PNNL-12160, Rev. 1

Pacific Northwest
National Laboratory
Operated by Battelle for the
U.S. Department of Energy

Facility Effluent Monitoring Plan for Pacific Northwest National Laboratory Balanced-of-Plant Facility

January 2001

Prepared for the U.S. Department of Energy
under Contract DE-AC06-76RL01830

PACIFIC NORTHWEST NATIONAL LABORATORY
operated by
BATTELLE
for the
UNITED STATES DEPARTMENT OF ENERGY
under Contract DE-AC06-76RL01830

Printed in the United States of America

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PNNL-12160, Rev. 1

Environmental Management Services

FACILITY EFFLUENT MONITORING PLAN FOR PACIFIC NORTHWEST NATIONAL LABORATORY BALANCE-OF-PLANT FACILITIES

Prepared by:

12/4/2000
M.Y. Ballinger
Effluent Management

12/7/00
K.D. Shields
Effluent Management

Approved for Use and Application by:

1/10/2001
E. G. Damberg, Manager
Effluent Management

1/11/01
A.K. Ikenberry, Manager
Environmental Management Services Department

1/16/01
J. Alvarez, Manager
Facilities Operations Department

Pacific Northwest National Laboratory
Operated by Battelle for the
U. S. Department of Energy

Summary

The Pacific Northwest National Laboratory (Pacific Northwest) operates a number of Research & Development facilities for the U.S. Department of Energy (DOE) on the Hanford Site. According to DOE Order 5400.1, a written environmental monitoring plan is required for each site, facility, or process that uses, generates, releases, or manages significant pollutants or hazardous materials. Facility Effluent Monitoring Plans (FEMPs) have been developed on the Hanford Site to document the facility effluent monitoring portion of the Environmental Monitoring Plan (DOE 2000) for the Hanford Site. Three of Pacific Northwest's R&D facilities, the 325, 331, and 3720 Buildings, are considered major emission points for radionuclide air sampling; thus, individual FEMPs have been developed for these facilities. Because no definition of "significant" is provided in DOE Order 5400.1 or the accompanying regulatory guide DOE/EH-0173T, this FEMP was developed to describe monitoring requirements in the DOE-owned, Pacific Northwest-operated facilities that do not have individual FEMPs. These facilities are referred to as Balance-of-Plant (BOP) facilities.

Activities in the BOP facilities range from administrative to laboratory and pilot-scale R&D. R&D activities include both radioactive and chemical waste characterization, fluid dynamics research, mechanical property testing, dosimetry research, and molecular sciences. The mission and activities for individual buildings are described in the FEMP.

Potential radioactive airborne emissions in the BOP facilities are estimated annually using a building inventory-based approach. The methods used are derived from the Code of Federal Regulations. Sampling at individual BOP facilities is based on a potential-to-emit assessment. Some of these facilities are considered minor emission points and thus are sampled routinely, but not continuously, to confirm the low emission potential. Sampling systems are located downstream of control technologies and just prior to discharge to the atmosphere.

The need for monitoring airborne emissions of hazardous chemicals is established in the Hanford Site Air Operating Permit and in Notices of Construction. Based on the current potential-to-emit, the Hanford Site Air Operating Permit does not contain general monitoring requirements for BOP facilities. However, the permit identifies monitoring requirements for specific projects and buildings. Needs for future monitoring will be established by future permits issued pursuant to the applicable state and federal regulations.

A number of liquid effluent discharge systems serve the BOP facilities: sanitary sewer, process sewer, and retention process sewer. None of these systems discharge to the environment; instead, they either discharge to treatment plants or to long-term storage. Routine compliance sampling of liquid effluents is only required at the Environmental Molecular Sciences Laboratory. Liquid effluents from other BOP facilities may be sampled or monitored to characterize facility effluents or to investigate discharges of concern. Liquid effluent characterization data is summarized in the FEMP.

Effluent sampling and monitoring for the BOP facilities depends on the inventories, activities, and environmental permits in place for each facility. A description of routine compliance monitoring for BOP facilities is described in the BOP FEMP.

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ACRONYMS

ALE – Fitzner/Eberhardt Arid Lands Ecology Reserve
ANSI – American National Standards Institute
BCAA – Benton Clean Air Authority
BOP – Balance-of-Plant
CFR – Code of Federal Regulations
CMC – Chemical Measurement Center
CMS – Chemical Management System
DEPO – Deposition Code
DOE – U.S. Department of Energy
DOE/RL – Department of Energy Richland Operations Office
EMP – Environmental Monitoring Plan
EMSL – Environmental Molecular Sciences Laboratory
EPA – U.S. Environmental Protection Agency
FEMP – Facility Effluent Monitoring Plan
FUA – Facility Use Agreement
GED – Gaseous Effluent Database
HEPA – High Efficiency Particulate Air
MDA – Minimum Detectable Activity
NESHAP – National Emission Standards for Hazardous Air Pollutants
NOC – Notice of Construction
OED - Offsite Emission Dose
POTW – Publicly Owned Treatment Works
PS – Process Sewer
PTE – Potential To Emit
QA – Quality Assurance
QC – Quality Control
R&D – Research and Development
RL –Richland Operations Office
RLWS – Radioactive Liquid Waste System
RPS – Retention Process Sewer
RQ – Reportable Quantity
SBMS – Standards-Based Management System
SNS – Sanitary Sewer
SOW – Statement Of Work
TEDF – Treated Effluent Disposal Facility
WAC – Washington Administrative Code
WDOE – Washington Department of Ecology
WDOH – Washington State Department of Health

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1.0 Introduction

It is the policy of the U.S. Department of Energy (DOE) to conduct its operations in an environmentally safe and sound manner and to ensure that programs are in place to ensure protection of the environment and the public. The Pacific Northwest National Laboratory (Pacific Northwest) is committed to providing a safe and healthy working environment for all staff; protecting the general public and the environment from unacceptable environmental, safety and health risks; and operating in a manner that protects and restores the environment. To implement these policies, effluent monitoring programs at Pacific Northwest must meet high standards of quality and credibility.

1.1 Purpose

DOE Order 5400.1 (DOE 1988), "General Environmental Protection Programs," states the following objective for environmental monitoring programs:

> " demonstrate compliance with legal and regulatory requirements imposed by applicable Federal, State, and local agencies; confirm adherence to DOE environmental protection policies; and support environmental management decisions (Section IV-1)."

Plans must be prepared for each site, facility, or process that uses "significant pollutants or hazardous materials" (DOE 1988, Section, IV-2). These requirements are being met through the environmental monitoring program conducted for the Hanford Site and described by the DOE Richland Operations Office (DOE/RL) in the Hanford Site Environmental Monitoring Plan (EMP) (DOE 2000).

The EMP identifies and discusses two major activities as specified by DOE 5400.1: effluent monitoring and environmental surveillance. Because the Hanford Site contains a number of facilities with effluent monitoring needs, individual effluent monitoring plans are prepared for those facilities to support the discussion of effluent monitoring in the EMP. Individual Facility Effluent Monitoring Plans (FEMPs) were prepared for the Pacific Northwest-operated 325, 331, and 3720 Buildings primarily because these facilities have "major" (potential to emit of > 0.1 mrem/yr) emission points for radionuclide air emissions according to the most recent annual National Emission Standards for Hazardous Air Pollutants (NESHAP) assessment. This report supplies information on effluent monitoring in all DOE-owned, Pacific Northwest-operated facilities other than the 325, 331, and 3720 Buildings. A complete listing of these Balance-of-Plant (BOP) facilities is provided in Appendix A. Facilities that are inactive or used only for administrative purposes (office buildings) are also listed in Appendix A, but are not required to be monitored and are not addressed further. The information provided in this FEMP is current at the time of FEMP issuance. DOE Order 5400.1 requires the EMP to be reviewed annually and updated every 3 years. Update of this FEMP will also occur every 3 years.

1.2 Scope

Characterizing the radioactive and nonradioactive constituents in inventories and in waste streams provides the underlying rationale for sampling and monitoring programs. Currently, confirmatory sampling for radionuclide air emissions is required for some of the BOP facilities. Routine sampling for air chemical emissions is not required for any of these facilities. However, confirmatory sampling of total carbon from some BOP stacks is conducted as required to confirm calculations submitted in permit applications or Notices of Construction. For liquid waste streams, Fluor Hanford performs compliance sampling of process liquid waste streams, and DynCorp performs compliance sampling of sanitary sewer discharges, as required, from the 300 Area (except the Environmental Molecular Sciences Laboratory [EMSL]). Pacific Northwest performs compliance sampling for process liquid streams discharged from EMSL. No routine liquid effluent monitoring is required for DOE-owned, Pacific Northwest-operated facilities in other areas.

A major activity of the FEMP effort is to identify the liquid and air release pathways (e.g., identify all access points to the various sewers and all radioactive emission release pathways) under normal operations and during process upset conditions. These are verified on as-built drawings that are maintained in Pacific Northwest's Essential Drawings System. This verification was performed for the following BOP facilities because they have the greatest potential for environmental release based on their radioactive or chemical inventories: 306-W (ventilation drawings), and 326 and 329 (ventilation and effluent piping drawings) (see Appendices C, D, E, and F for specific information on the 306-W, 320, 326, and 329 Buildings).

The method of characterization discussed in this FEMP identifies potential pollutants at the point of generation and potential upset conditions that are likely to occur, and evaluates the potential for those materials to enter an effluent stream.

1.3 Basis for Preparing FEMP

A FEMP is required for each site, facility, or process that uses, generates, releases, or manages significant pollutants or hazardous materials. No definition of "significant" is provided in DOE Order 5400.1 (DOE 1988) or the accompanying regulatory guide DOE/EH-0173T (DOE 1991), so this BOP FEMP is prepared to describe monitoring requirements in the DOE-owned, Pacific Northwest-operated facilities that do not have individual FEMPs.

1.4 References

DOE 1988. *General Environmental Protection Program*, DOE 5400.1. United States Department of Energy Order. United States Department of Energy, Washington, D.C.

DOE 1991. *Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance*, DOE/EH-0173T. United States Department of Energy Order. United States Department of Energy, Washington, D.C.

DOE 2000. *Environmental Monitoring Plan*, DOE/RL-91-50, Rev 3, United States Department of Energy, Richland Operations Office, Richland, Washington.

2.0 Facility Description

Facility use and mission may change, and modifications may be made that significantly affect effluent monitoring. Therefore, this section discusses the range of physical descriptions, missions, activities that generate effluents, and effluent pathways for all DOE-owned, Pacific Northwest-operated facilities. A listing of the BOP facilities at the time of writing this FEMP is provided in Appendix A along with more detailed information on these facilities.

DOE-owned, Pacific Northwest-operated facilities are located primarily in the 300 Area of the Hanford Site (see Figure 2.1) and range from small storage facilities to multilevel high-bay research facilities. Over 50 facilities fall into the BOP category. Of these, a few buildings are used for office or administrative purposes only, about one-quarter are research and development (R&D) facilities, another one-quarter are R&D support facilities (e.g., storage, maintenance services, waste operations), and the rest are inactive.

The BOP facilities are operated to support the Hanford Site's missions, which include environmental management as well as science and technology. The science and technology mission, for which Pacific Northwest is designated as a principal laboratory, is to develop and deploy science and technology to meet immediate cleanup needs and to develop global long-term cleanup solutions. One of the goals is to contribute knowledge and technology to DOE's other core missions consistent with Pacific Northwest's focus on the environmental mission. Activities in individual facilities range from administrative to laboratory and pilot-scale R&D. R&D activities include both radioactive and chemical waste characterization, fluid dynamics research, mechanical property testing, and dosimetry research. R&D work is performed on a project basis, and projects are evaluated for a number of factors, including environmental risk, before being initiated. Activities to take place in specific facilities are evaluated through a preparatory and risk analysis process that includes reviewing the project activities against current building operational boundaries. Appendix A provides a brief description of the type of work performed in individual active BOP facilities.

Facility Use Agreements (FUAs) have been prepared for most of the active BOP facilities. These FUAs describe the mission and activities for work in the individual facilities and specify the limiting boundaries for facility operations. They also describe the physical structure and operating design parameters of the facilities. In addition, facility drawings of BOP facilities are maintained by Pacific Northwest's Facilities and Operations Directorate, which also manages facility modifications.

2.1 Source Term Definition and Description

The characteristics of releases that could contribute to each effluent stream during normal operating and upset conditions are described in this section. Unconfined contact with ventilation air is the only prerequisite for an inventory to contribute a gas or aerosol source term to the air-effluent stream. Thus, all "passive" inventories stored in open containers, as well as those used in "active" processes, can potentially produce gas or aerosol source terms. The following subsections discuss potential source terms under normal and upset[1] conditions.

The building and local inventories of radionuclides and toxic chemicals are important to effluent characterization because of their potential for release. This section provides information on the types and forms of chemicals and radionuclides in the BOP facilities under current and foreseen operations. For the purposes of this section, a source term is a description of the nature and location of potential sources of releases of radioactive and/or chemical materials within the building. The release could be to the atmosphere or the sewers due to process activities.

1 The *Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance* (DOE 1991) states that "provisions for monitoring of airborne emissions during accident situations should* be considered." The term "upsets" is used in this document to refer to accidents that might be expected to occur in a facility and for which monitoring should be considered.

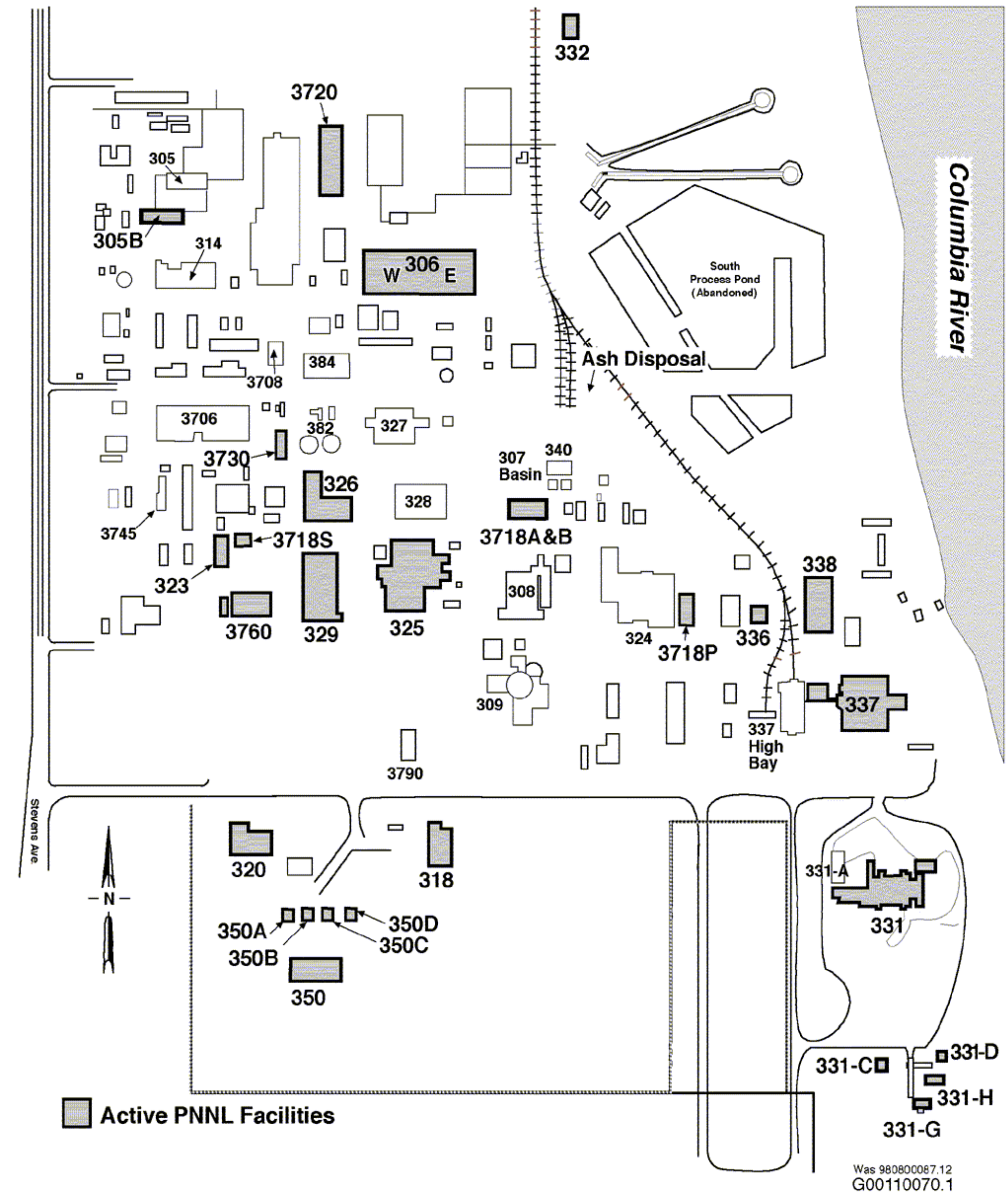

Figure 2.1 Active DOE-owned, Pacific Northwest-Operated Facilities in the 300 Area of the Hanford Site

Normal Operations

Under normal operations, most of the BOP facilities have ventilation systems that maintain a negative pressure in the building. Air is drawn into the building through work areas and carried through ducts to one or more emission points. Radionuclide air emissions generated from projects are evaluated on a case-by-case basis to determine compliance with permitting requirements for air emissions.

The need for monitoring airborne emissions of hazardous chemicals is established in the Hanford Site Air Operating Permit. Based on the current potential-to-emit, the permit does not contain general monitoring requirements for BOP facilities. However, the permit identifies monitoring requirements for specific projects and buildings. Needs for future monitoring will be established by future permits issued pursuant to the applicable state and federal regulations (e.g. Washington Administrative Code [WAC] 173-400, General Regulations for Air Pollution Sources, and WAC 173-460 Controls for New Sources of Toxic Air Pollutants).

