TXR-003	200 West Vault - Uranium recovery - out-of-service 1956 (stabilized in 1984 and isolated); minimum sludge in sump
244-UR-001	200 West Vault - Uranium recovery - out-of-service 1957 (isolated and stabilized in 1985); liquid and sludge in sump

Table A-1. TFTP Units Emitting or Having the Potential to Emit Hazardous and/or Radioactive Gases. (8 sheets)

Stack number or emission point	Facility
244-UR-002	200 West Vault - Uranium recovery - out-of-service 1957 (isolated and stabilized in 1985)
244-UR-003	200 West Vault - Uranium recovery - out-of-service 1957 or 1976 (isolated and stabilized in 1985); liquid and sludge in sump
244-UR-004	200 West Vault - Uranium recovery - out-of-service 1957 or 1976 (isolated and stabilized in 1985); minimum heel
2715EC	200 East Paint Shop
272AW	200 East Maintenance Shop
272S	Insulator Paint Shop (200 West area)
272WA	200 West Maintenance Shop
277W	Sheet Metal Boiler Shop
296-A-12[1]	244-AR Vessel Vent
296-A-13[2]	244-AR Cell & Canyon Exhauster
296-A-17[1]	241-AY/AZ Tank Farms Exhauster
296-A-18[2]	241-AY-101 Tank Annulus Exhauster
296-A-19[2]	241-AY-102 Tank Annulus Exhauster
296-A-20[2]	241-AZ Tank Farm Annulus Exhauster
296-A-21[2]	242-A Evaporator Building Ventilation
296-A-22[1]	242-A Evaporator Vessel Ventilation
296-A-25[2]	244-A Double Contained Receiver Tank Exhauster
296-A-26[2]	204-AR Rail Car Unloading Facility Exhauster
296-A-27[2]	241-AW Tank Farms Exhauster
296-A-28[2]	241-AW Tank Annulus Exhauster
296-A-29[2]	241-AN Tank Farm Exhauster
296-A-30[2]	241-AN Tank Annulus Exhauster
296-A-40[1]	241-AP Tank Farm Exhauster
296-A-41[1]	241-AP Tank Annulus Exhauster
296-B-28[1]	244-BX Double Contained Receiver Tank Exhauster
296-C-5[1]	244-CR Vault Exhauster
296-C-07[2]	103-C Vapor Mixer Stack
296-P-16[1]	241-C-105/106 Tank Exhauster
296-P-22[2]	241-SY Tank Annulus Exhauster
296-P-23[2]	241-SY Tank Farm Exhauster

Table A-1. TFTP Units Emitting or Having the Potential to Emit Hazardous and/or Radioactive Gases. (8 sheets)

Stack number or emission point	Facility
296-P-26[1]	241-AY/AZ Tank Farms Backup Exhauster
296-P-28[2]	241-SY Tank Farm Backup Exhauster
296-P-31[2]	209-E Building Exhauster
296-P-32[1]	Rotary Mode Core Sampling Truck Exhauster
296-P-33[1]	Rotary Mode Core Sampling Truck Exhauster
296-S-15[1]	241-SX Tank Farm Exhauster
296-S-18[2]	242-S Evaporator Building Ventilation
296-S-22[1]	244-S Double Contained Receiver Tank Exhauster
296-S-25[1]	241-SY Tank Farm Replacement Exhauster
296-T-17[2]	242-T Evaporator Building Ventilation
296-T-18[1]	244-TX Double Contained Receiver Tank Exhauster
296-U-11[1]	244-U Double Contained Receiver Tank Exhauster
296-W-03[2]	213-W Waste Compactor

Notes:

[1]Denotes a major stack for radionuclides.

[2]Denotes a minor stack for radionuclides.

APPENDIX B

SPECIFIC TANK SAMPLING RESULTS

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Table B-1. Gaseous Nonradionuclide Compounds Detected or Suspected of Being Emitted From TFTP Facilities. (2 sheets)

Compound	[BY104][1] mean, ppvb	[BY107][2] mean, ppvb	[BY108][3] mean, ppvb	[C103][4] mean, ppvb	[C104][5] mean, ppvb	[C105][6] mean, ppvb	[C106][7] mean, ppvb
Acetone	1200	2070	3270	19300	150	---	---
Acetonitrile	330	---	---	13,000	130	---	---
Benzene	42	33	81	---	9.9	2.0	0.5
1,3-Butadiene	---	12	116	---	8.0	1.3	---
Butane	2413	12070	---	---	---	---	---
2-butoxyethanol	---	---	31	---	---	---	---
n-Butyl acetate	---	---	---	3610	---	---	---
n-Butyl alcohol (n-Butanol)	1000	975	4545	28400	2900	---	---
Carbon disulfide	---	---	---	850	---	---	---
Chloroform	---	< 2	< 2	---	0.2	0.1	< 0.1
Dipropyl ketone (4-heptanone)	---	---	---	464	---	---	---
Ethyl acetate	---	---	---	12790	---	---	---
Ethyl butyl ketone (3-heptanone)	140	---	---	761	---	---	---
Ethyl ether	---	---	---	---	---	---	---
n-Heptane	120	---	962	660	15	---	---
n-Hexane	320	840	1400	800	38	---	---
Methyl butyl ketone (2-hexanone)	65	---	---	---	15	---	---
Methyl ethyl ketone (2-butanone)	464	---	254	14000	---	---	---
Methyl propyl ketone (2-pentanone)	160	---	---	1090	12	---	---
Methylene chloride	1.8	< 2	< 2	1620	---	1.3	---
Napthalene	28	---	---	2700	---	---	---
Nonane	28	---	261	280	17	---	---
Octane	59	---	180	330	13	---	---
Pentane	334	1670	2000	---	---	---	---
Tetrahydrofuran	280	---	---	5620	---	---	---