Facilities are equipped with liquid effluent systems that transport liquid waste streams to centralized treatment facilities. Under normal operations, liquid wastes are generated, designated as regulated or nonregulated, and only discharged to sewer systems after determining that the waste meets the appropriate discharge criteria.

Upset Conditions

Upset conditions for air emissions include failure of the building ventilation system, resulting in air emissions following a different pathway or inadvertent or unusual generation of airborne materials resulting in unexpected emissions. Section 3.3.2 discusses upset conditions that have been classified as off-normal or unusual occurrences. Failure of the building ventilation system (due to power outage or malfunction in the exhaust system) is the predominant type of upset condition.

Upset conditions for liquid effluents are similar in that a failure (break in the piping, pump malfunction) may occur, causing effluents to be spilled, or material may be inadvertently discharged to a sewer system resulting in unexpected effluents. Very few of these types of upsets have actually occurred (see Section 3.3.2); however, liquid effluent monitoring is performed as needed to respond to these events.

2.1.1 Chemical

Chemical storage and usage are well dispersed throughout the BOP facilities and consist of bulk materials (solvents, acids/bases), small volume chemicals, and standards used in conducting laboratory experiments. All chemicals within each facility are inventoried and tracked via an electronic database.

Of the more than a thousand different chemicals in the BOP facilities, only a fraction have the potential for exceeding the reportable quantities (RQs) specified by the U.S. Environmental Protection Agency (EPA 1997). RQs are the amounts that, if released to the environment from a facility, require notification to the National Response Center. All chemicals, their locations, and quantities are tracked using Pacific Northwest's Chemical Management System (CMS). Each of the BOP facilities has an FUA that provides the capabilities and limitations on chemical usage for the facility.

Many of the laboratories contain satellite accumulation areas for liquid and solid hazardous wastes. An active inventory of the waste contents is maintained. Liquid and solid wastes are disposed of in accordance with guidelines described in Pacific Northwest's Standards-Based Management System (SBMS). The SBMS is available electronically on the Internet via http://sbms.pnl.gov/ch00d010.htm. The SBMS subject areas on waste management and effluent control are listed under the subject area category "Waste Management".

2.1.2 Radionuclide

Radioactive material storage and usage are dispersed throughout many BOP facilities and include a large number of isotopes. These materials are found in several forms, including solid, liquid, particulate, and gas. Some of these materials may be heated during R&D activities, producing vapors.

A current inventory for each building is assessed yearly to determine radiological air emission monitoring. This inventory list is a combination of the following three lists:

- Inventory estimates provided by staff responsible for any radioactive materials not included in the next two bullets.

- Composite Radioactive Material Inventory, which contains data on sealed sources that are assigned to custodians and accounted for by Pacific Northwest's Safety and Health Department. This database also contains data on radioactive materials covered under the State of Washington Radioactive Material License.

- Nuclear Materials Inventory, which is the inventory of special nuclear material (SNM) that is maintained in a material balance area (MBA) and assigned to a material balance area custodian.

This assessment methodology is documented in Ballinger, Sula, Shields, and Edwards (1999). In addition, Appendix A provides information on the types of radionuclides found in each active BOP facility.

2.2 Identification of Effluent Pathways

The term "point-of-discharge," as used in this section, refers to the point at which the effluent leaves Pacific Northwest's control. For airborne emissions, the discharge point coincides with the point of effluent entry into the uncontrolled environment. Thus, "discharges" of airborne emissions must comply with DOE, EPA, and Washington State Department of Health (WDOH) emission control and monitoring requirements.

Liquid effluents originating in all BOP facilities, on the other hand, remain in a controlled system at the "point-of-discharge" from the facility. At these points, the responsibility for the effluent stream, including its ultimate disposition, passes from Pacific Northwest to the site operations contractors: Fluor Hanford for the process sewer in the 300 Area, DynCorp for the sanitary sewer in the 300 Area, and the City of Richland for the 700 Area, and EMSL[2]. As such, these contractors are responsible for monitoring and controlling environmental discharges of liquid effluents. However, Pacific Northwest is responsible for characterizing effluents originating in its facilities and for exercising appropriate control over the discharge of these effluents. In addition, because of an industrial wastewater permit, Pacific Northwest is responsible for sampling the process sewer discharges at EMSL before they are batch discharged to the City of Richland Publicly Owned Treatment Works (POTW).

2.2.1 Gaseous and Aerosol Emission Pathways

As-built ventilation drawings, which have been identified as "essential drawings," were prepared for the 306-W, 326, and 329 Buildings. Any facility modification that changes building flow paths 1) must receive prior concurrence from the building manager (per SBMS), and 2) requires updating of the appropriate drawing before project close-out. The Pacific Northwest SBMS[3] subject area, Creating or Modifying Engineering Calculations, Drawings, and Specifications, provides the requirements for controlling facility modifications.

The FUAs contain information on ventilation-system capabilities, including control features for air emissions. The most predominant air-emission control is high-efficiency particulate air (HEPA) filtration because work with radioactive materials with particulate emissions is the primary concern for most of the BOP facilities. Potentially radioactively contaminated airflow usually passes through a HEPA filter before exiting the building through a stack or vent.

Most of the air emission points in the BOP facilities are part of the ventilation exhaust system. However, vents may be located in elevator shafts and sewer systems. Under normal operations, airborne emissions travel through facility

[2] Pacific Northwest-operated facilities at the Fitzner/Eberhardt Arid Lands Ecology Reserve (ALE) are only storage buildings and do not produce facility effluents that require monitoring. The 622-R Building in the 600 Area has primarily normal sanitary effluents and is connected to a nearby sanitary system. No monitoring is required for the 622-R Building.

[3] The SBMS provides staff with Laboratory-wide standards, procedures, and guidelines for the work they perform. The Laboratory develops standards, procedures, and guidelines based on an evaluation of external requirements documents, including orders, directives, and federal, state and local laws, as well as Battelle policy.

ductwork to one or more emission points from the building. If air emission sampling is required, the sampling system is located downstream of control technologies and before the location at which the air is discharged to the atmosphere. However, some BOP facilities or sections of facilities are passively ventilated, and some do not have an emission point or points. Appendix A contains information on ventilation systems for the active BOP facilities.

2.2.2 Liquid Effluent Pathways

Liquids effluents are discharged from the BOP facilities via liquid waste systems. In the 300 Area (except EMSL), these include the sanitary sewer system (SNS), the process sewer system (PS), and the retention process sewer system (RPS). After they exit the buildings, these systems come under the control of DynCorp for the SNS and Fluor Hanford for the PS and RPS. Figures 2.2, 2.3, and 2.4 show the general layout of liquid effluent systems in the 300 Area.

Radioactive liquid wastes generated under normal operations are collected at individual facilities and then transported to the 325 Building, where they are discharged to the Radioactive Liquid Waste System tank. The tank contents are then transferred to a tanker for transportation to the 200 Area for disposal on an as-needed basis.

Liquid effluents from the 600 Area (622-A, B, C, and R Buildings) are discharged to a nearby sanitary septic system[4]. Effluents from these facilities are generated primarily from bathrooms and sinks in the 622-R Building, and no wastewater monitoring is required. Almost all facilities at Fitzner/Eberhardt Arid Lands Ecology Reserve (ALE) are inactive, and liquid effluents not generated.

Stormwater systems are located on the outside of some BOP facilities and may drain to the soil at various locations around the building. A listing of injection wells and stormwater outfalls for Pacific Northwest facilities is maintained by Pacific Northwest's Effluent Management Group. The potential for radioactive or chemical contamination to be washed into the soil with stormwater is considered low, and no monitoring is required.

Sanitary Sewer

The 300 SNS receives effluent primarily from restrooms, lunchrooms, change rooms, some cooling processes, and other water uses in which no contamination is believed to be likely. Under normal operating conditions, no regulated materials are present in the SNS effluent. The sanitary wastewater is discharged into the 300 Area SNS, operated by DynCorp under contract with DOE. The 300 Area SNS discharges to the City of Richland POTW under a contract agreement between DOE and the City.

Sanitary effluents from EMSL and the 747-A Building also discharge to the City of Richland POTW and do not require a permit. Liquid effluents from the 622 Building complex are primarily sanitary, and all discharge to a nearby sanitary septic system.

Process Sewer

The PS receives process wastewater (e.g., equipment cooling water, laboratory wastewater) from the 300 Area. In all 300 Area BOP facilities except EMSL, the PS discharges to the 300 Area PS System, which then flows to the Treated Effluent Disposal Facility (TEDF) for treatment before discharge to the Columbia River. EMSL process water is held in effluent tanks that are sampled before discharge to the City of Richland POTW.

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4 A drywell that services discharges from a 622-R Building kitchen sink and fume hood was identified in 1998. Carboys were installed to suspend discharges to the drywell, and the inactive well was added to the list of miscellaneous streams.

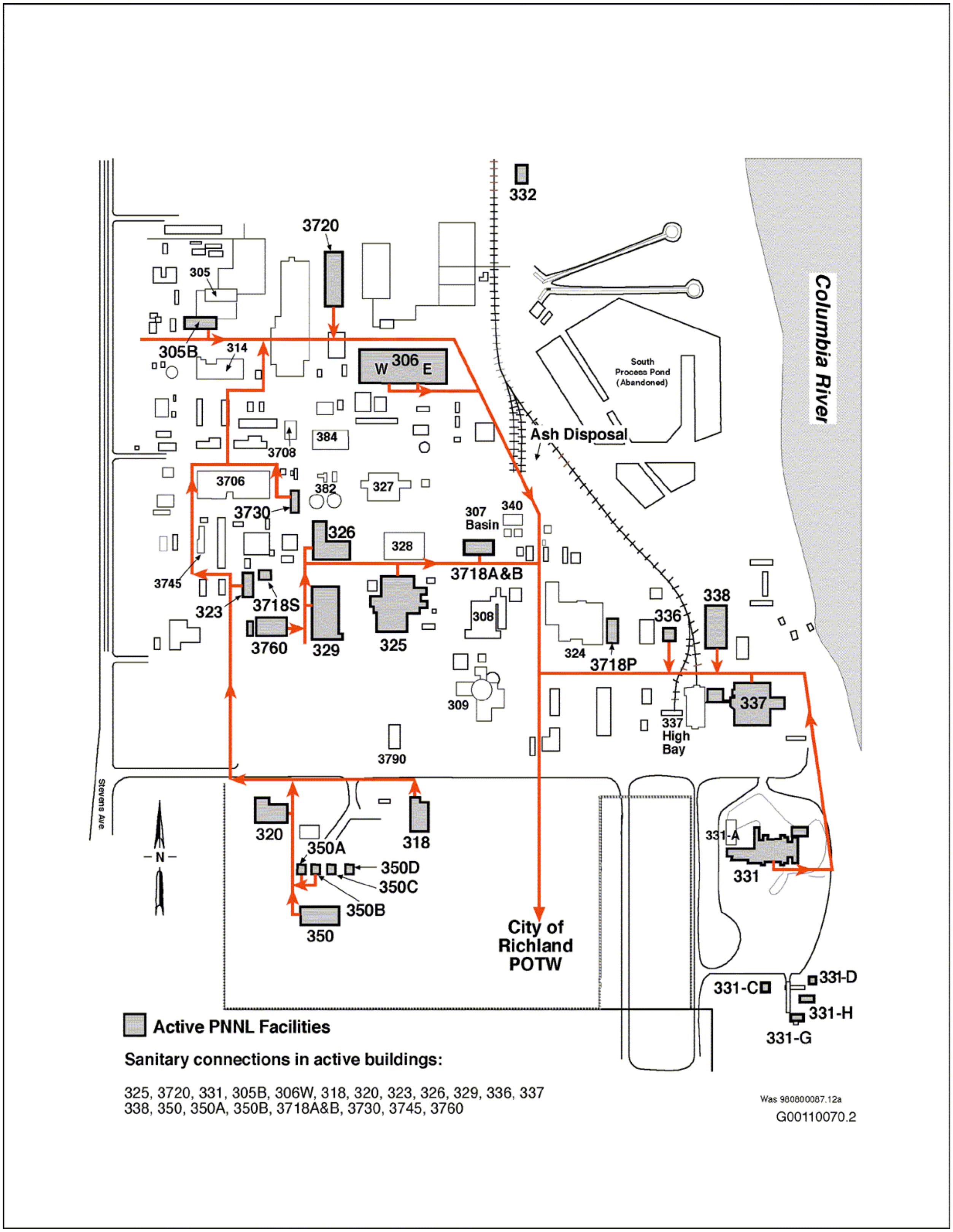

Figure 2.2 Schematic of 300 Area Sanitary Sewer System

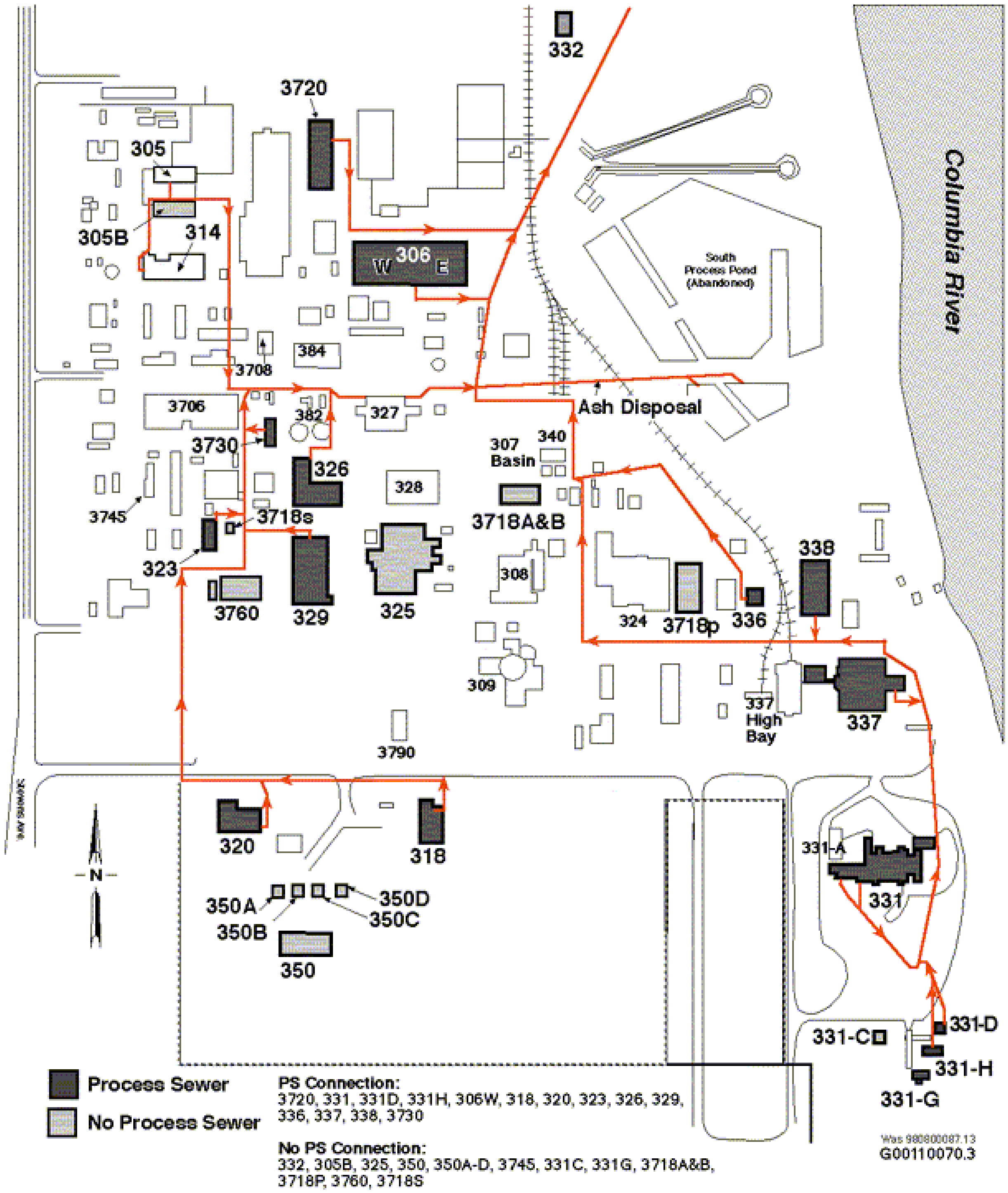

Figure 2.3 Schematic of 300 Area Process Sewer System

Retention Process Sewer

The RPS receives wastewater, such as equipment cooling water, laboratory wastewater, and floor drain water, which is normally free of radioactive contamination but has potential for such contamination in the event of a failure of an engineered barrier or administrative procedure. The only BOP facilities that are connected to the RPS are the 326 and 329 Buildings. RPS piping is routed through a diverter station (operated by Fluor Hanford) inside the facility that provided automatic diversion to the Radioactive Liquid Waste System (RLWS) before 1998 in the event of radioactive contamination being detected. The diverter station consists of a lead-shielded, gamma-radioactivity counting instrument, an automatically operated three-way valve, and associated alarms for diverting liquid flow from the RPS to RLWS if radioactivity in the waste exceeded a preset level of 5000 pCi/L of ^{137}Cs or equivalent. In 1998, the diverters were modified to remove the diversion capability. The diverters will now provide alarm to the 340 Complex if radioactivity in the waste exceeds the preset level. After passing the diverter stations, the liquid wastes from the RPS are subsequently discharged to the 307 Building basins (also operated by Fluor Hanford) in the 340 Complex. If the diverter alarms, the RPS is to be diverted to a dedicated basin at the 340 Complex. If the diverter does not alarm, the effluent is screened at the 307 Building basins for alpha radioactivity before being discharged to the PS. Liquid effluent sampling systems for the RPS system are in place and maintained in the 326 and 329 Buildings. The system is sampled by Pacific Northwest on an as-needed basis.

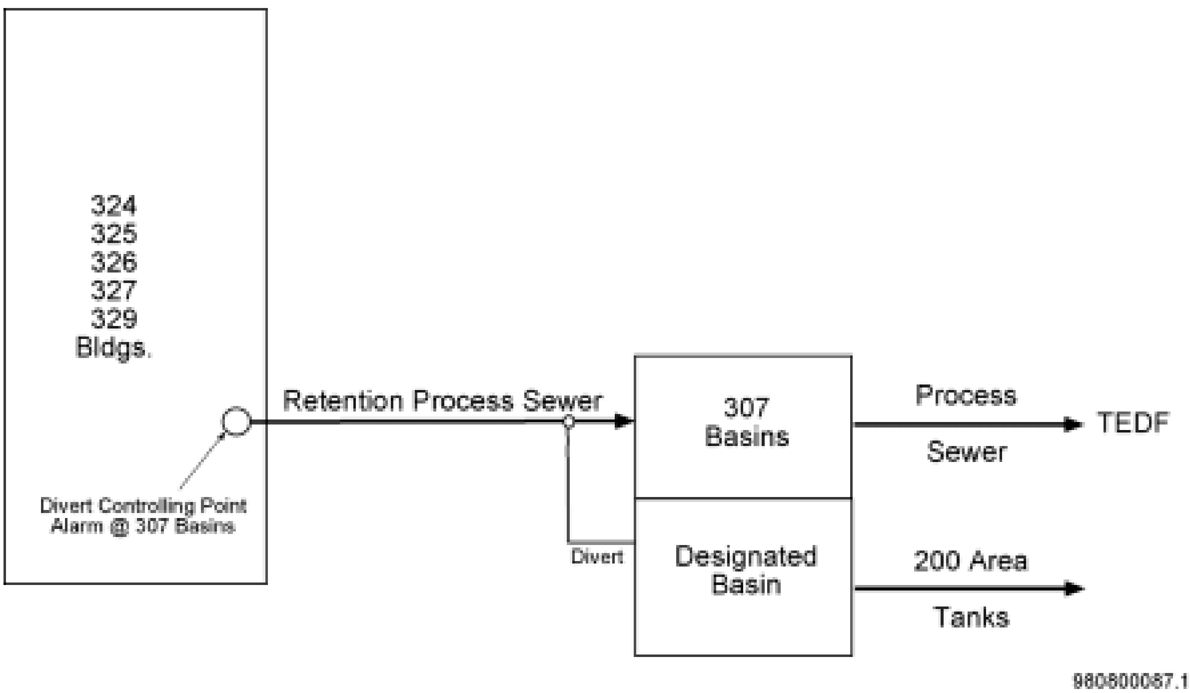

Figure 2.4 Schematic of 300 Area RPS System

2.4 References

Ballinger, M.Y., M.J. Sula, and K.D. Shields, D.L. Edwards. 1999. *Assessment of Unabated Facility Emission Potentials for Evaluating Airborne Radionuclide Monitoring Requirements at Pacific Northwest National Laboratory – 1999*, PNL-10855 Rev. 1 AD-902, Pacific Northwest National Laboratory, Richland, Washington.

DOE 1991. *Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance*, DOE/EH-0173T. U.S. Department of Energy. Washington D.C.

EPA 1997. *Reportable Quantities*. 40 Code of Federal Regulations (CFR) 302.4. U.S. Code of Federal Regulations. U.S. Environmental Protection Agency. Washington D.C.

SBMS, Airborne Emissions. 1998. *Airborne Emissions*. SBMS Subject Area (http://sbms.pnl.gov/standard/0g/0g00t010.htm), Pacific Northwest National Laboratory, Richland, Washington.

SBMS, Creating or Modifying Engineering Calculations, Drawings, and Specifications. 1997. Creating or Modifying Engineering Calculations, Drawings, and Specifications. Standards-Based Management System Subject Area (http://sbms.pnl.gov/standard/91/9100t010.htm), Pacific Northwest National Laboratory, Richland, Washington.

SBMS Managing Liquid Effluents. 1998. *Managing Liquid Effluents*. SBMS Subject Area (http://sbms.pnl.gov/standard/0q/0q00t010.htm), Pacific Northwest National Laboratory, Richland, Washington.

SBMS, Managing Nonradioactive Chemical Waste. 2000. *Managing Nonradioactive Chemical Waste*. Standards-Based Management System Subject Area (http://sbms.pnl.gov/standard/0f/0f00t010.htm), Pacific Northwest National Laboratory, Richland, Washington.

WAC 1994. *General Regulations for Air Pollution Sources,* WAC 173-400, Washington Administrative Code. Washington Department of Health.

WAC 1994. *Controls for New Sources of Toxic Air Pollutants.* WAC 173-460, Washington Administrative Code. Washington Department of Health.

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3.0 Rationale and Design Criteria for Sampling and Monitoring

This section discusses design criteria for the BOP facilities' Effluent Monitoring Program. Criteria are established to ensure that effluents are measured according to applicable regulations and guidance and are appropriate for current facility operations.

In this section, the terms "sampling" and "monitoring" are used to distinguish between two types of airborne or liquid effluent measurement processes:

- "Sampling" refers to collecting a representative portion of the emission over a period of time, with subsequent analysis for constituents of interest. "Sampling" is an "after-the-fact" measurement.

- "Monitoring," on the other hand, is measuring emission rates by means of a detector located in the sample stream. "Monitoring" is a "real-time" measurement.

Airborne or liquid effluent sampling is performed to demonstrate compliance with emission standards, to identify emission trends, and to provide evidence regarding the effectiveness of emission control systems (procedures and equipment). Effluent sampling may also be performed to characterize waste streams or investigate discharges of concern.

Effluent streams are monitored as a means to provide timely indication of a significant change in emission rate. Currently, monitoring is not required at any of the BOP facilities, although liquid effluent monitoring systems are provided in some BOP facilities (see Appendix A) as a tool to investigate potential problematic discharges.

3.1 Basis for Design Criteria

The following regulations and guidance were considered in effluent sampling and monitoring system design and operation:

- *Regulations on Standards of Performance for New Stationary Sources, Appendix A: Reference Methods.* Environmental Protection Agency, U.S. Code of Federal Regulations, 40 CFR 60. (EPA 1971)

- *National Emission Standards for Hazardous Air Pollutants*. Environmental Protection Agency, U.S. Code of Federal Regulations, 40 CFR 61 (EPA 1990).

- *Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities.* American National Standards Institute (ANSI) N13.1-1969 (ANSI 1969).

- *Specifications and Performance of Onsite Instrumentation for Continuously Monitoring Radioactivity in Effluents*. American National Standards Institute (ANSI) N42.18 1980b (ANSI 1980).

- *Industrial Wastewater Permit to Environmental Molecular Sciences Laboratory (EMSL)*. CR-IU005. City of Richland. (City of Richland 1997).

- *Richland Pretreatment Program.* City of Richland Ordinance No. 7-96. City of Richland. (City of Richland 1996)

- *Hanford Site Air Operating Permit*. Washington State Department of Ecology (WDOE) and Washington State Department of Health. HNF-AOP-00-1 (WDOE and WDOH pending as of 12/2000).

- WAC 1994. *Radiation Protection – Air Emissions*, WAC 246-247, Washington Administrative Code, Washington Department of Health.

- *General Environmental Protection Program*. U.S. Department of Energy. DOE 5400.1 (DOE 1988).

- *Radiation Protection of the Public and the Environment*. U.S. Department of Energy. DOE 5400.5 (DOE 1990).

- *General Design Criteria*. U.S. Department of Energy. DOE 6430.1A (DOE 1987).

- *Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance.* U.S. Department of Energy. DOE/EH-0173T (DOE 1991).

The following are additional requirements for sampling/monitoring at the BOP facilities as prescribed in Pacific Northwest operational and programmatic documents:

- *Standards-Based Management System subject area, Airborne Emissions.* Pacific Northwest National Laboratory, Richland, Washington. (SBMS, Airborne Emissions)

- *Standards-Based Management System subject area, Managing Nonradioactive Chemical Waste*. Pacific Northwest National Laboratory, Richland, Washington. (SBMS, Managing Nonradioactive Chemical Waste)

- *Standards-Based Management System subject area, Working With Chemicals.* Pacific Northwest National Laboratory, Richland, Washington. (SBMS, Working With Chemicals)

- *Standards-Based Management System subject area, Managing Liquid Effluents.* Pacific Northwest National Laboratory, Richland, Washington. (SBMS, Managing Liquid Effluents)

- *Standards-Based Management System subject area, Creating or Modifying Engineering Calculations, Drawings, and Specifications.* Pacific Northwest National Laboratory, Richland, Washington. (SBMS, Creating or Modifying Engineering Calculations, Drawings, and Specifications)

3.2 Criteria for Radiological Air Emission Sampling and Monitoring

Airborne radionuclide emission points at Pacific Northwest are classified as either “major” or “minor.” These two categories are defined as follows:

Major emission points	Those emission points where radionuclide emissions could cause an offsite emission dose (OED)[5] of 0.1 mrem/yr if emission controls were not applied. Major emission points are sampled according to requirements in Subpart H of EPA (1990).
Minor emission points	Those emission points that could potentially release radionuclides, but not at the levels of a “major” point.

All of the BOP facilities are either considered minor emission points or do not have a potential for releasing radionuclides.

Continuous emission monitoring is required for any emission system where

- a potential of greater than once per year exists for exceeding 20% of the OED standard of 10 mrem/yr (credit may be taken for emission control equipment, such as HEPA filters) per DOE (1991)
- continuous emission monitoring is specified by a Safety Analysis Report (SAR) or operational safety requirement.

None of the BOP facilities meet the above criteria; thus, none are required to have continuous emission monitoring.

[5] The annual OED is the maximum committed effective dose equivalent that could be expected to be received by an offsite individual from facility airborne radionuclide emissions if the facility was operated without any HEPA filtration or other emission controls. The method for calculating the OED consists of identifying the radionuclide inventory potentially available for release, multiplying this by a fractional release value, and multiplying this product times an emission dose factor calculated by the EPA Clean Air Act compliance code, CAP-88. Ballinger et al. (1999) provides additional discussion of this assessment method.

3.2.1 Sampling System Performance Criteria

Sampling at each minor emission point should provide the capability for detecting an annual radionuclide release quantity resulting in an OED of 0.1 mrem/yr (DOE 1991).

All radionuclides anticipated to contribute greater than 10% of the potential to emit (PTE) from the sampled emission point shall be accounted for, either by direct analysis or by inference from an indicator measurement (EPA 1990).

Biases in emission measurements, arising from the sample collection and analysis process, shall be minimized through the judicious application of design and operation practices according to American National Standards Institute (ANSI) (1969) and DOE (1991).

3.2.2 Sampling System Design Criteria

Sample extraction location criteria are provided in EPA (1971), Method 1 in Appendix A. Method 1 states that

> "Sampling or velocity measurements are to be performed at a site located at least eight stack or duct diameters downstream and two diameters upstream from any flow disturbance such as a bend, expansion, or contraction in the stack, or from a visible flame."

However, the method also states that

> ". . . if necessary, an alternative location may be selected, at a position at least two stack or duct diameters downstream and 0.5 diameters upstream from any flow disturbance."

For minor stack sampling, this criterion is desired, but not required.

Air emission samplers should be designed to maximize the sensitivity of the sample, considering the capacity of the collection media, radioactive decay, and sample-analysis costs. Representative samples shall be withdrawn on a continuous basis at the sampling site following the guidance in ANSI (1969)[6], Appendix A, Section A3.2. ANSI (1969) recommends that each withdrawal point within a cylindrical stack be centered in an annular area of size equal to the cross-sectional area divided by the number of probes. Withdrawal points may be on a single traverse or spaced to obtain samples from the total cross section. Additional design criteria for particulate and gaseous radionuclides are specified by ANSI (1969) and DOE (1991).

3.2.3 Criteria for Sampling System Operation

Pacific Northwest's Effluent Management Group maintains sampling system configuration drawings for all emission point radionuclide air sampling systems. This includes calculations of sampling system efficiencies for particle sizes of 1 micron and 10 microns. A 1-micron particle size is assumed under normal operating conditions because most radionuclide air emissions are HEPA filtered.

Sampling-system operating criteria are based on regulations and guidance documents listed in Section 3.1.

Sampling is performed to verify minor stack status during a calendar year for BOP facilities that have a potential to emit airborne radioactive material. The frequency of collecting samples is based on a graded approach considering the PTE, current and expected activities, and past practices in the facility. All of the BOP facilities are either considered minor for radioactive air emission sampling or have no potential for radioactive air emissions. Continuous sampling is conducted at the minor emission points that meet the following criteria:

- Assessment of potential emissions indicate that the point is near the borderline of 'minor.' In dose terms, these are emission points for which the potential unmitigated annual offsite dose exceeds 0.01 mrem/yr.
- Radionuclide emissions occur and are highly variable over time such that periodic release measurements do not provide an adequate means for confirming that annual emissions are low.
- Continuous sampling is deemed necessary after considering radionuclide inventory, release history, emission controls, and current activities.

6 ANSI N13.1 was updated in 1999. However, applicability of the new standard to sampling systems already in place has yet to be determined.

Minor emission points that do not meet the above criteria are sampled either quarterly or annually, depending on their emission potential. Because DOE requires an annual emission report, minor emission points are sampled a minimum of once per year, although hand calculations may be used to estimate emissions for some facilities. The period of sample collection is based primarily on the capacity of the collection media. A current radionuclide air sampling schedule for BOP facilities is maintained within the Gaseous Effluent Database (GED).

Samples are analyzed in the laboratory according to procedures required by Appendix B, Method 114, "Test Methods for Measuring Radionuclide Emissions from Stationary Sources," in 40 CFR 61 in EPA (1973). Radioanalytical laboratories analyze samples according to prescribed statements of work. Work statements specify analytical performance requirements, including minimum detectable activity (MDA), turnaround time, reporting requirements, quality control (QC) requirements, and sample handling.

Sampling performance criteria in Section 3.2.1 specify an emission detection level of 0.01mrem/yr OED. The analytical MDA required to meet this criterion depends on a combination of factors, including sample size, stack flow rate, collection period, radionuclide half-life, and radionuclide emission dose factor.

Historically, laboratory analysis of particulate emission samples consisted of total activity (total alpha, total beta) measurements. Total-activity measurements were performed because

- emissions have historically been very low
- potentially significant constituents of the emission stream were known
- the gross activity measurement is nondestructive; the sample could be measured for specific radionuclides if gross activity measurements show a potentially significant release quantity.

When gross activity measurements were used for assessing offsite dose, dose factors for the most restrictive radionuclide were applied.

Exhaust stream flow rates at sampling locations are measured using EPA Method 2 (EPA 1971). Flow-rate measurements are performed annually or when modifications are made or flows change more than ±10%.

3.3 Historical Sampling Data for Effluent Streams

When required, the effluent streams from the BOP facilities have been sampled over the history of operations. Information from historical sampling and monitoring is provided here (additional detail in Appendix A) to aid in providing a basis for future sampling needs. Historical sampling has been performed for some BOP facilities to measure radioactive air emissions and to characterize liquid effluents. No historic data (before 1998) exists for air-chemical emissions. The following section provides a description of historic sampling data under normal operating conditions for air and liquid effluent streams. Estimates of the types of releases and release pathways experienced during plant operations under upset conditions are given in Section 3.3.2.

3.3.1 Normal Conditions

Some of the air and liquid effluent streams have been sampled since some of the BOP facilities started operations. The types and locations of sampling and analytical methods under normal operations are described in this section. Discussion is generally limited to the past 7 years (1993 to 1999) because this time period is the most relevant to future operations and monitoring needs.

3.3.1.1 Historical Radioactive Air Effluent Sampling

Effluent air from BOP facility emission points has been sampled and monitored downstream of the final HEPA filters for radioactive particles and tritium (326 Building only). Sampling for particulate gross alpha and beta has been provided by record sampler for facilities that have a potential to emit radionuclides. Data from 1993 to 1999 are provided in Table 3.1. In 1996, Pacific Northwest implemented a graded approach to sampling, depending on a number of facility factors. Continuous sampling continued to be conducted at all major emission points and for minor emission points that met the following criteria:

- Assessment of potential emissions indicate that the point is near the borderline of 'minor.' In dose terms, these are emission points for which the potential unmitigated annual offsite dose exceeds 0.01 mrem/yr.
- Radionuclide emissions occur and are highly variable over time such that periodic release measurements do not provide an adequate means for confirming that annual emissions are low.

- Continuous sampling is deemed necessary after considering radionuclide inventory, release history, emission controls, and current activities.

BOP facilities with potential radiological air emissions that were minor, but did not meet the above criteria, were sampled on a less frequent basis, either quarterly or annually, depending on their emission potential.