Table B-1. Gaseous Nonradionuclide Compounds Detected or Suspected of Being Emitted From TFTP Facilities. (2 sheets)

Compound	[BY104][1] mean, ppvb	[BY107][2] mean, ppvb	[BY108][3] mean, ppvb	[C103][4] mean, ppvb	[C104][5] mean, ppvb	[C105][5] mean, ppvb	[C106][6] mean, ppvb
Toluene	41	47	83	38	82	1.1	---
Tributyl phosphate	0.82	---	---	510	---	---	---
Trichlorofluoro-methane	175	22	190	---	---	15	---
Vinylidene chloride	---	8	16	< 9	---	0.5	---
Xylenes	---	8	68	---	0.6	0.1	0.6
Ammonia	49	---	248	---	---	---	---
Carbon monoxide	2 (0.22)	---	1.0	< 5	---	---	---
Nitric oxide	---	---	0.4	---	---	---	---
Nitrogen dioxide	0.003	---	0.07	---	---	---	---
Nitrous oxide	64 (2.8)	---	201	---	---	---	---

Notes:

ppbv - parts per billion by volume

[1]Results taken from Jenkins (1994b) and Clauss (1994)

[2]Results taken from Sharma (1994), and Rasmussen (1994c)

[3]Results taken from Rasmussen (1994c) and McVeety (1994)

[4]Results taken from Huckaby and Story (1994)

[5]Results taken from Jenkins (1994a) and Rasmussen (1994a)

[6]Results taken from Rasmussen (1994a)

--- Indicates that no quantity was detected.

APPENDIX C

TAP QUANTIFICATION LEVELS

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Table C-1. Class B - Toxic Air Pollutants WAC 173-460, Section 160. (18 sheets)

Class B toxic CAS number	Air pollutants and acceptable source impact levels substance	Analytical quantification limit mg/m³
76-11-9	1,1,1,2-Tetrachloro-2,2-difluoroethane	3335
76-12-0	1,1,2,2-Tetrachloro-1,2-difluoroethane	3335
79-34-5	1,1,2,2-Tetrachloroethane	133
76-13-1	1,1,2-Trichloro-1,2,2-trifluorethane	3335
79-00-5	1,1,2-Trichloroethane	1734
594-72-9	1,1-Dichloro-1-nitroethane	400
75-34-3	1,1-Dichloroethane	3335
57-14-7	1,1-Dimethylhydrazine	13
96-18-4	1,2,3-Trichloropropane	1734
120-82-1	1,2,4-Trichlorobenzene	1334
96-12-8	1,2-Dibromo-3-chloropropane	13
540-59-0	1,2-Dichloroethylene	3335
106-88-7	1,2-Epoxybutane	133
118-52-5	1,3-Dichloro-5,5-Dimethyl hydantoin	13
600-25-9	1-Chloro-1-nitropropane	400
108-03-2	1-Nitropropane	133
540-84-1	2,2,4-Trimethylpentane	13
75-99-0	2,2-Dichloropropionic acid	133
93-76-5	2,4,5-T	400
95-95-4	2,4,5-Trichlorophenol	13
118-96-7	2,4,6-Trinitrotoluene	13
51-28-5	2,4-Dinitrophenol	13
121-14-2	2,4-Dinitrotoluene	13
128-37-0	2,6-Ditert, butyl-p-cresol	400
504-29-0	2-Aminopyridine	13
111-76-2	2-Butoxyethanol	3335
110-80-5	2-Ethoxyethanol	1734
111-15-9	2-Ethoxyethyl acetate	800
591-78-6	2-Hexanone (MBK)	800
999-61-1	2-Hydroxypropyl acrylate	13

Table C-1. Class B - Toxic Air Pollutants WAC 173-460, Section 160. (18 sheets)