Table 3.1 Radionuclide Air Emissions from BOP Facilities (Ci/year)

Building	Measure	1993	1994	1995	1996	1997	1998	1999
303-C	Total Alpha Total Beta	1.9E-8 1.3E-7	1.4E-8 6.8E-8	6.1E-9 7.3E-8	6.2E-9 7.6E-8	Inactive	Inactive	Inactive
305-B	Total Alpha Total Beta	-	-	-	1.7E-10 3.0E-9	ND[7] 4.4E-9	6.8E-10 5.5E-09	1.2E-09 6.3E-09
306-W	Total Alpha Total Beta	6.6E-7 2.6E-6	2.9E-7 1.7E-6	2.2E-7 2.7E-6	2.7E-7 1.7E-6	5.0E-8 5.0E-7	2.4E-08 4.7E-07	2.2E-08 4.4E-07
314	Total Alpha Total Beta	3.9E-8 7.1E-7	1.9E-8 1.2E-7	1.2E-8 1.2E-7	2.2E-8 9.3E-8	Inactive	Inactive	Inactive
318	Total Alpha Total Beta	7.5E-8 3.0E-7	1.2E-8 4.8E-8	3.5E-8 4.0E-7	1.1E-7 1.5E-6	7.5E-8 1.5E-6	4.3E-09 6.5E-08	2.9E-09 3.9E-08
320	Total Alpha Total Beta	6.9E-7 4.8E-6	3.5E-7 1.8E-6	1.9E-7 2.3E-6	2.4E-7 2.9E-6	8.8E-8 1.3E-6	4.8E-08 6.3E-07	1.53E-08 1.91E-07
323	Total Alpha Total Beta	1.1E-7 3.5E-7	2.7E-8 1.6E-7	2.0E-8 1.1E-7	8.9E-9 6.1E-8	1.6E-8 1.3E-7	5.8E-09 9.0E-08	8.2E-09 1.0E-07
326	Total Alpha Total Beta Tritium	2.4E-6 2.1E-5	1.2E-6 5.2E-6 5.0E-3	5.9E-7 6.7E-6	7.1E-7 7.3E-6	5.2E-7 7.6E-6	6.5E-07 6.3E-06	3.7E-07 5.0E-06
329	Total Alpha Total Beta	8.7E-7 5.2E-6	1.6E-7 8.4E-7	4.6E-8 4.7E-7	ND ND	ND 1.2E-7	5.2E-09 2.4E-08	8.9E-09 4.8E-08
3708	Total Alpha Total Beta	8.0E-8 4.9E-7	3.0E-8 1.2E-7	1.6E-8 1.1E-7	2.0E-8 9.2E-8	ND 8.7E-8	Inactive	Inactive
3730	Total Alpha Total Beta	3.1E-9 4.9E-8	1.5E-9 6.2E-9	3.0E-10 7.7E-9	7.4E-10 7.6E-9	5.7E-10 4.2E-9	6.9E-10 3.3E-09	6.9E-11 1.6E-09
3745	Total Alpha Total Beta	1.2E-8 4.3E-8	4.8E-9 2.6E-8	2.5E-9 2.3E-8	1.0E-8 2.9E-8	2.6E-9 3.5E-8	ND 3.5E-08	ND 1.0E-08
3746-A	Total Alpha Total Beta	4.4E-8 2.2E-7	8.9E-9 4.2E-8	ND 3.5E-8	ND 2.3E-8	Inactive	Inactive	Inactive
6652-H	Total Alpha Total Beta	4.0E-8 1.8E-7	1.5E-8 6.6E-8	2.8E-9 6.1E-8	ND 9.0E-9	Inactive	Inactive	Inactive
EMSL	Total Alpha Total Beta	-	-	-	-	9.3E-10 2.0E-09	ND ND	ND ND

3.3.1.2 Historical Liquid Effluent Monitoring

Liquid waste streams in the BOP facilities have been served by the systems as described in Section 2.2.2. Most of the BOP facilities are located in the 300 Area. Liquid effluent streams from Pacific Northwest facilities in other areas have not been monitored and are not currently required to be monitored. Therefore, this section focuses on the 300 Area liquid waste systems.

Table 3.2 summarizes the type of historical monitoring/sampling each liquid waste system has had. As noted in the table, historically, 300 Area sanitary liquid waste was sampled at the SNS system just before the waste entered the SNS septic tanks. Before 1997, sanitary wastes were discharged to a 300 Area septic tank/trench system. In 1997, the 300 Area SNS was connected to the City of Richland POTW. A brief description of the sampling and analysis program before connection to the City of Richland POTW is given in the *Westinghouse Hanford Company Effluent Report for 300, 400, and 1100 Area Operations* (McCarthy 1990). Because this sampling program is not specific to the BOP facilities, its historical data is not reported here.

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[7] ND = Nondetectable

Historically, the 300 Area PS was discharged to trenches. Samples of the composite liquid waste from all 300 Area PS lines were taken before the liquid was discharged to the 300 Area process trenches (McCarthy 1990). These sampling data are not specific to Pacific Northwest BOP facilities and thus are not included in this report. However, in December 1994, a treatment facility, the 300 Area TEDF, was brought into operation to replace the trenches. Around that time, Pacific Northwest conducted a sampling campaign to characterize the waste streams from the primary Pacific Northwest R&D facilities. Results of this campaign are documented in Thompson et al. (1997). Sampling and analysis for radioactive and nonradioactive constituents occurred at the following BOP waste streams as a result of the campaign: 306-W Building PS, 320 Building PS, 326 Building PS and RPS. A summary of the data is provided in Appendices C, D, and E.

Only two BOP facilities, the 326 and 329 Buildings, have RPS systems. The RPS from both buildings is routed to a diversion station (located at the 326 Building) equipped with a radioactivity monitor that measured gamma activity and an automatically operated three-way valve that diverted flow to the RLWS if radioactivity above a preset level was detected in the waste stream. Diverter alarms were annunciated in various locations in each facility when diversion occurred, and a sample was taken automatically. Data from the monitor were not recorded. As shown in Table 3.3, diversion of these RPS streams rarely occurred; only three diversions took place from 1991 to mid-1998.

Normally, the RPS passed through the diverter stations and subsequently (after reaching the 307 Building Basins and being analyzed for gross alpha contamination) into the 300 Area PS lines. As previously described, this stream was discharged to trenches before December 1994 and to the 300 Area TEDF after that date.

The RLWS, deactivated in 1998, served liquid waste streams diverted from the RPS. Waste diverted to the RLWS lines were discharged to the 340 Building. The composite water in the holding tanks at the 340 Building was sampled before being transferred to the 200 Area by rail car. Because the RLWS stream was not released to the environment, the sampling program is not pertinent to the FEMP.

Table 3.2 Summary of Historical Liquid Monitoring/Sampling

System	Notes
SNS	No sampling or monitoring at BOP Facilities. Sampled as composite with other 300 Area SNS before 1997 and sampled as required by contract with City of Richland POTW after 1997 hook-up. Current sampling is performed by the 300 Area infrastructure contractor as required.
PS	Sampling of 306-W Building Process Sewer (PS), 320 Building PS, and 326 Building PS conducted as part of Pacific Northwest's 1994 and 1995 sampling campaign to characterize liquid wastes for TEDF.
RPS	Retention Process Sewer (RPS) for 326 and 329 monitored at diverter station in 326 Building. Sampling at 326 was conducted as part of Pacific Northwest's 1994 and 1995 sampling campaign. Sampled as composite with other 300 Area RPS wastewater at the 307 Basins.
RLWS	Historically sampled at 340 Building before transport to the 200 Area tanks.
EMSL	Process wastewater sampled at effluent tank pit before discharge to City of Richland POTW.

EMSL started operations in 1997, and sampling was initiated at that time.

3.3.2 Upset Conditions

The nature of upset conditions potentially affecting the environment around or effluent sampling systems in the BOP facilities since 1991 are shown in Table 3.3. This table summarizes the events noted as off-normal or unusual occurrences. The types of events shown in the table could be expected to occur during future operations and are considered in effluent monitoring planning.

Table 3.3 Off-Normal and Unusual Occurrences in the BOP Facilities

Type of Event	Number of Occurrences
Release of hazardous material/radioactive contamination to the ground or contaminated equipment found outside BOP facilities	20
Power outages affecting single or multiple facilities	18
Spills of fuel or antifreeze to the ground	9
Disruption/failure of facility exhaust flow	8
Spill of hazardous material inside facility (primarily Hg spills)	4
Release of hazardous material/radioactive contamination to sinks or hoods	3
Diversion of the RPS to the Radioactive Liquid Waste System	3
Failure of vacuum pump supporting facility air emission sampler	2

The greatest number of environmental events listed above occurred outside the facilities and outside the range of facility effluent monitoring equipment. However, they indicate the potential for spills and contamination inside the facility, many of which would not be considered an off-normal occurrence (ONO) or unusual occurrence (UO) because it could be cleaned up with no adverse effects. As shown in Table 3.3, spills of mercury within facilities and spills of hazardous or radioactive materials to sinks or hoods where they could be released to the environment are the types of events classified as an off-normal occurrence or unusual occurrence. For contamination found in sinks or traps, liquid effluent sampling is performed at the time the contamination is found to quantify the release, determine potential effects, or evaluate the impact on future effluents. At EMSL, spills may trigger isolation of the receiving tank and special sampling.

Wastes that are diverted to the dedicated basin at the 307 facility RPS are not released to the environment. However, when these occur, investigative action is taken by Pacific Northwest to determine the cause of the diversion. In some cases, samples of the diverted stream may be taken by Pacific Northwest or by the 307 Basin operator to aid in the investigation.

Disruptions to the facility primary power exhaust flow, or air emission sampling systems may interrupt air emission sampling periods. For BOP facilities, the purpose of radioactive air emission sampling is to confirm the low air emissions. Thus, interruptions are not considered critical and the sampling period can be adjusted or a discrepancy report completed to identify and correct for the effect on the measurements taken. Sampling for air chemical emissions or liquid effluents is periodic and loss of power or sampling equipment malfunctions is also not considered critical. Similar adjustments can be made in the measurement data.

3.4 Sampling System Descriptions

3.4.1 Radiological Air Sampling System

Airborne radionuclide emissions are sampled at BOP emission points as identified in the sampling plan maintained in the Gaseous Emissions Database (GED). Ventilation flow rates from these emission points are measured yearly at a minimum and range from 300 to 60,000 cfm.

To support the development of a stack emission measurement program for the BOP facilities, knowledge of the types and quantities of radionuclides potentially present in the ventilation exhaust is necessary. An index of emission potential is used by Pacific Northwest so that the relative significance of different radionuclides and different emission points can be compared. The index, expressed in terms of a projected potential dose equivalent to a maximum offsite receptor, is based on emission assessment methods in 40 CFR 61 Appendix D of EPA (1989). It is assumed that no engineered emission controls (e.g., HEPA filters) are provided in the ventilation system and that without such controls, the potential for radionuclide emissions is related to the quantity and physical form of radioactive material in the facility. This assessment method is described in Ballinger et al. (1999).

Radionuclide air sampling systems in BOP facilities range from multinozzle probes to single tubes. The samplers generally consist of a probe that projects into the stack or vent, a sample transport line that extends from the probe assembly to where a sample collection filter is located.

Stack particulate emission samples are withdrawn from the stack and through the sampling system by means of the building vacuum system or portable pump. The sampling rate is controlled using a control valve located downstream of the particulate sampling filter. Sample flow is measured by a rotameter upstream of the control valve. Figure 3.1 is a schematic of a typical BOP air sampling system. Stack velocities are measured on an annual frequency using Method 2 in EPA (1971) or when modifications are made or flows change more than ± 10%.

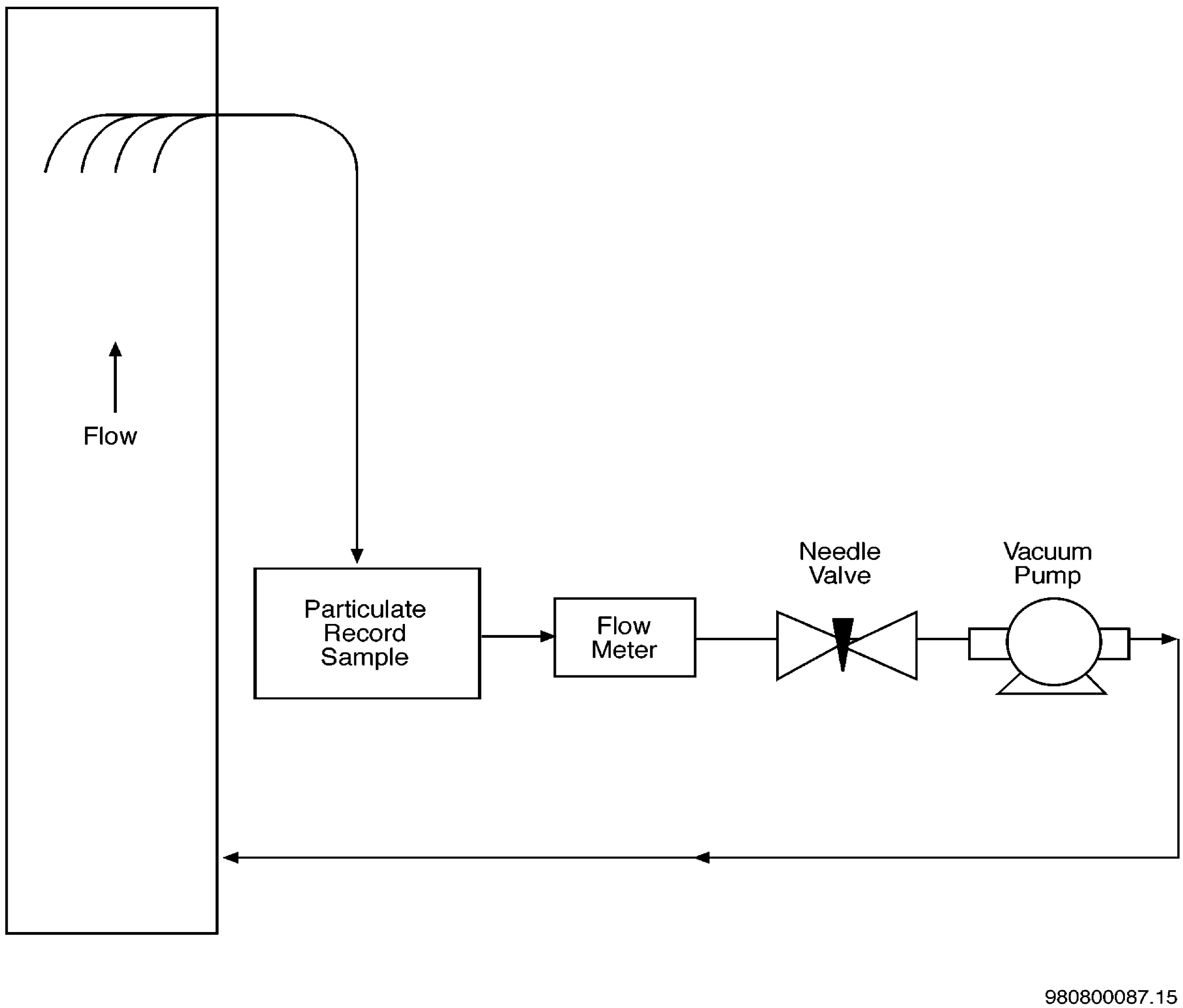

Figure 3.1 Schematic of Typical Air Sampling System

Transport efficiency of the sample through the stack particulate sampling system has been calculated using the deposition (DEPO) Code and assuming a 1-micron activity median aerodynamic diameter aerosol at nominal sampler and stack flow rates[(8)]. A 10um particle size calculation is also performed to represent unfiltered emissions.

Airborne particles are collected on a 47-mm diameter membrane filter (Gellman Versapor V-3000TN). The V-3000TN has an estimated retention efficiency for 0.3-micron particles of greater than 91% at face velocities of 180 fpm.

The sample collection filter is used for a 2-week continuous sampling period. The sample filter may be replaced more frequently depending on filter loading. The sample filter is stored for 7 days after being removed from the sampler to permit decay of radon and thoron daughter radionuclides. The filter is then analyzed for gross alpha and gross beta radioactivity.

8 Loss calculations were performed using DEPO Version 2.0 (Wong 1991) originally and Version 4.0 later for updates. A 1-micron activity median aerodynamic diameters polydisperse aerosol was assumed for the calculations based on the assumption that building operations and controls (HEPA filters) are “normal.”

Each sample is screened individually for gross alpha and gross beta activity. A subcontracted analytical laboratory analyzes samples using methods described in Chapter 4.0. Sample analysis results are evaluated as described in Section 3.6.

3.4.2 Criteria for Air Chemical Emission Sampling

Air chemical emission sampling for the BOP facilities is performed to comply with criteria established by the Hanford Air Operating Permit or Notices of Construction (NOCs) issued under WAC 173-400 and WAC 173-460. Criteria typically consists of EPA Standard Methods or alternate methods accepted by the agency. The following elements are in place to ensure that sampling for air chemical emissions meet required criteria:

- Pacific Northwest Effluent Management staff track requirements through an action/tracking plan and perform assessments of required sampling.
- Measurement equipment is procured, acceptance tested, calibrated, and maintained according to an Effluent Monitoring Quality Assurance Plan (see Section 5) to ensure that sampling equipment has the capability to perform required measurements.
- Test plans and procedures are developed for measurements taken by Pacific Northwest's Effluent Management Group to ensure that measurements meet requirements.

3.4.3 Liquid Effluent Sampling

The only BOP facility with required routine liquid effluent sampling is EMSL. Process water from EMSL laboratories is discharged to tanks that must be sampled prior to discharge to the City of Richland POTW. An Industrial Wastewater Permit was issued to EMSL (City of Richland 1997) before startup and provides the sampling criteria for the stream. The permit also gives discharge limits and reporting criteria. Pacific Northwest's Effluent Management Group performs liquid effluent sampling at EMSL according to permit criteria. This group also administers a discharge approval process and prepares required monitoring reports in support of the EMSL permit. The following elements are in place to ensure that EMSL liquid effluent sampling takes place as required and that sampling criteria are met:

- The EMSL process sewer system is designed to provide for holdup of wastewater before discharge (holding tanks in effluent pit).
- The process sewer effluent tanks system is designed with a mixing capability (sparging system) to ensure a well-mixed sample.
- Pacific Northwest's Effluent Management Group has sampling procedures in place that specify sampling constituents, frequency, hold times, preservatives, and other sampling criteria.
- EMSL staff have procedures in place to support sampling (e.g., tank isolation, process effluent tank mixing, approval for discharge).
- Pacific Northwest's Effluent Management Group has contracts with analytical laboratories to provide for required analysis.