Class B toxic CAS number	Air pollutants and acceptable source impact levels substance	Analytical quantification limit mg/m³
109-86-4	2-Methoxyethanol	133
110-49-6	2-Methoxyethyl acetate	800
102-81-8	2-N-Dibutylaminoethanol	400
96-69-5	4,4-Thiobis(6-tert, butyl-m-cresol)	400
150-76-5	4-Methoxyphenol	133
92-93-3	4-Nitrobiphenyl	13
100-02-7	4-Nitrophenol	13
532-27-4	a-Chloroacetophenone	13
98-83-9	a-Methyl styrene	3335
60-35-5	Acetamide	13
64-19-7	Acetic acid	800
108-24-7	Acetic anhydride	800
67-64-1	Acetone	3335
75-05-8	Acetonitrile	1734
98-86-2	Acetophenone	13
79-27-6	Acetylene tetrabromide	400
107-02-8	Acrolein	13
79-10-7	Acrylic acid	13
107-18-6	Allyl alcohol	133
107-05-1	Allyl chloride	13
106-92-3	Allyl glycidyl ether (AGE)	800
2179-59-1	Allyl propyl disulfide	400
C7429-90-5	Aluminum, Al alkyls	13
7429-90-5	Aluminum, as AL metal dust	400
C7429-90-5	Aluminum, as AL pyro powders	133
C7429-90-5	Aluminum, as Al soluble salts	13
C7429-90-5	Aluminum, as Al welding fumes	133
7664-41-7	Ammonia	1334
12125-02-9	Ammonium chloride fume	400
3825-26-1	Ammonium perfluorooctanoate	13

Table C-1. Class B - Toxic Air Pollutants WAC 173-460, Section 160. (18 sheets)

Class B toxic CAS number	Air pollutants and acceptable source impact levels substance	Analytical quantification limit mg/m
7773-06-0	Ammonium sulfamate	400
62-53-3	Aniline & homologues	13
29191-52-4	Anisidine (o-,p-isomers)	13
C7440-36-0	Antimony & compounds as Sb	13
1309-64-4	Antimony trioxide, as Sb	13
86-88-4	ANTU	13
7784-42-1	Arsine	13
8052-42-4	Asphalt (petroleum) fumes	133
1912-24-9	Atrazine	133
86-50-0	Azinphos-methyl	13
57-57-8	B-Propiolactone	13
C7440-39-3	Barium, soluble compounds Ba	13
17804-35-2	Benomyl	400
98-07-7	Benzotrichloride	13
94-36-0	Benzoyl Peroxide	133
100-44-7	Benzyl chloride	133
92-52-4	Biphenyl	13
1304-82-1	Bismuth telluride	400
1304-82-1	Bismuth telluride Se doped	133
C1303-96-4	Borates, anhydrous	13
C1303-96-4	Borates, decahydrate	133
C1303-96-4	Borates, pentahydrate	13
1303-86-2	Boron oxide	400
10294-33-4	Boron tribromide	400
76737-07-2	Boron trifluoride	13
314-40-9	Bromacil	400
7726-95-6	Bromine	13
7789-30-2	Bromine pentafluoride	13
106-97-8	Butane	
141-32-2	Butyl acrylate	1734

Table C-1. Class B - Toxic Air Pollutants WAC 173-460, Section 160. (18 sheets)

Class B toxic CAS number	Air pollutants and acceptable source impact levels substance	Analytical quantification limit mg/m³
156-62-7	Calcium cyanamide	13
1305-62-0	Calcium hydroxide	133
1305-78-8	Calcium oxide	13
76-22-2	Camphor, synthetic	400
105-60-2	Caprolactam, dust	13
105-60-2	Caprolactam, vapor	800
2425-06-1	Captafol	13
133-06-2	Captan	133
63-25-2	Carbaryl	133
1563-66-2	Carbofuran	13
1333-86-4	Carbon black	133
75-15-0	Carbon disulfide	1334
558-13-4	Carbon tetrabromide	13
353-50-4	Carbonyl fluoride	133
463-58-1	Carbonyl sulfide	13
120-80-9	Catechol	800
21351-79-1	Cesium hydroxide	13
133-90-4	Chloramben	13
55720-99-5	Chlorinated diphenyl oxide (hexachlorophenyl et)	13
7782-50-5	Chlorine	13
10049-04-4	Chlorine dioxide	13
7790-91-2	Chlorine trifluoride	13
107-20-0	Chloroacetaldehyde	133
79-11-8	Chloroacetic acid	13
79-04-9	Chloroacetyl chloride	13
108-90-7	Chlorobenzene	1734
74-97-5	Chlorobromomethane	3335
75-45-6	Chlorodifluoromethane	
76-15-3	Chloropentafluoroethane	

Table C-1. Class B - Toxic Air Pollutants WAC 173-460, Section 160. (18 sheets)

Class B toxic CAS number	Air pollutants and acceptable source impact levels substance	Analytical quantification limit mg/m³
76-06-2	Chloropicrin	13
2921-88-2	Chlorpyrifos	13
C7440-47-3	Chromium (II) compounds, as Cr	13
C7440-47-3	Chromium (III) compounds, Cr	13
7440-47-3	Chromium (metal)	13
14977-61-8	Chromyl chloride	13
2971-90-6	Clopidol	400
7440-48-4	Cobalt as Co metal Dust and fume	13
10210-68-1	Cobalt carbonyl as Co	13
16842-03-8	Cobalt hydrocarbonyl	13
C7440-50-8	Copper, Dusts and mists, as Cu	13
7440-50-8	Copper, Fume	13
--	Cotton dust, raw	13
1319-77-3	Cresol, all isomers	800
4170-30-3	Crotonaldehyde	133
299-86-5	Crufomate	133
98-82-2	Cumene	3335
420-04-2	Cyanamide	13
51-12-5	Cyanides, as CN	133
460-19-5	Cyanogen	800
506-77-4	Cyanogen chloride	13
110-82-7	Cyclohexane	3335
108-93-0	Cyclohexanol	3335
108-94-1	Cyclohexanone	3335
110-83-8	Cyclohexene	3335
108-91-8	Cyclohexylamine	1734
121-82-4	Cyclonite	13
542-92-7	Cyclopentadiene	3335
287-92-3	Cyclopentane	3335
13121-70-5	Cyhexatin	133

Table C-1. Class B - Toxic Air Pollutants WAC 173-460, Section 160.
(18 sheets)

Class B toxic CAS number	Air pollutants and acceptable source impact levels substance	Analytical quantification limit mg/m³
17702-41-9	Decaborane	13
8065-48-3	Demeton	13
123-42-2	Diacetone alcohol	3335
333-41-5	Diazinon	13
334-88-3	Diazomethane	13
19287-45-7	Diborane	13
107-66-4	Dibutyl phosphate	133
84-74-2	Dibutyl phthalate	133
7572-29-4	Dichloroacetylene	13
75-71-8	Dichlorodifluoromethane	
75-43-4	Dichlorofluoromethane	1734
542-75-6	Dichloropropene	133
76-14-2	Dichlorotetrafluoroethane	
62-73-7	Dichlorvas	13
141-66-2	Dicrotophos	13
77-73-6	Dicyclopentadiene	1334
102-54-5	Dicyclopentadienyl iron	400
111-42-2	Diethanolamine	400
96-22-0	Diethyl ketone	3335
84-66-2	Diethyl phthalate	133
64-67-5	Diethyl sulfate	13
109-89-7	Diethylamine	1334
100-37-8	Diethylaminoethanol	1734
111-40-0	Diethylene triamine	133
75-61-6	Difluorodibromomethane	3335
2238-07-5	Diglycidyl ether	13
108-83-8	Diisobytyl ketone	3335
108-18-9	Diisopropylamine	800
127-19-5	Dimethyl acetamide	1334
60-11-7	Dimethyl aminoazobenzene	13

Table C-1. Class B - Toxic Air Pollutants WAC 173-460, Section 160. (18 sheets)

Class B toxic CAS number	Air pollutants and acceptable source impact levels substance	Analytical quantification limit mg/m³
79-44-7	Dimethyl carbamoyl chloride	13
124-40-3	Dimethylamine	800
121-69-7	Dimethylaniline	800
68-12-2	Dimethylformamide	400
131-11-3	Dimethylphthalate	133
148-01-6	Dinitolmide	133
534-52-1	Dinitro-o-cresol	13
528-29-0	Dinitrobenzene, all isomers	13
78-34-2	Dioxathion	13
122-39-4	Diphenylamine	13
123-19-3	Diprophyl ketone	3335
34590-94-8	Dipropylene glycol methyl ether	3335
85-00-7	Diquat	13
97-77-8	Disulfiram	13
298-04-4	Disulfuton	13
330-54-1	Diuron	400
1321-74-0	Divinyl benzene	1734
115-29-7	Endosulfan	13
72-20-8	Endrin	13
13838-16-9	Enflurane	3335
2104-64-5	EPN	13
141-43-5	Ethanolamine	133
563-12-2	Ethion	13
141-78-6	Ethyl acetate	3335
140-88-5	Ethyl acrylate	800
64-17-5	Ethyl alcohol	
541-85-5	Ethyl amyl ketone	3335
100-41-4	Ethyl benzene	3335
74-96-4	Ethyl bromide	3335
106-35-4	Ethyl butyl ketone	3335

Table C-1. Class B - Toxic Air Pollutants WAC 173-460, Section 160. (18 sheets)

Class B toxic CAS number	Air pollutants and acceptable source impact levels substance	Analytical quantification limit mg/m^3
51-79-5	Ethyl carbamate	13
75-00-3	Ethyl chloride	
60-29-7	Ethyl ether	3335
109-94-4	Ethyl formate	3335
75-08-1	Ethyl mercaptan	13
78-10-4	Ethyl silicate	3335
75-04-7	Ethylamine	800
107-07-3	Ethylene chlorohydrin	133
107-15-3	Ethylene diamine	800
107-21-1	Ethylene glycol	3335
628-96-6	Ethylene glycol dinitrate	13
151-56-4	Ethylenimine	13
16219-75-3	Ethylidene norbornene	800
22224-92-6	Fenamiphos	13
115-90-2	Fensulfothion	13
55-38-9	Fenthion	13
14484-64-1	Ferbam	400
12604-58-9	Ferrovanadium dust	13
--	Fibrous glass dust	400
--	Fine mineral fibers	400
16984-48-8	Fluorides, as F	13
7782-41-4	Fluorine	13
944-22-9	Fonofos	13
75-12-7	Formamide	800
64-18-6	Formic acid	400
98-01-1	Furfural	133
98-00-1	Furfuryl alcohol	1734
7782-65-2	Germanium tetrahydride	13
111-30-8	Glutaraldehyde	13
556-52-5	Glycidol	1734

Table C-1. Class B - Toxic Air Pollutants WAC 173-460, Section 160. (18 sheets)