Figure 3.2 provides a diagram of the EMSL liquid effluent tanks and sampling system.

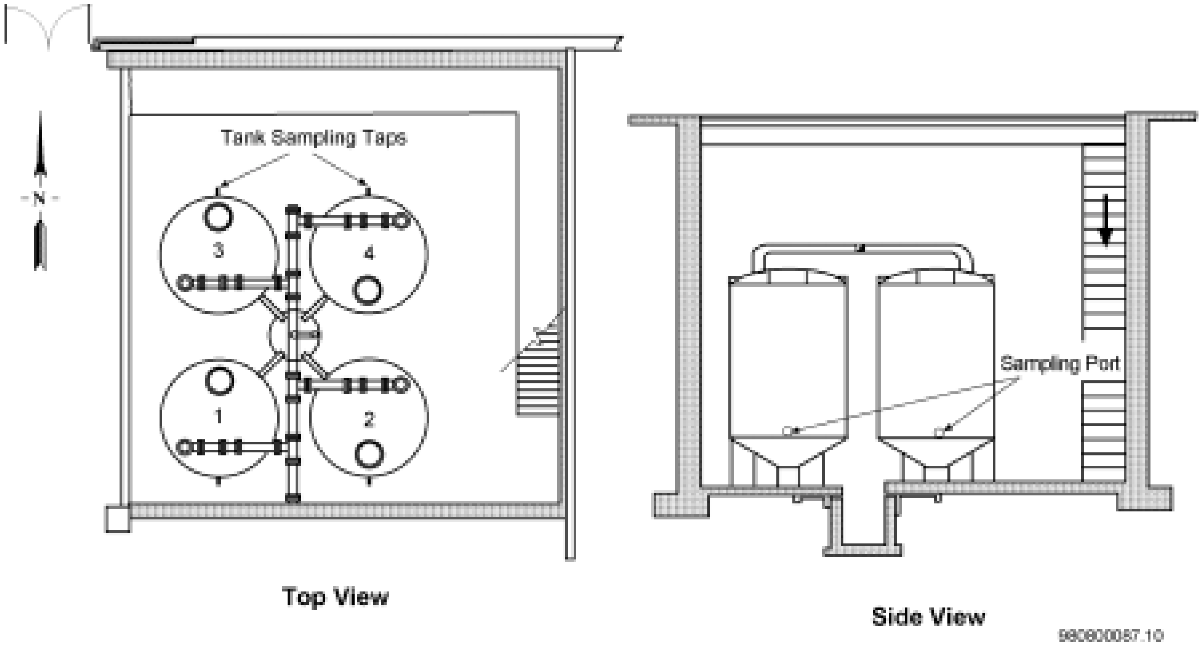

Figure 3.2 EMSL Process Sewer Tanks

Other BOP facilities have liquid effluent sampling systems (320, 326, 329 Buildings) that are used to characterize facility effluents, when needed, and to investigate potential discharges of concern. The primary criteria for these sampling systems are:

- Sampling capability is sufficient to obtain grab and composite samples for effluent characterization data.
- Characterization sampling must ensure that a valid sample is obtained and that the sample can be analyzed for almost any chemical or parameter.
- Sampling and monitoring equipment is sufficient to enable periodic verification of effluent characteristics as needed.
- Sampling and monitoring equipment provides the capability to investigate potential discharges of concern.

The liquid effluent sampling systems installed have the ability to take grab or flow-composite samples and are equipped with refrigeration cabinets to ensure preservation temperatures. In addition, Pacific Northwest's Effluent Management Group has sampling procedures in place and a contract with an analytical laboratory to ensure that sampling requirements are met. Figures 3.3 and 3.4 provide the locations and general schematic of the BOP liquid effluent sampling and monitoring systems. The streams are monitored for flow, pH, and conductivity.

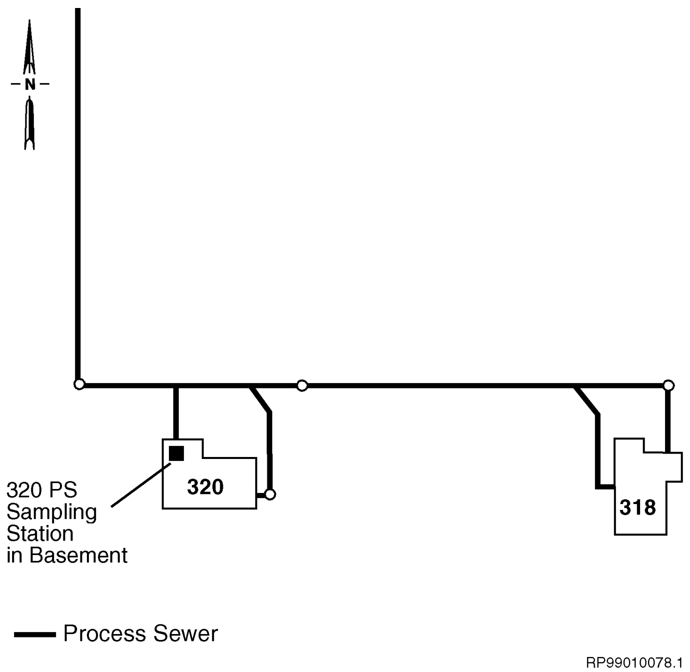

Figure 3.3 Location of the 320 Building Liquid Effluent Sampling and Monitoring System

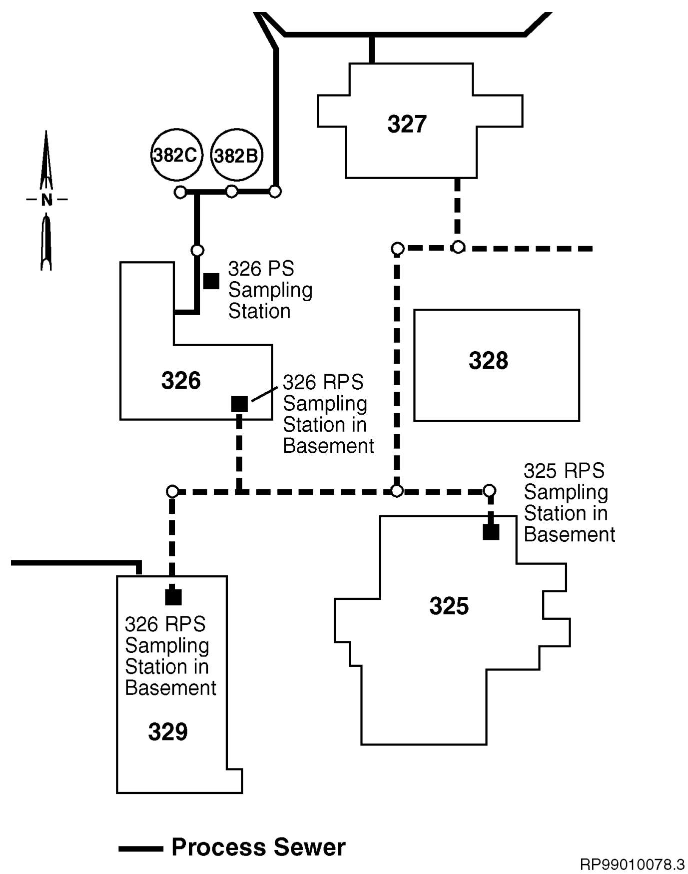

Figure 3.4 Location of the 326 and 329 Buildings Liquid Effluent Sampling and Monitoring Systems

3.5 Sampling System Performance

3.5.1 Radiological Air Sampling System Description

Performance criteria for sampling are provided in Section 3.2.1. One criterion concerns measurement sensitivity and the other concerns measurement bias. The criterion for bias is based on conformance of the system to design and operational guidance in ANSI (1969) and DOE (1991). System description information is consistent with the design and operational guidance; thus, the bias criterion is met.

Sensitivity criteria for sampling are stated in terms of detectable offsite dose. Per performance criteria in Section 3.2.1, radionuclides shall be detectable at emission levels resulting in an annual, committed effective dose equivalent of 0.01 mrem/yr[9]. Total alpha activity and total beta activity are measured to screen for other radionuclides in the stack exhaust.

The sensitivity of particulate radionuclide sampling is proportional to the collection efficiency of the sampler, the fraction of the emission quantity collected by the sampler, and the level at which the radionuclide can be detected in the collected sample. These values vary depending on the emission point flow rate and sampling system design. Minimum detection levels required by the analytical laboratory were based on the worst-case facility. (The 325 Building required the lowest detection level because of the high stack flow rate.) Using the MDAs of 1 pCi/sample alpha and 38 pCi/sample beta required of the laboratory, the detectable annual release from each of the BOP minor emission points sampled is shown in Table 3.4. Supporting calculations for Table 3.4 can be found in Appendix B. These detectable Ci of gross alpha and gross beta released are all below the values of 5E-5 Ci alpha and 2E-3 Ci beta, which would result in a 0.01 mrem/yr dose. Thus, the BOP facility stack sampling systems exceed the minimum criteria for detection of radionuclides in emissions.

Table 3.4 Detectable Activity from BOP Minor Emission Points

Emission Point	Detectable Annual Release (Ci)	
	Gross Alpha	Gross Beta
EP-305B-01-S	1.10E-8	4.18E-7
EP-306W-03-V	3.03E-7	1.15E-5
EP-318-01-S	1.10E-8	4.17E-7
EP-320-01-S	4.31E-7	1.64E-5
EP-320-02-S	1.61E-8	6.12E-7
EP-320-03-S	1.20E-8	4.54E-7
EP-320-04-S	1.12E-8	4.27E-7
EP-323-01-S	1.58E-7	6.01E-6
EP-326-01-S	8.92E-7	3.39E-5
EP-329-01-S	6.58E-7	2.50E-5
EP-3730-01-S	5.08E-9	1.93E-7
EP-3020-01-S	1.41E-7	5.35E-6

3.6 Handling of Sampling Data

Routine compliance sampling of facility effluents for DOE-owned, Pacific Northwest-operated facilities is performed for radiological air emissions and liquid effluent discharges. In addition, periodic sampling or monitoring data on effluents and emissions may be collected to verify, characterize, or investigate effluents. This sampling is performed by Pacific Northwest's Effluent Management Group. Sampling data are handled according to the following general requirements:

- Chain of Custody forms are generated for each sample to track the sample from collection through disposal. These forms contain the place, date, and time of sampling; who performed the sampling and measurements; the signature, name, date, and time of transfers; and any applicable special instructions on storage and preservation or reference to a statement of work (SOW) for specific instructions. For field measurements where the

[9] The determination of minimum sampler capability is based on a series of worst-case assumptions for exposure scenarios, resulting in calculations of upper-bound doses. Thus, the methods used here to evaluate system capability are not appropriate for assessment of actual releases. A realistic assessment of the significance of a sample reading can be made only by considering the actual operational and environmental conditions at the time of the release.

measurement is taken immediately (within 15 minutes) and the sample is not transferred, the Chain of Custody information can be documented in a logbook.

- Data are validated to detect potential quality problems in analytical data. Data are reviewed for 1) results that indicate detectable sample activity or chemical concentration, 2) results above any predefined action level, and 3) results that are unexpected.
- Discrepancies, anomalies, unusual data, or data above action levels are investigated and the resolutions documented using a discrepancy report.
- Manipulation of measurement data into a format that will be reported to DOE or regulatory agencies or that will be used as a basis for regulatory decisions is documented to ensure traceability. Technical reviews are performed on calculations involving sampling data to ensure accuracy.
- Sampling data records are maintained according to regulatory requirements that are specified in the effluent management project records inventory and disposition schedule (RIDS).

These general requirements and management-specific data obtained from each activity performed by Pacific Northwest's Effluent Management Group (e.g., radiological air emission sampling, air chemical-emission sampling, liquid-effluent compliance sampling) is documented in an internal group quality assurance plan.

3.7 Calibration and Maintenance of Equipment

Sampling and monitoring equipment, including rotameters, are maintained and calibrated according to schedules determined when the equipment is installed or purchased. (Some equipment is user-calibrated before each use.) Calibration and preventative maintenance of installed facility effluent sampling and monitoring equipment are tracked by Pacific Northwest maintenance services. Pacific Northwest's Effluent Management Group supports calibration and maintenance by helping develop calibration and maintenance procedures, obtaining vendor information on recommended calibration and maintenance or on equipment functions, working with building managers to identify needed repairs, and performing inspections of sampling systems when needed to ensure proper functioning. The Pacific Northwest SBMS subject areas, *Service Request Process* and *Calibration,* provide requirements and guidance pertinent to calibrations and maintenance.

3.8 References

Anand, N.K., et. al. 1993. *DEPOSITION: Software to Calculate Particle Penetration Through Aerosol Transport Systems.* NUREG/GR-0006. U.S. Nuclear Regulatory Commission.

ANSI 1969. *Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities,* ANSI N13.1-1969. American National Standards Institute.

ANSI 1980. *Specifications and Performance of Onsite Instrumentation for Continuously Monitoring Radioactivity in Effluents,* ANSI N42.18 1980b. American National Standards Institute

Ballinger, M.Y., M.J. Sula, K.D. Shields and D.L. Edwards. 1999. *Assessment of Unabated Facility Emission Potentials for Evaluating Airborne Radionuclide Monitoring Requirements at Pacific Northwest National Laboratory – 1999*. PNL-10855, Rev. 1, AD-902, Pacific Northwest National Laboratory, Richland, Washington.

City of Richland 1996. *Richland Pretreatment Program*. City of Richland Ordinance 7-96. City of Richland. Richland, Washington.

City of Richland 1997. *Industrial Wastewater Permit to Environmental Molecular Sciences Laboratory (EMSL)*. CR-IU005. City of Richland, Richland, Washington.

DOE 1987. *General Design Criteria*, DOE 6430.1A, U.S. Department of Energy Order. U.S. Department of Energy. Washington D.C.

DOE 1988. *General Environmental Protection Program*, DOE 5400.1, U.S. Department of Energy Order. U.S. Department of Energy. Washington D.C.

DOE 1990. *Radiation Protection of the Public and the Environment*, DOE 5400.5, U.S. Department of Energy Order. U.S. Department of Energy. Washington D.C.

DOE 1991. *Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance*, DOE/EH-0173T. U.S. Department of Energy. Washington D.C.

DOE 2000. *Environmental Monitoring Plan*, DOE/RL-91-50, Rev 3, United States Department of Energy, Richland Operations Office, Richland, Washington.

EPA 1971. *Regulations on Standards of Performance for New Stationary Sources, Appendix A: Test Methods.* 40 CFR 60. Environmental Protection Agency, U.S. Code of Federal Regulations.

EPA 1973. *Test Methods for Measuring Radionuclide Emissions from Stationary Sources, Appendix B: Test Methods.* 40 CFR 61. Environmental Protection Agency, U.S. Code of Federal Regulations.

EPA 1981. *National Pollutant Discharge Elimination System Permit-NPDES WA-000374-3*. U.S. Environmental Protection Agency. Washington D.C.

EPA 1989. *Test Methods for Measuring Radionuclide Emissions from Stationary Sources, Appendix D: Methods for Estimating Radionuclide Emissions.* 40 CFR 61. Environmental Protection Agency, U.S. Code of Federal Regulations.

EPA 1990. *National Emission Standards for Hazardous Air Pollutants*. 40 CFR 61. Environmental Protection Agency, U.S. Code of Federal Regulations. 1990.

McCarthy, M. J. 1990. *Westinghouse Hanford Company Effluent Report for 300, 400, and 1100 Area Operations for Calendar Year 1989*. WHC-EP-0267-1, Westinghouse Hanford Company, Richland, Washington.

Standards Based Management System. SBMS Subject Areas "*Service Request Process*" and "*Calibration,*" available on Internet at http://sbms.pnl.gov/standard/97/9700t010.htm and http://sbms.pnl.gov/standard/79/7900t010.htm.

Thompson, C.J., M.Y. Ballinger, E.G. Damberg, and R.G. Riley. 1997. *Characterization and Monitoring of 300 Area Facility Liquid Waste Streams During 1994 and 1995*, Pacific Northwest-11552, Pacific Northwest National Laboratory, Richland, Washington.

WAC 1994. *Radiation Protection - Air Emissions*, WAC 246-247, Washington Administrative Code. Washington Department of Health.

WDOE and WDOH 1999. *Hanford Site Air Operating Permit*, HNF-AOP-97-1. Washington State Department of Ecology and Washington State Department of Health.

4.0 Laboratory Analyses

This section provides information on the analytical laboratories and procedures used to analyze samples collected in support of the Pacific Northwest Effluent Monitoring Program. As stated in previous sections, these samples may contain radioactivity or chemicals or chemical parameters associated with airborne effluents and liquid discharges.

Section 3.4 describes the types of samples collected throughout the BOP facilities. The laboratories and procedures used to perform sample analyses are described in Section 4.1, and Section 4.2 provides a description of procedures employed by Pacific Northwest and its supporting analytical laboratories.

4.1 Analytical Procedures

Analytical procedures for alpha and beta particulate radioactivity, isotopic analysis, and chemical contaminants are provided in this section. The principal radionuclides potentially found in BOP airborne emissions and liquid effluent are described in the Appendices. These radionuclides are detectable using procedures described in this section. Analyses are performed by the Chemical Measurement Center (CMC) of the Pacific Northwest Radiochemical Processing Group located in the 325 Building. All analytical work associated with radionuclide sampling is performed according to required methods per Pacific Northwest contract and statement of work (SOW) with the analytical laboratory. The SOW is prepared to meet the quality assurance (QA) requirements from 40 CFR 61 (EPA 1990).

4.1.1 Determination of Alpha and Beta Activity on Particulate Air Filters

Particulate air filter samples from the BOP sampling systems are collected and initially delivered to a counting laboratory operated by Pacific Northwest's Radiation Protection Section. The samples are held at the laboratory to allow for adequate decay of radon daughter radionuclides.

Following the hold time for radon daughter decay, each particulate filter is delivered to the 325 Building CMC. Analytical services are performed according to documented requirements in a SOW.

Samples are received, logged in, classified, and analyzed according to procedures documented as Standard Operating Procedures (SOPs).

The CMC particulate alpha and beta analysis method is documented in the Center’s standard operating procedures. Samples are counted on an alpha and beta proportional counter. The counters are operated with a full open energy window and are calibrated using ^{239}Pu and ^{90}Sr sources corrected for self-absorption. As specified in the SOW, required detection levels are 1-pCi/sample alpha and 38-pCi/sample beta activity on a single (2-week sample) filter for Type I and Type II errors of 0.05. Section 3.5 addresses the performance capability of the particulate emission sampling program in terms of detectable offsite dose.

4.1.2 Isotopic Analysis

The record particulate filters analyzed by CMC for alpha and beta, as discussed in Section 4.1.1 may be further analyzed for ^{90}Sr, ^{137}Cs, ^{241}Am, ^{243}Am, ^{238}Pu, $^{239/240}$Pu, and ^{241}Pu. These analyses are performed by CMC staff on particulate samples composited on a semi-annual basis.

The CMC composite preparation and analysis methods used for the above isotopes are listed in Table 4.1. As specified in the SOW, required detection levels are also listed in Table 4.1.

Before digesting the particulate filters for isotopic analysis, the filters are grouped on a semiannual basis in preparation for gamma scan analysis. The semiannual groups of samples are transferred to a standard geometry container for counting on the gamma detectors. Intrinsic germanium (high-purity germanium) detectors are used to detect isotopes with gamma ray energies between 60 and 2000 KeV.

Table 4.1 Isotopic Separation and Analysis Methods

Method	Minimum Detectable Activities (pCi/sample)
Air Filter Preparation and Compositing	-NA-
Gamma Analysis Sample Preparation, All Matrices	38(1)
Electrodeposition Procedure for the Actinides	-NA-
Strontium Determination for 6-Month Filter Composites	38
Isotopic Plutonium Determination for 6-Month Filter Composites	1
Isotopic Americium/Curium Determination for 6-Month Filter Composites	0.7
(1) - Based on ^{137}Cs, will depend on isotope	

Following the gamma scan, the semiannual groups are digested and the elements of interest are separated from other elements and the sample matrix by chemistry. The ^{90}Sr content is determined by the chemical separation and counting of a daughter element, ^{90}Y. The strontium is separated from other elements chemically, then ^{90}Y is permitted to grow into equilibrium with the ^{90}Sr. The ^{90}Y is then separated and processed to determine the chemical recovery and counted on a low background beta proportional counter. The quantity of ^{90}Sr is then determined based on the quantity of the daughter ^{90}Y produced.

Plutonium is separated from other elements and the sample matrix by adsorption on an anion exchange column. The plutonium is then processed chemically and electroplated or coprecipitated on rare earth fluorides. Isotopic concentrations of the deposited material are determined by alpha spectrometry. Following the removal of the plutonium, the sample matrix is further processed chemically and the americium and curium removed by passing the sample through a cation exchange column. The americium and curium are eluted from the column and either electroplated or coprecipitated. As with the plutonium, isotopic concentrations of the deposited material are determined by alpha spectrometry.

4.1.3 Liquid Effluent Samples

Liquid effluent samples are collected from the EMSL liquid effluent tank pit as necessary to empty the tanks. For some measurements (pH, conductivity), the analysis is performed in the field using procedures developed by Pacific Northwest's Effluent Management Group. For other measurements (chemical constituents), EMSL liquid waste samples are shipped to an analytical laboratory contracted by Pacific Northwest National Laboratories as required by permit.

Nonroutine liquid effluent samples may also be collected from EMSL or other Pacific Northwest facilities. Desired analyses for non-routine samples may be performed in the field, at the Pacific Northwest Effluent Monitoring laboratory, or shipped to another Pacific Northwest analytical laboratory or a commercial analytical laboratory offsite. Analytical procedures may vary depending on the sampling concern. Analyses needed to determine compliance or support compliance decisions are performed using methods accepted by the appropriate regulatory agency.

4.2 Procedures

Pacific Northwest's Effluent Management Group maintains documented technical and operation procedures for all aspects of effluent monitoring. The SBMS subject area, Procedures, Permits, and Other Work Instructions, contains the requirements for preparation, review, and approval of these procedures. Effluent Management Group procedures incorporate all required elements of the subject area.

Sampling procedures include identification of applicable staff, identification of possible hazards encountered while collecting samples, emergency contacts, any applicable prerequisites to performing the work, and work instructions. The work instructions address areas such as equipment operation, sample collection media to be used, amount of sample to be collected, and sample preservatives (as needed).

Effluent Management staff maintain documented chain-of-custody procedures for all samples. Procedures include provisions for transfer of samples between operational staff, to and from regulated storage areas, and to the analytical laboratory. Both Pacific Northwest and any offsite analytical services contractor may implement chain-of-custody within the Laboratory.

The analytical laboratory maintains documented and approved chain-of-custody procedures for the preliminary analyses of particulate emission samples and for record analysis of particulate air filters. Radiological air emission samples are stored for 18 months before being discarded.

4.3 References

EPA 1990. *National Emission Standards for Hazardous Air Pollutants*. 40 CFR 61. Environmental Protection Agency, U.S. Code of Federal Regulations. 1990.

SBMS, Procedures, Permits, and Other Work Instructions. 2000. *Procedures, Permits, and Other Work Instructions*. Standards-Based Management System Subject Area (http://sbms.pnl.gov/standard/74/7400t010.htm). Pacific Northwest National Laboratory, Richland, Washington.

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5.0 Quality Assurance Requirement

5.1 Quality Assurance Plan

A number of Quality Assurance plans were developed to address QA for the different types of effluent monitoring activities performed by Pacific Northwest, including: radiological air, chemical air, and liquid effluent sampling and monitoring. These plans were integrated into one Effluent Management QA Plan in 1997. This plan addresses QA for all Pacific Northwest effluent management activities and is updated on an annual basis. The QA Program described by the plan is based on the following general requirements and guidance:

- DOE Order 414.1A, *Quality Assurance* (DOE 1999)
- 10 CFR 830.120 *Quality Assurance* (DOE 1994)
- Pacific Northwest Quality Homepage, *General Quality Assurance Planning*) (http://quality.pnl.gov/guidance/genqaplan/qaplan.htm)
- DOE Order 5400.1, *General Environmental Protection Program* (DOE 1988)
- U.S. Environmental Protection Agency (EPA) QAMS-005/80, *Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans.* (EPA 1980)
- American National Standards Institute/American Society for Quality Control (ANSI/ASQC) E4-1994, *American National Standard Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs* (ANSI/ASQC 1994).
- DOE/EH-0173T, *Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance* (DOE 1991b).

In addition, QA requirements specified in permits and regulations, including 40 CFR 61 (EPA 1990), for Pacific Northwest effluent sampling or monitoring activities are incorporated into the QA Plan.

5.2 Internal and External Plan Review

DOE 5400.1 (DOE 1988) states that the EMP will be reviewed annually and updated every 3 years. As a support document to the EMP, the FEMP will also be updated every 3 years. Additionally, this plan will be updated, as necessary, after each major change in facility processes, structure, ventilation and liquid collection systems, monitoring equipment, waste treatment, or a significant change to safety analysis reports or safety assessments. At a minimum, the FEMP assessment will be performed annually.

5.3 References

ANSI/ASQC 1994, *American National Standard Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs*. E4-1994. American National Standards Institute/American Society for Quality Control.

DOE 1988. *General Environmental Protection Program.* DOE Order 5400.1. U.S. Department of Energy Order. U.S. Department of Energy. Washington D.C.
DOE 1999. Order 414.1A, *Quality Assurance* (DOE 1999)

DOE 1991b. DOE/EH-0173T, *Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance*. U.S. Department of Energy. Washington D.C.

DOE 1994. *Quality Assurance*. 10 CFR 830.120. Department of Energy, U.S. Code of Federal Regulations.

EPA 1980. *Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans.* QAMS-005/80. U.S. Environmental Protection Agency. Washington D.C.

EPA 1990. *National Emission Standards for Hazardous Air Pollutants*. 40 CFR 61. Environmental Protection Agency, U.S. Code of Federal Regulations. 1990.

PNNL Quality Homepage, *General Quality Assurance Planning*)
(http://quality.pnl.gov/guidance/genqaplan/qaplan.htm).

6.0 Program Implementation Procedures

The Hanford Site EMP (DOE 2000) documents the effluent monitoring and environmental surveillance programs for the Hanford Site.

6.1 Interface with the Near-facility Environmental Monitoring Program

The EMP divides the effluent monitoring coverage into two areas, the FEMPs and the Near-Facility Environmental Monitoring Program. The FEMPs cover the monitoring of effluents from facilities at the facility. Pacific Northwest's Effluent Management Program maintains implementation procedures for all Pacific Northwest facility-monitoring activities. These procedures meet the Pacific Northwest National Laboratory's requirements for technical and operating procedures (SBMS subject area, Procedures, Permits, and Other Work Instructions) and ensure that facility effluent sampling and monitoring is conducted compliantly. The Near-Facility Environmental Monitoring Program monitors air, surface water, groundwater, soil, sediment, vegetation, and biota around site facilities to evaluate the adequacy of effluent control at various facilities at the Hanford Site. The program is conducted by Waste Management Federal Services, Inc. Northwest Operations.

6.2 Interface with the Operational Environmental Surveillance Program

Environmental surveillance of the 300 Area and the surrounding onsite and offsite areas is performed by the Pacific Northwest Hanford Site Surface Environmental Surveillance Project and the Pacific Northwest Site-Wide Groundwater Monitoring Project. These projects are notified in the event of actual or apparent new or off-normal discharges to the soil, surface waters, or air so they can assist in assessing their environmental and compliance significance. The data from these programs are also useful to verify the occurrence or nonoccurrence of facility releases. These surveillance projects are described in detail in DOE (2000).

6.3 References

DOE 2000. *Environmental Monitoring Plan, United States Department of Energy, Richland Operations Office.* DOE/RL-91-50, Rev. 3, U. S. Department of Energy, Richland Washington.

SBMS, Procedures, Permits, and Other Work Instructions. 2000. *Procedures, Permits, and Other Work Instructions*. Standards-Based Management System Subject Area (http://sbms.pnl.gov/standard/74/7400t010.htm). Pacific Northwest National Laboratory, Richland, Washington.

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7.0 Reporting

This section describes the compliance reporting and notification requirements related to facility effluent monitoring. It also identifies the requirements and provides an overview of the procedural steps for the notification, investigation, and reporting of all environmental off-normal events for Pacific Northwest operations.

7.1 Routine Effluent Monitoring Reports

On a periodic basis, effluent monitoring data are gathered by Pacific Northwest on specific DOE Richland Operations Office (DOE/RL) facilities for compilation and reporting to DOE and the various regulatory agencies.

The following effluent monitoring reports are submitted to regulatory agencies:

<u>Airborne Effluent</u>

- An annual NESHAP Air Emissions Report for the Hanford Site that provides the required annual emissions measurements and climatological data is submitted to EPA and WDOH for the Hanford Site radioactive airborne emissions.
- The Annual Radioactive Effluent and Onsite Discharge Data Report is submitted to DOE-Headquarters, EPA, and WDOH through the DOE/RL after compilation by EG&G Idaho.
- Semiannual reports providing updates of compliance-related activities under the Hanford Site Air Operating Permit (WDOE and WDOH 1999) are submitted to WDOE.
- The annual Compliance Certification is provided to WDOE as to the continuous or intermittent compliance of activities under the Hanford Site Air Operating Permit.

<u>Liquid Effluent</u>

- The City of Richland is provided a monthly Discharge Monitoring Report (DMR) for discharges to the City sanitary sewer system from EMSL (City of Richland 1997).
- WDOE is provided an annual report on significant discharges of hydrotest, maintenance, or construction wastewater discharged to ground as required by Permit ST-4508 (WDOE 1997).
- WDOE is provided an annual inventory of miscellaneous liquid effluent discharges to ground as required by WDOE Consent Order DE 91NM-177 (WDOE 1991).

<u>Other</u>

- WDOE is provided with a monthly status report of all reportable spills from the previous month through DOE/RL.

7.2 Nonroutine Notifications and Reports

There are a number of reports, including notification reports, which are required with respect to effluent monitoring activities.

- A NOC must be provided to WDOH and/or WDOE and/or the Benton Clean Air Authority (BCAA), depending on emissions type, whenever a new emission unit is to be created, or if there is to be significant modification to an existing emission unit.
- A Notice of Transient or Abnormal Conditions must be provided to WDOH as soon as practicable in accordance with Hanford Site Air Operating Permit requirements. A Notification Follow-up Report may also be requested in addition to the initial notification.
- A Report of Closure shall be submitted to WDOH whenever an emission unit covered under WAC 246-247 (WAC 1994) ceases emission.
- A Notification of Renovation/Demolition Activities Involving Asbestos must be provided to BCAA any time work involving renovation or demolition activities in a facility with asbestos is planned.

7.3 Event Notification and Reporting

"Events" or conditions may adversely affect DOE or contractor personnel, the public, property, the environment, or the DOE mission. Staff who discover an event that requires mitigation must notify the Battelle single-point-contact to begin the response and mitigation process. Managers who are notified of events within their domain participate in the recovery, evaluation, analysis, and corrective action of the event. These two processes, staff notification and management participation, are described in a Pacific Northwest National Laboratory SBMS subject area, Event Reporting. This subject area incorporates requirements from DOE 232.1A, "Occurrence Reporting and Processing of Operations Information," (DOE 1997) and associated DOE/RL Implementing Directives (RLIDS).

7.4 References

City of Richland 1997. *Industrial Wastewater Permit to Environmental Molecular Sciences Laboratory (EMSL)*. CR-IU005. City of Richland, Richland, Washington.

DOE 1997. *Occurrence Reporting and Processing of Operations Information*, DOE 232.1A. U.S. Department of Energy Order. U.S. Department of Energy. Washington D.C.

EPA 1981. *National Pollutant Discharge Elimination System Permit*. NPDES WA-000374-3. U.S. Environmental Protection Agency

SBMS, Event Reporting. 1999. *Event Reporting*. Standards-Based Management System Subject Area http://sbms.pnl.gov/standard/27/2700t010.htm). Pacific Northwest National Laboratory, Richland, Washington.

WAC 1994. *Radiation Protection - Air Emissions*, WAC 246-247, Washington Administrative Code. Washington Department of Health.

WDOE 1991. *Consent Order in the Matter of the Compliance by United States Department of Energy with Chapter 70.105 and 90.48 RCW and the Rules and Regulations of the Department of Ecology*, DE 91NM-177. Washington State Department of Ecology

WDOE 1997. *State Waste Discharge Permit for the Discharge of Hydrotest, Maintenance, and Construction Discharges*, ST-4508. Washington State Department of Ecology

WDOE and WDOH 2000. *Hanford Site Air Operating Permit*, HNF-AOP-00-1. Washington State Department of Ecology and Washington State Department of Health (pending as of 12/2000).

Appendix A

Information on Current Balance-of-Plant Facilities

A.1.0 General Balance-of-Plant Information

This appendix provides information on the mission, physical description, activities, radiological and chemical inventories, required facility monitoring, and history of measured emissions for all DOE-owned, Pacific Northwest National Laboratory-operated facilities except those with an individual Facility Effluent Monitoring Plan or that are inactive or purely administrative. In addition, the following four buildings were split out into separate appendices because of their higher potential chemical loading: 306W, 320, 326, and 329. Table A.1 provides a summary of the current Balance-of-Plant (BOP) facilities, locations, and uses. Table A.2 provides historic data on dose for unabated PTE for radionuclide releases from BOP facilities for the past 6 years. The methodology is described in Ballinger et al. (1999).