Class B toxic CAS number	Air pollutants and acceptable source impact levels substance	Analytical quantification limit mg/m³
--	Glycol ethers	13
7440-58-6	Hafnium	13
151-67-7	Halothane	3335
142-82-5	Heptane (n-Heptane)	3335
87-68-3	Hexachlorobutadiene	13
77-47-4	Hexachlorocyclopentadiene	13
67-72-1	Hexachloroethane	400
1335-87-1	Hexachloronaphthalene	13
684-16-2	Hexafluoroacetone	13
822-06-0	Hexamethylene diisocyanate	13
100-54-3	Hexane (n-Hexane)	1734
--	Hexane, other isomers	3335
107-41-5	Hexylene glycol	3335
10035-10-6	Hydrogen bromide	400
7647-01-0	Hydrogen chloride	13
74-90-8	Hydrogen cyanide	400
7664-39-3	Hydrogen flouride, as F	13
7722-84-1	Hydrogen peroxide	13
7783-07-5	Hydrogen selenide, as Se	13
7783-06-4	Hydrogen sulfide	13
123-31-9	Hydroquinone	13
95-13-6	Indene	1734
C7440-74-6	Indium & Compounds as In	13
7553-56-2	Iodine	13
75-47-8	Iodoform	400
1309-37-1	Iron oxide fume, Fe 20 3 as Fe	133
13463-40-6	Iron pentacarbonyl, as Fe	13
--	Iron salts, soluble as Fe	13
123-92-2	Isoamyl acetate	3335
123-51-3	Isoamyl alcohol	3335

Table C-1. Class B - Toxic Air Pollutants WAC 173-460, Section 160. (18 sheets)

Class B toxic CAS number	Air pollutants and acceptable source impact levels substance	Analytical quantification limit mg/m³
110-19-0	Isobutyl acetate	3335
78-83-1	Isobutyl alcohol	3335
26952-21-6	Isocytl alcohol	3335
78-59-1	Isophorone	800
4098-71-9	Isophorone diisocyanate	13
109-59-1	Isopropoxyethanol	3335
108-21-4	Isopropyl acetate	3335
67-63-0	Isopropyl alcohol	3335
108-20-3	Isopropyl ether	3335
4016-14-2	Isopropyl glycidyl ether (IGE)	3335
75-31-0	Isopropylamine	400
463-51-4	Ketene	13
3687-31-8	Lead arsenate, as Pb 3(A 20 1) 2	13
7758-97-6	Lead chromate, as Cr	13
68476-85-7	Liquified petroleum gas	3335
7580-67-8	Lithium hydride	13
626-17-5	m-Phthalodinitrile	133
108-44-1	m-Toluidine	133
1477-55-0	m-Xylene a,a'-diamine	13
1309-48-4	Magnesium oxide fume	400
121-75-5	Malathion	400
108-31-6	Maleic anhydride	13
12079-65-1	Manganese cyclopentadienyl tricarbonyl	13
C7439-96-5	Manganese dust & compounds	13
C7439-96-5	Manganese fume	13
C7439-97-6	Mercury, Aryl & inorganic cmpd	13
C7439-97-6	Mercury, as Hg Alkyl compounds	13
C7439-97-6	Mercury, vapors except alkyl	13
141-79-7	Mesityl oxide	1734
79-41-4	Methacrylic acid	1734

Table C-1. Class B - Toxic Air Pollutants WAC 173-460, Section 160. (18 sheets)

Class B toxic CAS number	Air pollutants and acceptable source impact levels substance	Analytical quantification limit mg/m
16752-77-5	Methomyl	13
72-43-5	Methoxychlor	400
137-05-3	Methyl 2-cyanoacrylate	400
79-20-9	Methyl acetate	3335
74-99-7	Methyl acetylene	3335
59355-75-8	Methyl acetylene-propadiene mixture (MAPP)	3335
96-33-3	Methyl acrylate	1334
67-56-1	Methyl alcohol	3335
74-83-9	Methyl bromide	13
74-87-3	Methyl chloride	3335
71-55-6	Methyl chloroform (1,1,1-Trichloroethane)	
8022-00-2	Methyl demeton	13
78-93-3	Methyl ethyl ketone (MEK)	3335
1338-23-4	Methyl ethyl ketone peroxide	13
107-31-3	Methyl formate	3335
60-34-4	Methyl hydrazine	13
74-88-4	Methyl iodide	400
110-12-3	Methyl isoamyl ketone	3335
108-11-2	Methyl isobutyl carbinol	3335
108-10-1	Methyl isobutyl ketone (MIBK)	3335
624-83-9	Methyl isocyanate	13
563-80-4	Methyl isopropyl ketone	3335
74-93-1	Methyl mercaptan	13
80-62-6	Methyl methacrylate	3335
110-43-0	Methyl n-amyl ketone	3335
591-78-6	Methyl n-butyl ketone	800
298-00-0	Methyl parathion	13
107-87-9	Methyl propyl ketone	3335
681-84-5	Methyl silicate	133
1634-04-4	Methyl tert-butyl ether	3335

Table C-1. Class B - Toxic Air Pollutants WAC 173-460, Section 160. (18 sheets)

Class B toxic CAS number	Air pollutants and acceptable source impact levels substance	Analytical quantification limit mg/m³
126-98-7	Methylacrylonitrile	13
109-87-5	Methylal	
74-89-5	Methylamine	400
108-87-2	Methylcyclohexane	3335
25639-42-3	Methylcyclohexanol	3335
12108-13-3	Methylcyclopentadienyl manganese tricarbonyl	13
5124-30-1	Methylene bis (4-cyclo-hexylisocyanate)	13
101-68-8	Methylene bis(phenyl isocyanate)	13
21087-64-9	Metribuzin	133
7786-34-7	Mevinphos	13
C7439-98-7	Molybdenum, as Mo soluble cpds	133
C7439-98-7	Molybdenum, insoluble cpds	400
6923-22-4	Monocrotophos	13
110-91-8	Morpholine	1734
628-63-7	n-Amyl acetate	3335
123-86-4	n-Butyl acetate	3335
71-36-3	n-Butyl alcohol	3335
2426-08-6	n-Butyl glycidyl ether (BGE)	3335
138-22-7	n-Butyl lactate	800
109-79-5	n-Butyl mercaptan	13
109-73-9	n-Butylamine	400
100-74-3	N-Ethylmorpholine	800
768-52-5	N-Isopropylaniline	400
100-61-8	N-Methyl aniline	13
684-93-5	N-Nitroso-N-methylurea	13
109-60-4	n-Propyl acetate	3335
71-23-8	n-Propyl alcohol	3335
627-13-4	n-Propyl nitrate	3335
110-62-3	n-Valeraldehyde	3335
300-76-5	Naled	133

Table C-1. Class B - Toxic Air Pollutants WAC 173-460, Section 160. (18 sheets)

Class B toxic CAS number	Air pollutants and acceptable source impact levels substance	Analytical quantification limit mg/m³
91-20-3	Napthalene	1734
54-11-5	Nicotine	13
1929-82-4	Nitrapyrin	400
7697-37-2	Nitric acid	133
10102-43-9	Nitric oxide	1334
98-95-3	Nitrobenzene	13
79-24-3	Nitroethane	3335
7783-54-2	Nitrogen trifluoride	800
55-63-0	Nitroglycerin	13
75-52-5	Nitromethane	3335
88-72-2	Nitrotoluene	400
111-84-2	Nonane	3335
2698-41-1	o-Chlorobenylidene malonitrile	13
2039-87-4	o-Chlorostyrene	3335
95-49-8	o-Chlorotoluene	3335
95-50-1	o-Dichlorobenzene (1,2-Dichlorobenzene)	3335
583-60-8	o-Methylcyclohexanone	3335
89-72-5	o-sec-Butylphenol	1334
2234-13-1	Octachloronaphthalene	13
111-65-9	Octane	3335
8012-95-1	Oil mist, mineral	133
20816-12-0	Osmium tetroxide, as Os	13
144-62-7	Oxalic acid	13
7783-41-7	Oxygen difluoride	13
100-01-6	p-Nitroaniline	133
100-00-5	p-Nitrochlorobenzene	13
106-50-3	p-Phenylenediamine	13
98-51-1	p-tert-Butyltoluene	1734
106-49-0	p-Toluidine	133
8002-74-2	Parafin was fume	13

Table C-1. Class B - Toxic Air Pollutants WAC 173-460, Section 160. (18 sheets)

Class B toxic CAS number	Air pollutants and acceptable source impact levels substance	Analytical quantification limit mg/m³
4685-14-7	Paraquat	13
56-38-2	Parathion	13
19624-22-7	Pentaborane	13
1321-64-8	Pentachloronaphthalene	13
82-68-8	Pentachloronitrobenzene (quintobenzene)	13
109-66-0	Pentane	
594-42-3	Perchloromethyl mercaptan	13
7616-94-6	Perchloryl fluoride	400
108-95-2	Phenol	800
92-84-2	Phenothiazine	13
101-84-8	Phenyl ether	133
122-60-1	Phenyl glycidyl ether	3335
108-98-5	Phenyl mercaptan	13
100-63-0	Phenylhydrazine	13
638-21-1	Phenylphosphine	13
298-02-2	Phorate	13
75-44-5	Phosgene	13
7803-51-2	Phosphine	13
7664-38-2	Phosphoric acid	13
7723-14-0	Phosphorus	13
10025-87-3	Phosphorus oxychloride	13
10026-13-8	Phosphorus pentachloride	13
1314-80-3	Phosphorus pentasulfide	13
7719-12-2	Phosphorus trichloride	13
85-44-9	Phthalic anhydride	133
1918-02-1	Picloram	400
88-89-1	Picric acid	13
83-26-1	Pindone	13
142-64-3	Piperazine dihydrochloride	133
7440-06-4	Platinum, Metal	13

Table C-1. Class B - Toxic Air Pollutants WAC 173-460, Section 160. (18 sheets)