Table A.1 Current BOP Facilities

Building	Title	Area	Use
213-J	Underground Storage Vault	200	Store soil samples
242-B & BL	Radioactive Particle Research Laboratory	200	Inactive
2718-E	Critical Mass Fissile Storage	200	Storage
303-C	Materials Evaluation Laboratory	300	Inactive
303-J	Material Storage Building	300	Inactive
305-B	Hazardous Waste Storage Building	300	R&D Waste Operations
306-W	Materials Development Laboratory	300	R&D
314 & 314-B	Engineering Development Laboratory	300	Inactive
318 & 318 Trl4	Radiological Calibrations Laboratory	300	R&D
320	Analytical and Nuclear Research Laboratory	300	R&D
323	Mechanical Properties Laboratory	300	R&D
326	Materials Sciences Laboratory	300	R&D
329	Chemical Sciences Laboratory	300	R&D
332	Packaging Test Facility	300	Service - Packaging Tests
336	High Bay Testing Facility	300	R&D
337	Technical Management Center	300	Administrative
338	Prototype Engineering Laboratory	300	R&D
350	Plant Operations & Maintenance Facility	300	Maintenance Services
350-A	Paint Shop	300	Maintenance Services
350-B	Warehouse	300	Storage
350-C	Storage Building	300	Storage
350-D	Oil Storage Facility (Waste Handling Facility)	300	Storage
3020	Environmental Molecular Sciences Laboratory (EMSL)	300	R&D
3708	Radioanalytical Laboratory	300	Inactive
3718-A & B	Lab Equipment Central Pool	300	Equipment Storage
3718-P	General Storage Warehouse	300	Storage
3718-S	Storage Building	300	Storage
3730	Gamma Irradiation Facility	300	R&D
3731	Laboratory Equipment Central Pool	300	Inactive
3731-A	Graphite Machine Shop	300	Inactive
3745 & Trlr 3	Radiological Calibrations & Standards Building	300	Inactive
3745-B	Positive Ion Accelerator Facility	300	Inactive
3760	Office Building	300	Administrative
3762	Technical Security	300	Inactive
3764	Office Building	300	Inactive
3767	Office Building	300	Inactive
622-A	Elevator Control Building	600	Service
622-B	Pilot Balloon Release Building	600	R&D

Building	Title	Area	Use
622-C	Storage Building	600	Storage
622-F	Field Office	600	Inactive
622-R	Meteorology Laboratory	600	R&D
6652-C, shed, D, Dome2, G, H, I, J, LP, M, UP	Arid Lands Ecology (ALE) Laboratories, Observatory, & Storage Facilities	ALE	Inactive
6652-Dome1	ALE Observatory	ALE	R&D
6652-E	Lysimeter Preparation Building	ALE	R&D Storage
6652-L	Bunkers	ALE	R&D
747A & TR1	Whole Body Counter	700	Service
100, 300, and 600 Area Lysimeters	Lysimeter Plots	100, 300, 600	Field R&D
614, 614 BYRL, 1614 D3, 3614A, EMS 100, 300, 400	Environmental Monitoring Stations	100, 300, 400, 600	Environmental Monitoring
361	Air Monitoring Station	300	R&D

Table A.2 PTE for BOP Facilities (mrem/yr)

BUILDING	1995	1996	1997	1998	1999	2000
2718-E	0	0	0	0	0	0
305-B	1.5E-04	2.6E-03	7.8E-04	1.83E-02	6.15E-02	3.61E-02
306-W	3.0E-03	2.9E-03	1.8E-02	1.56E-03	1.59E-03	1.60E-03
318	1.4E-07	1.5E-07	7.7E-10	1.70E-09	1.76E-06	2.26E-06
320	1.2E-03	7.7E-04	7.6E-04	7.66E-04	7.14E-04	7.76E-04
323	7.2E-05	7.7E-05	1.7E-04	4.39E-05	2.51E-05	3.44E-05
326	1.8E-04	3.5E-05	3.9E-05	1.01E-05	5.5E-05	4.69E-05
329	1.7E-02	9.7E-03	3.5E-03	3.5E-03	3.47E-03	3.74E-03
3020	ND	ND	0	0	0	1.09E-11
3730	2.0E-04	3.0E-04	3.9E-04	2.84E-04	2.81E-04	3.38E-04
3745	9.5E-05	9.3E-05	5.4E-05	1.25E-02	4.8E-06	7.91E-04
622-R	0	0	0	0	0	0
6652	1.1E-07	0	0	0	0	0
747-A	8.2E-12	0	0	0	0	0

A.2.0 Building-Specific Information

Due to the expanded chemical inventories located inside the 306W, 320, 326 and 329 Buildings, separate appendices [C, D, E, and F (respectively)] have been included to provide more in-depth information on those facilities.

A.2.1 213-J Building

Mission and Activities: The underground storage vault in the 213-J Building is used to store soil samples.

Physical Description: The storage vault is a reinforced concrete structure with about 500 square feet of space. It is not equipped with a ventilation system, water supply, liquid effluent system, or air and water sampling systems.

Radiological Inventory: None. Radiological materials are not permitted within this facility.

Chemical Inventory: The only chemicals present are those associated with the samples stored.

Emission History: N/A. No monitoring or sampling of facility effluents has been required, and no historic data exist.

A.2.2 2718-E Building

Mission and Activities: The 2718-E Building is currently used only as storage for some Light Water Reactor (LWR) fuel rods.

Physical Description: The 2718-E Building is located in the 200 East Area and has about 2,000 square feet of floor space. The building is steel framed.

Radiological Inventory: Kilogram quantities of LWR fuel rods are stored in the building. The 2000 PTE from the 2718-E Building was 0 mrem/yr because the material is stored in U.S. Department of Transportation containers all year. See Table A.2.

Chemical Inventory: No chemicals are currently being used in the facility.

Emissions History: N/A. No monitoring or sampling of facility effluents has been required and no historic data exists.

A.2.3 305-B Building

Mission and Activities: The 305-B Building is used to receive, store, and prepare shipments of dangerous waste and radioactive mixed waste (RMW) generated by Hanford Site programs. These wastes are primarily generated in support of R&D activities. Wastes are brought to the 305-B Building and segregated by compatibility for storage until enough waste is accumulated to fill a lab-pack or bulking container, usually a 30- to 55-gallon drum. When a sufficient number of shipping containers of waste has accumulated, they are manifested for shipment, generally to permitted offsite recycling, treatment, or disposal facilities. Dangerous wastes are stored in the high bay; radioactive mixed waste is stored in the basement of the original wing of the building. The building is a permitted treatment, storage, and disposal facility (TSDF).

Physical Description: This approximately 10,000-square-foot building consists primarily of high-bay dry laboratory space with associated storage space and an administrative office wing. A fume hood is available for repackaging activities, and radioactive air emissions from the fume hood are high-efficiency particulate air (HEPA)-filtered. A sampling system is available to sample particulate material emitted from the hood. Figure A.1 is a simplified drawing of the ventilation and air emission sampling systems. Sampling system configuration drawings have been developed and are maintained in Pacific Northwest's Essential Drawings System.

The 305-B Building is connected to the 300 Area sanitary SNS, but processing and storage areas do not have any sewer system access points. In addition, the 305-B Building has a sump connected to the process sewer. However, the sump pump has been electrically disconnected, and no discharges are provided to the PS.

Radiological Inventory: The 305-B Building may house a number of different radionuclides in various forms, depending on activities conducted in a given year. Small quantities (millicurie or less) of radionuclides in the form of contaminated solids, liquids, or dispersible solids may be present. The 2000 PTE from the 305-B Building was 3.61E-02 mrem/yr. See Table A.2.

Chemical Inventory: A number of different chemicals may be present in the 305-B Building, depending on the waste materials generated from Pacific Northwest R&D activities.

Emission History: Monitoring for radioactive air emissions from the 305-B Building was initiated in 1996. Table 3.1 shows the estimated emissions since 1996. A NOC was obtained in 1996 for repackaging work performed in the fume hood. Because the 305-B Building does not have sewer access points from the processing and storage areas, wastewater from the building has not been monitored.

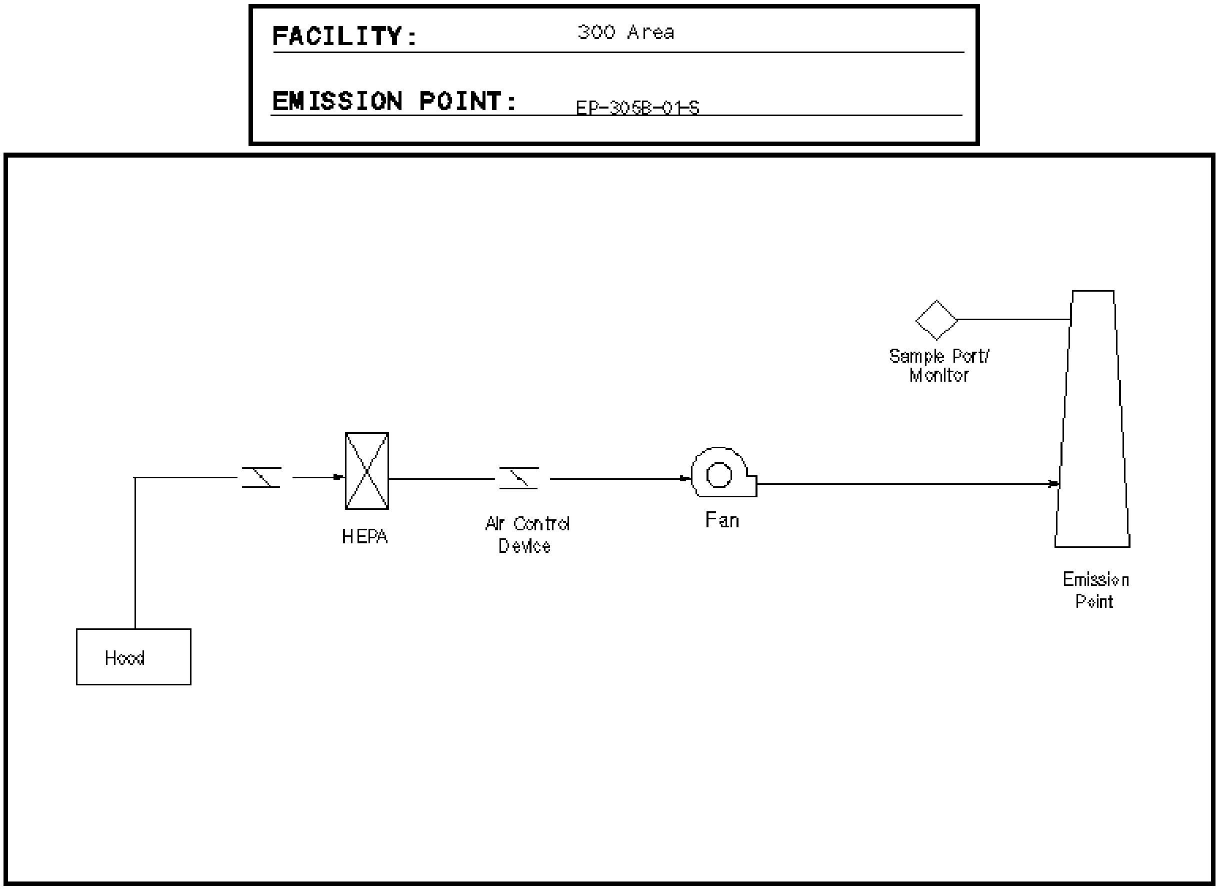

Figure A.1 305-B Building Simplified Ventilation System Drawing

A.2.4 318 Building

Mission and Activities: The 318 Building is primarily used to provide technical services in internal dosimetry, external dosimetry, instrument calibration, repair, and testing for 1) protecting the health of workers and the public and 2) providing liability protection for government and industrial customers. Research in the 318 Building includes development of radiation detection and measuring instruments.

Physical Description: The 318 Building contains about 37,000 square feet of floor space in a two-story building with a basement. The basement area contains an X-ray room and control room, a high-exposure room, and a mechanical equipment room. The first floor contains a low-scatter room, laboratories, and a small computer room. The second floor contains offices, a lunchroom, and a mechanical equipment room.

Fume hoods are provided in the building for airborne emissions. Exhaust air is not equipped with HEPA filtration. The building has one emission point and an isokinetic radioactive air sampling system that samples for particulate material. Figure A.2 is a simplified drawing of the ventilation and air emission sampling systems. Sampling system configuration drawings have been developed and are maintained in Pacific Northwest's Essential Drawings System.

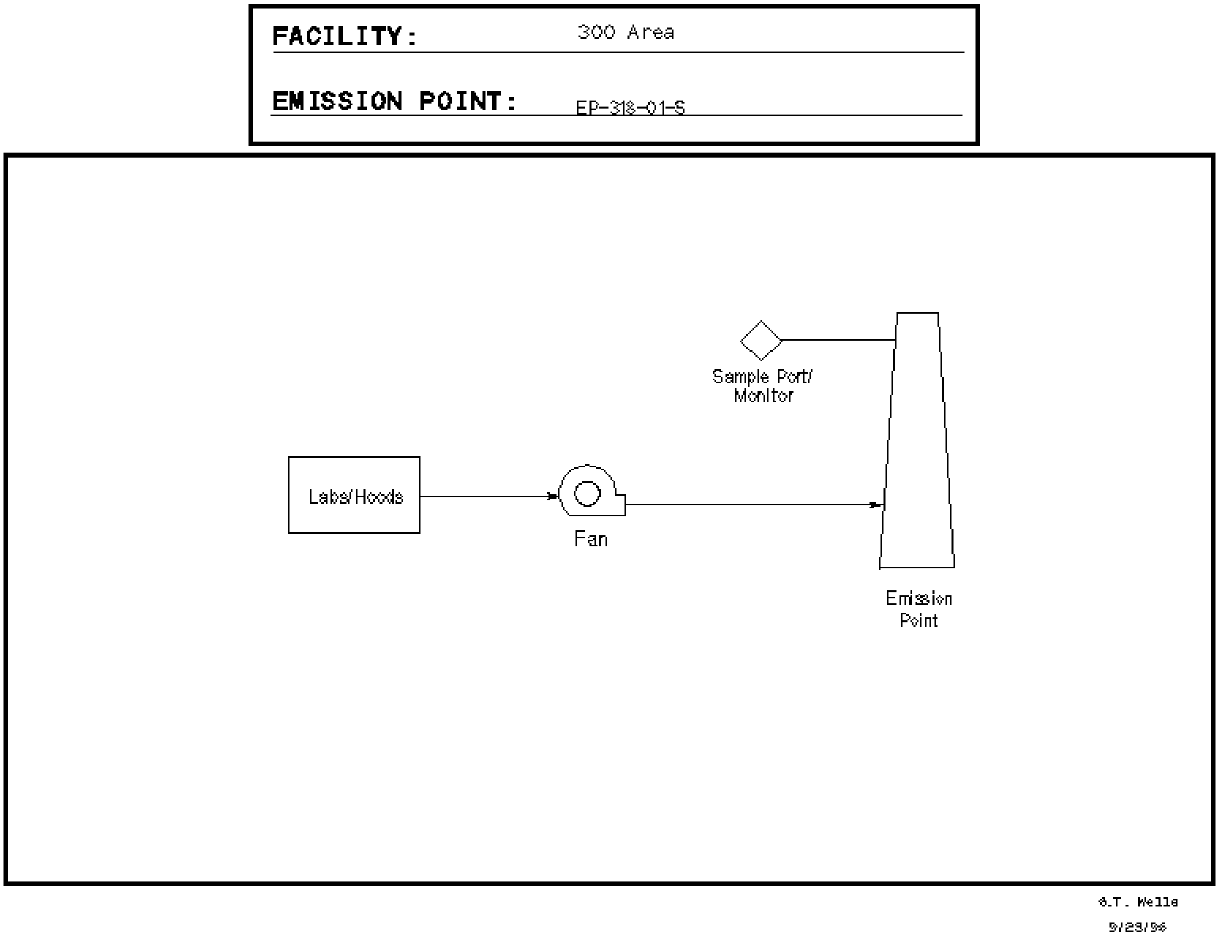

Figure A.2 318 Building Simplified Ventilation System Drawing

The building is served by the 300 Area PS and SNS; the SNS serves the restrooms and lunchrooms, and the PS serves process areas. No liquid effluent sampling system exists for the facility.

Radiological Inventory: Most of the radiological inventory is in the form of sealed sources, although very small quantities of radon, thoron, and other gases are emitted during some calibrations. Also, microcurie or less quantities of various radioactive materials may also be present in the form of check sources, dispersible solids, or liquids. The 2000 PTE for the building was 2.26E-06 mrem/yr. See Table A.2.

Chemical Inventory: A variety of types and forms of chemicals are used in the 318 Building.

Emission History: Radioactive air emissions have been and continue to be measured. Radionuclide air emission data since 1993 are shown in **Table 3.1**.

Liquid effluents from the 318 Building have not been sampled. With few dispersible radioactive materials and minor quantities of hazardous chemicals, the potential for effluent release to the PS or SNS is considered low.

A.2.5 323 Building

Mission and Activities: Work in the 323 Building includes research into the development and characterization of structural materials. The activities conducted in this building are in support of the mechanical property (tensile and compression) testing mission for both radioactive and nonradioactive material as well as autoclave testing for high-temperature corrosion and stress corrosion studies. Tests are conducted in a small hot cell. Tested materials are solid form and contain activation products resulting from irradiation in a reactor.

Physical Description: The 323 Building is a one-story, rectangular-shaped, metal-frame structure built on a concrete foundation and floor slab. The roof is pitched, and the exterior of the building is made of insulated metal siding. The building has about 4,200 square feet of floor space. Exhaust air is HEPA filtered and sampled for radioactive particles before being emitted from the building. Figure A.3 is a simplified drawing of the ventilation and air-emission sampling systems. Sampling system configuration drawings have been developed and are maintained in Pacific Northwest's Essential Drawings System. The building is serviced by the 300 Area SNS and PS and is not equipped with any liquid effluent sampling or monitoring systems.

Radiological Inventory: Curie quantities of radioactive materials in solid form are stored and tested in the 323 Building hot cell. The 2000 PTE for the building was 3.45E-05 mrem/yr. See Table A.2.

Chemical Inventory: A variety of types and forms of chemicals are used in the 323 Building.

Emission History: Radioactive air emissions have been and continue to be measured. Radionuclide air emission data since 1993 are shown in Table 3.1.