Class B toxic CAS number	Air pollutants and acceptable source impact levels substance	Analytical quantification limit mg/m^3
C7440-06-4	Platinum, Soluble salts as Pt	13
1310-58-3	Potassium hydroxide	13
107-19-7	Propargyl alcohol	13
123-38-6	Propionaldehyde	13
79-09-4	Propionic acid	1334
114-26-1	Propoxur	13
6423-43-4	Propylene glycol dinitrate	13
107-98-2	Propylene glycol monomethyl ether	3335
75-55-8	Propylene imine	133
8003-34-7	Pyrethrum	13
110-86-1	Pyridine	400
91-22-5	Quinoline	13
106-51-4	Quinone	13
108-46-3	Resorcinol	1734
7440-16-6	Rhodium Metal	13
C7440-16-6	Rhodium, Insoluble compounds	13
C7440-16-6	Rhodium, Soluble compounds	13
299-84-3	Ronnel	400
83-79-4	Rotenone	133
--	Rubber solvent (Naphtha)	3335
626-38-0	sec-Amyl acetate	3335
105-46-4	sec-Butyl acetate	3335
78-92-2	sec-Butyl alcohol	3335
108-84-9	sec-Hexyl acetate	3335
C7782-49-2	Selenium compounds, as Se	13
7783-79-1	Selenium hexafluoride, as Se	13
136-78-7	Sesone	400
7803-62-5	Silicon tetrahydride	133
7440-22-4	Silver, Metal	13
C7440-22-4	Silver, soluble compounds as Ag	13

Table C-1. Class B - Toxic Air Pollutants WAC 173-460, Section 160. (18 sheets)

Class B toxic CAS number	Air pollutants and acceptable source impact levels substance	Analytical quantification limit mg/m^3
26628-22-8	Sodium azide	13
7631-90-5	Sodium bisulfite	133
62-74-8	Sodium fluoroacetate	13
1310-73-2	Sodium hydroxide	13
7681-57-4	Sodium metabisulfite	133
7803-52-3	Stibine	13
57-24-9	Strychnine	13
100-42-5	Styrene	3335
96-9-3	Styrene oxide	13
1395-21-7	Subtilisins	13
3689-24-5	Sulfotep	13
2551-62-4	Sulfur hexafluoride	
10025-67-9	Sulfur monochloride	133
5714-22-7	Sulfur pentafluoride	13
7783-60-0	Sulfur tetrafluoride	13
7664-93-9	Sulfuric acid	13
2699-79-8	Sulfuryl fluoride	800
35400-43-2	Sulprofos	13
C7440-25-7	Tantalum, metal & oxide dusts	133
C13494-80-9	Tellurium & compounds as Te	13
7783-80-4	Tellurium hexafluoride, as Te	13
3383-96-8	Temephos	400
107-49-3	TEPP	13
26140-60-3	Terphenyls	133
540-88-5	tert-Butyl acetate	3335
75-65-0	tert-Butyl alcohol	3335
1189-85-1	tert-Butyl chromate, as CrO3	13
1335-88-2	Tetrachloronaphthalene	13
78-00-2	Tetraethyl lead, as Pb	13
109-99-9	Tetrahydrofuran	3335

Table C-1. Class B - Toxic Air Pollutants WAC 173-460, Section 160. (18 sheets)

Class B toxic CAS number	Air pollutants and acceptable source impact levels substance	Analytical quantification limit mg/m
75-74-1	Tetramethyl lead, as Pb	13
3333-52-6	Tetramethyl succinonitrile	13
509-14-8	Tetranitromethane	133
7722-88-5	Tetrasodium pyrophosphate	133
479-45-8	Tetryl	13
C7440-28-0	Thallium, soluble compounds, Tl	13
68-11-1	Thioglycolic acid	133
7719-09-7	Thionyl chloride	133
137-26-8	Thiram	13
7440-31-5	Tin, Metal	13
C7440-31-5	Tin, Organic compounds, as Sn	13
7440-31-5	Tin, oxide, & inorganic except SnH 4	13
7550-45-0	Titanium tetrachloride	13
108-88-3	Toluene	3335
126-73-8	Tributyl phosphate	13
76-03-9	Trichloroacetic acid	133
75-69-4	Trichlorofluoromethane	
1321-65-9	Trichloronaphthalene	133
121-44-8	Triethylamine	13
75-63-8	Trifluorobromomethane	
1582-09-8	Trifluralin	13
552-30-7	Trimellitic anhydride	13
2551-13-7	Trimethyl benzene	3335
121-45-9	Trimethyl phopshite	400
75-50-3	Trimethylamine	800
78-30-8	Triorthocresyl phosphate	13
603-34-9	Triphenyl amine	133
115-86-6	Triphenyl phosphate	133
C7440-33-7	Tungsten, Insoluble compounds	133
C7440-33-7	Tungsten, Soluble compounds	13

Table C-1. Class B - Toxic Air Pollutants WAC 173-460, Section 160. (18 sheets)

Class B toxic CAS number	Air pollutants and acceptable source impact levels substance	Analytical quantification limit mg/m^3
8006-64-2	Turpentine	3335
C7440-61-1	Uranium, insoluble & soluble	13
1314-62-1	Vanadium, as V 20 5	13
108-05-4	Vinyl acetate	1734
593-60-2	Vinyl bromide	800
106-87-6	Vinyl cyclohexene dioxide	1734
25013-15-4	Vinyl toluene	3335
75-35-4	Vinylidene chloride	800
8032-32-4	VM & P Naphtha	3335
81-81-2	Warfarin	13
--	Welding fumes	133
1330-20-7	Xylenes (m-,o-,p-isomers)	3335
1300-73-8	Xylidine	13
C7440-65-5	Yttrium, metal and cpds as Y	13
7646-85-7	Zinc chloride fume	13
13530-65-9	Zinc chromates	13
1314-13-2	Zinc oxide, fume	133
C7440-67-7	Zirconium compounds, as Zr	133

Table C-2. Class A - Toxic Air Pollutants WAC 173-460, Section 150. (2 sheets)

CAS number	Substance	Analytical quantification limit mg/m³
107-06-2	1,2-Dichloroethane (ethylene chloride)	1.3
122-66-7	1,2-Diphenylhydrazine	0.065
106-99-0	1,3-Butadiene	0.065
764-41-0	1,4-Dichloro-2-butene	0.065
106-46-7	1,4-Dichlorobenzene	65
123-91-1	1,4-Dioxane	1.3
1746-01-6	2,3,7,8-Tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD)	0.065
88-06-2	2,4,6-Trichlorophenol	6.5
95-80-7	2,4-Toluene diamine	1.3
79-46-9	2-Nitropropane	0.065
91-94-1	3,3'-Dichlorobenzidine	2.6
119-93-7	3,3-Dimethyl benzidine	0.065
75-07-0	Acetaldehyde	6.5
79-06-1	Acrylamide	0.065
107-13-1	Acrylonitrile	1.3
309-00-2	Aldrin	0.065
62-53-3	Aniline	65
C7440-38-2	Arsenic and inorganic arsenic compounds	0.065
1332-21-4	Asbestos (Note: fibers/ml)	0.065
71-43-2	Benzene	2.6
92-87-5	Benzidine and its salts	0.065
50-32-8	Benzo(a)pyrene	0.065
7440-41-7	Beryllium and compounds	0.065
111-44-4	Bis(2-chloroethyl)ether	0.065
117-81-7	Bis(2-ethylhexyl)phthalate (DEHP)	65
542-88-1	Bis(chloromethyl)ether	0.065
75-25-2	Bromoform	6.5
7440-43-9	Cadmium and compounds	0.065
56-23-5	Carbon tetrachloride	2.6
57-74-9	Chlordane	0.065
510-15-6	Chlorobenzilate	6.5
67-66-3	Chloroform	1.3

Table C-2. Class A - Toxic Air Pollutants WAC 173-460, Section 150. (2 sheets)

CAS number	Substance	Analytical quantification limit mg/m³
108-43-0	Chlorophenols	6.5
C7440-47-3	Chromium, hexavalent metal and compounds	0.065
--	Coke oven emissions	0.065
3547-04-4	DDE(p,p'-dichlorodiphenyldichloroethylene)	2.6
50-29-3	DDT (1,1,1 Trichloro-2,2-Bis (p-chlorophenyl)-ethane)	0.065
75-09-2	Dichloromethane (methylene chloride)	6.5
60-57-1	Dieldrin	0.065
106-89-8	Epichlorohydrin	6.5
106-93-4	Ethylene dibromide (dibromethane)	0.065
75-21-8	Ethylene oxide	1.3
96-45-7	Ethylene thiourea	65
50-00-0	Formaldehyde	2.6
76-44-8	Heptachlor	0.065
118-74-1	Hexachlorobenzene	0.065
58-89-9	Hexachlorocyclohexane (Lindane) gamma BHC	0.065
302-01-2	Hydrazine	0.065
924-16-3	N-Nitrosodi-n-butylamine	0.065
55-18-5	N-Nitrosodiethylamine (diethylnitrosoamine)(DEN)	0.065
62-75-9	N-Nitrosodimethylamine	0.065
C7440-02-0	Nickel and compounds (as nickel subsulfide or nickel refinery dust)	0.065
95-53-4	o-Toluidine	6.5
636-21-5	o-Toluidine hydrochloride	6.5
87-86-5	Pentachlorophenol	6.5
127-18-4	Perchloroethylene (tetrachloroethylene)	65
1336-36-3	Polychlorinated biphenyls (PCB)	0.065
75-56-9	Propylene oxide	6.5
8001-35-2	Toxaphene	0.065
79-01-6	Trichloroethylene	6.5
75-01-4	Vinyl chloride	1.3

Table C-3. Class A Toxic Air Pollutants WAC 173-460, Section 150.

CAS number	Substance	Analytical Quantification Limit mg/m^3
61-82-5	Amitrol	0.065
90-04-0	O-Anisidine	65
126-99-8	β-Chloroprene	65
94-75-7	2-4-D and esters	65
78-87-5	1,2-Dichloropropane	65
77-78-1	Dimethyl sulfate	65
540-73-8	1,2-Dimethylhydrazine	65
319-84-6	Hexachlorocyclohexane (Lindane) alpha BHC	65
319-85-7	Hexachlorocyclohexane (Lindane) beta BHC	65
------	Lead compounds	6.5
101-77-9	4,4-Methylene dianiline	6.5
-------	Polyaromatic hydrocarbon (PAH) emissions	0.065
584-84-9	2,4-Toluene diisocyanate	1.3

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