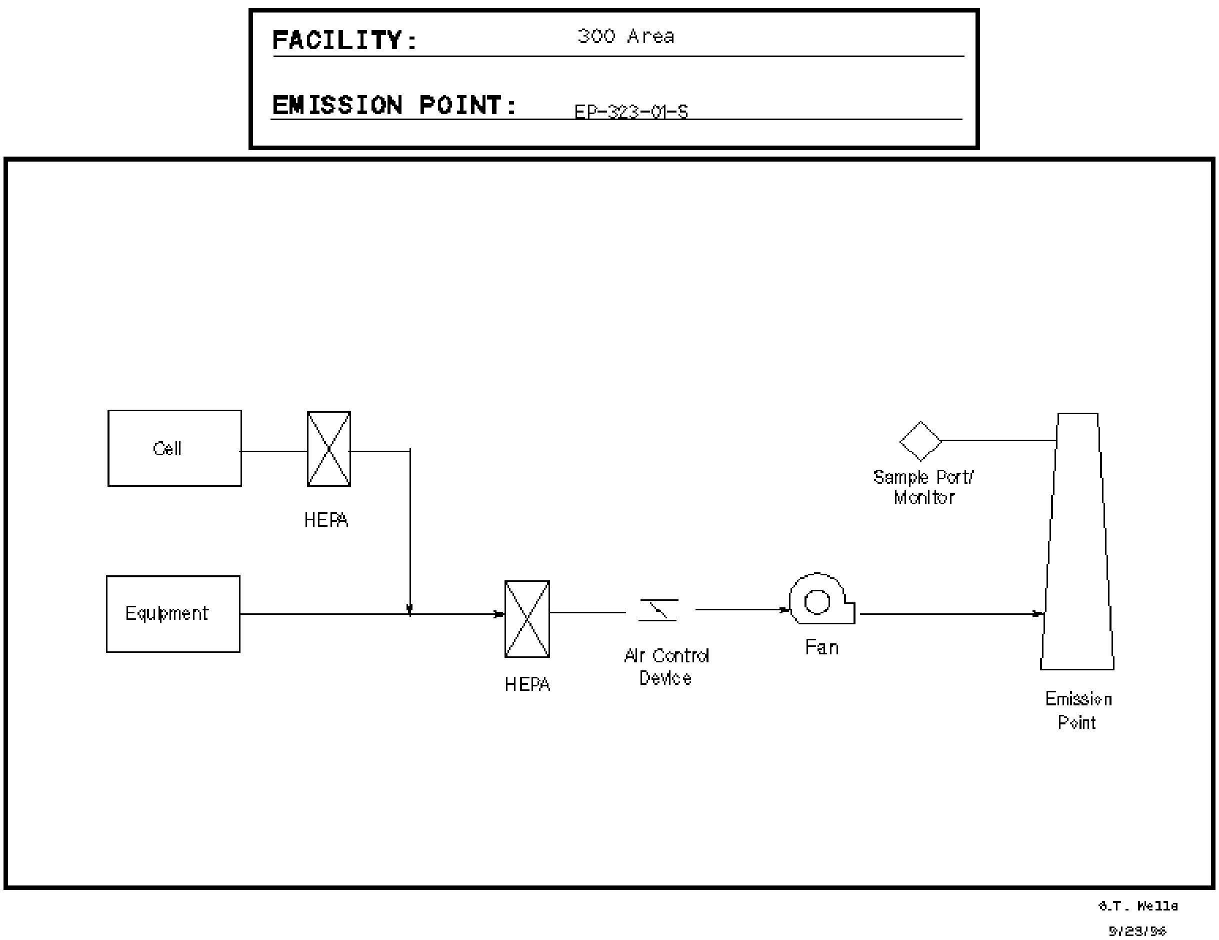

Figure A.3 323 Building Simplified Ventilation System Drawing

A.2.6 332 Building

Mission and Activities: The 332 Building is a one-room packaging and testing facility used by Pacific Northwest's Environmental Management Services Department to determine if prototype packaging can pass prescribed U.S. Department of Transportation test requirements.

Physical Description: The building is an insulated metal building on concrete footings and a slab. It is a one-room building with about 400 square feet of floor space. No water supply or sewer systems are provided in the building, although the building has a drain connected to a sump that can be manually pumped out. The ventilation system is a fume hood exhaust that is manually controlled. The building has no effluent sampling or monitoring systems.

Radiological Inventory: None. Radiological materials are not permitted within this facility.

Chemical Inventory: Very few, if any, chemicals are present in the building. The only chemicals are those used to fill packages when testing (water, inert materials).

Emission History: N/A. No monitoring or sampling of facility effluents has been required, and no historic data exist.

A.2.7 336 Building

Mission and Activities: The primary mission of the 336 Building is the engineering and analysis of multiphase flow experiments. Near-term objectives support model development and code assessment activities to continue involvement in basic research related to multiphase flow phenomena, and to experimentally address issues related to Hanford waste retrieval, transport, and disposal. Activities of the Fluid Dynamics Laboratory include bubble dynamics experiments, slurry transport/re-suspension studies, and waste tank mixing/mitigation/retrieval experiments using a variety of non-radioactive physical simulants. Major building equipment/systems include the 1/4- and 1/12-scale waste tank models, a scaled waste retrieval/pneumatic conveyance test facility, and numerous other semi-permanent to temporary test articles and facilities.

Work activities conducted by research staff include the development and assessment of waste retrieval and transport technologies. A multi-scale tanks system (1/4, 1/12, and 1/25 scale of Double Shell Tanks) and ancillary equipment are used to accommodate the full-technology development cycle for retrieval technologies such as pulsed-air, pneumatic conveyance, and extendable nozzle. Additional studies are performed to enhance or better understand existing technologies such as aerosol generation during sluicing and performance correlations for mixer pumps. A 3-inch slurry test loop is used to test the performance of candidate instruments for monitoring slurry transport through pipes. An adjacent simulant development and measurements laboratory supports the high-bay testing and houses state-of-the-art instruments that provide a wide range of physical properties important to waste retrieval and transport.

Physical Description: The 336 Building provides staff with a three-story-high bay and a 20-foot-diameter circular pit, approximately 50-feet deep. The approximately 4,000-square-foot building houses a series of tanks up to about a 25,000-gallon capacity. The southwest corner of the building provides two supporting laboratories.

The ventilation system has a nominal capacity of ten air changes per hour. The building is not equipped with exhaust air filtration or sampling systems.

The building is served by the 300 Area PS and SNS; the SNS serves the restrooms, and the PS serves process areas. The building does not have a liquid effluent sampling system.

Radiological Inventory: None. Radiological materials are not permitted within this facility.

Chemical Inventory: A variety of types and forms of chemicals are used in the building.

Emission History: N/A. No monitoring or sampling of facility effluents has been required, and no historic data exist.

A.2.8 338 Building

Mission and Activities: The principal effort in the 338 Building is focused on assembling and testing equipment to be used by the DOE client. The work is performed with only nonradioactive materials. A portable X-ray machine may be used. A second project is being conducted in the 338 Building high-bay using the Variable Geometry truss robot.

The 338 Building houses materials-processing laboratories that consist of several metals-processing capabilities centered around aluminum and light metal development and casting of lightweight materials and advanced metal composites.

The Thermomechanical Processing Laboratory located in the 338 Building consists of a rolling mill, heat treating furnaces, and brake shear.

The second major processing laboratory is the metal-casting laboratory. The laboratory consists of two induction power units, a centrifugal casting unit, meltspin caster, a die casting coatings evaluation unit, and associated equipment for sectioning, mixing, and heat treating cast materials. The drop tower will be used for coining of cast gears and is an element of the casting and processing laboratory.

Physical Description: The building has about 18,000 square feet of floor space on one floor consisting of office, high-bay, and support space. The building also has a large basement area. The exhaust air is not HEPA filtered or sampled before exiting the building, and no air emission filtration or sampling systems are in place.

The building is served by the 300 Area PS and SNS; the SNS serves the restrooms, and the PS serves process areas. The building does not have a liquid effluent sampling system.

Radiological Inventory: None. Radiological materials are not permitted within this facility.

Chemical Inventory: A variety of types and forms of chemicals are used in the building.

Emission History: N/A. No monitoring or sampling of facility effluents has been required, and no historic data exist.

A.2.9 350 Building

Mission and Activities: The 350 Building is primarily offices and shop areas used by Pacific Northwest's Crafts Services Department.

Physical Description: The 350 Building is a single-story structural steel building with about 16,000 square feet of floor space. It contains craft shops, change rooms, restrooms, a lunchroom, and offices. The craft shops have a dust collection system, and the air is filtered before being recirculated into each respective shop. The building is not equipped with HEPA filtration or a sampling system for airborne emissions. The building is served by the 300 Area SNS and does not have a liquid effluent sampling system.

Radiological Inventory: None. Radiological materials are not permitted within this facility.

Chemical Inventory: A variety of types and forms of chemicals are used in the building.

Emission History: N/A. No monitoring or sampling of facility effluents has been required, and no historic data exist.

A.2.10 350-A Building

Mission and Activities: The 350-A Building is used as a paint shop with storage space for paints and similar products and a paint spray booth.

Physical Description: The 350-A Building has about 1,400 square feet of floor space. No HEPA filter or sampling system exists for airborne emissions. The building is served by the 300 Area SNS and does not have a liquid effluent sampling system.

Radiological Inventory: None. Radiological materials are not permitted within this facility.

Chemical Inventory: The chemical inventory consists of paints, solvents, and similar materials.

Emission History: N/A. No monitoring or sampling of facility effluents has been required, and no historic data exist.

A.2.11 350-B Building

Mission and Activities: The 350-B Building is used as a small warehouse that houses parts and materials required to perform maintenance.

Physical Description: The 350-B Building has about 2,100 square feet of floor space for storage. Ventilators are provided to remove excess summer heat, but no filtration or sampling systems exist for airborne emissions. The building is connected to the 300 Area SNS and does not have a liquid effluent sampling system.

Radiological Inventory: None. Radiological materials are not permitted within this facility.

Chemical Inventory: Some flammable/combustible liquids or corrosive liquids may be present in the building.

Emission History: N/A. No monitoring or sampling of facility effluents has been required, and no historic data exist.

A.2.12 350-C Building

Mission and Activities: The 350-C Building is a small storage building used to store miscellaneous building lumber and carpenter supplies.

Physical Description: The 350-C Building is a prefabricated metal building on a concrete slab floor with a large roll-up door. It has about 200 square feet of floor space for storage, and does not have ventilation, water, sewer, or sampling capabilities.

Radiological Inventory: None. Radiological materials are not permitted within this facility.

Chemical Inventory: None. Storage of chemicals in the building is not allowed.

Emission History: N/A. No monitoring or sampling of facility effluents has been required, and no historic data exist.

A.2.13 350-D Building

Mission and Activities: The 350-D Building is a small storage building used to stage used oils and other waste products before ultimate disposal. The building includes a < 90-day storage area for polychlorinated biphenyl waste.

Physical Description: The 350-D Building has about 1,000 square feet of floor space for storage. No filtration or sampling systems exist in the building for airborne emissions. No sewer system connections or liquid effluent sampling systems are provided.

Radiological Inventory: None. Radiological materials are not permitted within this facility.

Chemical Inventory: A variety of types and forms of chemicals are used in the building.

Emission History: N/A. No monitoring or sampling of facility effluents has been required, and no historic data exist.

A.2.14 3020 Building (EMSL)

Mission and Activities: Commonly referred to as Environmental Molecular Sciences Laboratory (EMSL), this building provides integrated laboratory, computer, and seminar functions and contains basic, multidisciplinary research programs involving chemical, biological, materials, and computational sciences. Research and development activities are undertaken in EMSL to advance the understanding of molecular sciences and to apply the advanced understanding gained to a broad spectrum of environmental restoration and waste management missions.

Physical Description: EMSL consists of experimental laboratories (dry, wet, and filtered), theory laboratories, laboratory support offices, conference rooms, computer graphics rooms, administrative support offices, a library, lunch/interaction areas, support/crafts shops, storage, and a seminar area. EMSL has about 200,000 square feet of floor space.

The EMSL experimental laboratories are arranged in five clusters. Each of the five lab clusters has separate once-through ventilation and emissions exhaust systems for chemical hoods. A separate HEPA-filtered exhaust system is also provided that is equipped with a particulate sampling system for measuring radioactive air emissions. All of the five emission points are equipped with ports through which air chemical emissions can be sampled. Figure A.4 is a simplified drawing of the HEPA-filtered exhaust and air-emission sampling systems. Ventilation and sampling system configuration drawings have been developed and are maintained in Pacific Northwest's Essential Drawings System.

EMSL is equipped with two sewer systems: a sanitary system that serves restrooms, lunchrooms, and mechanical room areas, and a process system that serves laboratories. The process system discharges to large tanks in a tank pit. The tanks are equipped with sampling and monitoring systems so that process effluent batches can be sampled and measured before discharge. Figure A.5 shows the process collection tanks. Ultimately, liquid effluent from the process tanks discharges to the sanitary sewer, which discharges to the City of Richland Publicly Owned Treatment Works. EMSL has an Industrial Wastewater Permit with the City of Richland to govern the discharges of process effluent. As-built drawings of the liquid effluent distribution and sampling systems have been developed and are maintained in Pacific Northwest's Essential Drawings System.

Radiological Inventory: The EMSL radiological inventory consists of a number of sealed sources and radioactive samples brought into the facility for analysis only. The 2000 PTE for the building was 1.09E-11 mrem/yr. See Table A.2.

Chemical Inventory: A wide variety of types and forms of chemicals are used in the building.

Emission History: EMSL began operations in 1997, so previous historic data does not exist. Sampling for radioactive airborne emissions began in December of 1997. Radionuclide air emission data since 1997 are shown in Table 3.1. The measured emissions for December are 9.3E-10 total alpha and 2.0E-9 total beta. However, since no dispersible radioactive material was introduced into the building in 1997, the emitted radioactivity is indicative of background levels (naturally occurring materials and worldwide fallout).

Total organic carbon in air emissions were measured in 1998 in compliance with a NOC and demonstrated that emissions were below the 0.24 lb/hr permitted emission limit.

Compliance sampling of liquid effluents also began in 1997 after EMSL started operations. These data are reported on monthly Discharge Monitoring Reports to the City of Richland.

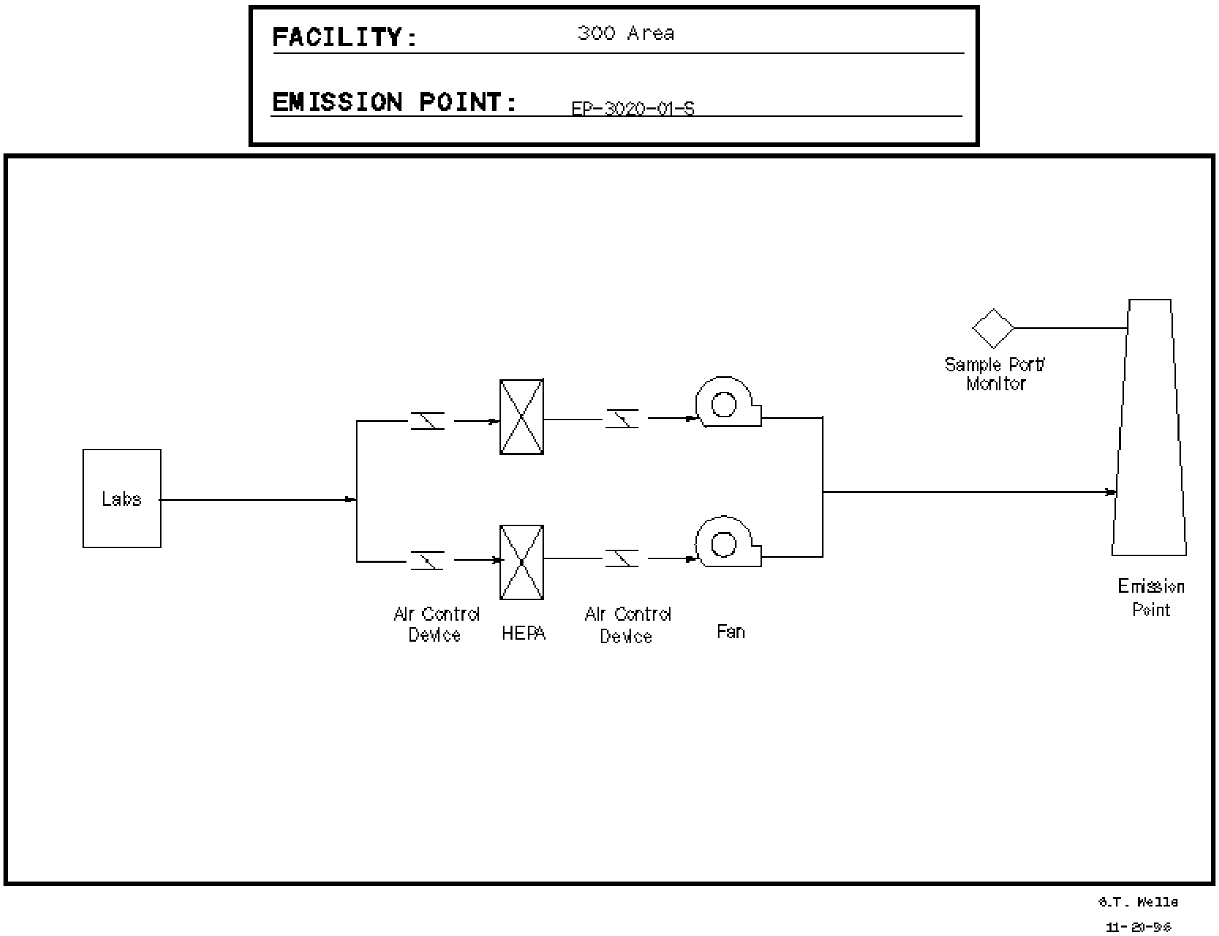

Figure A.4 EMSL Simplified Ventilation System Drawing

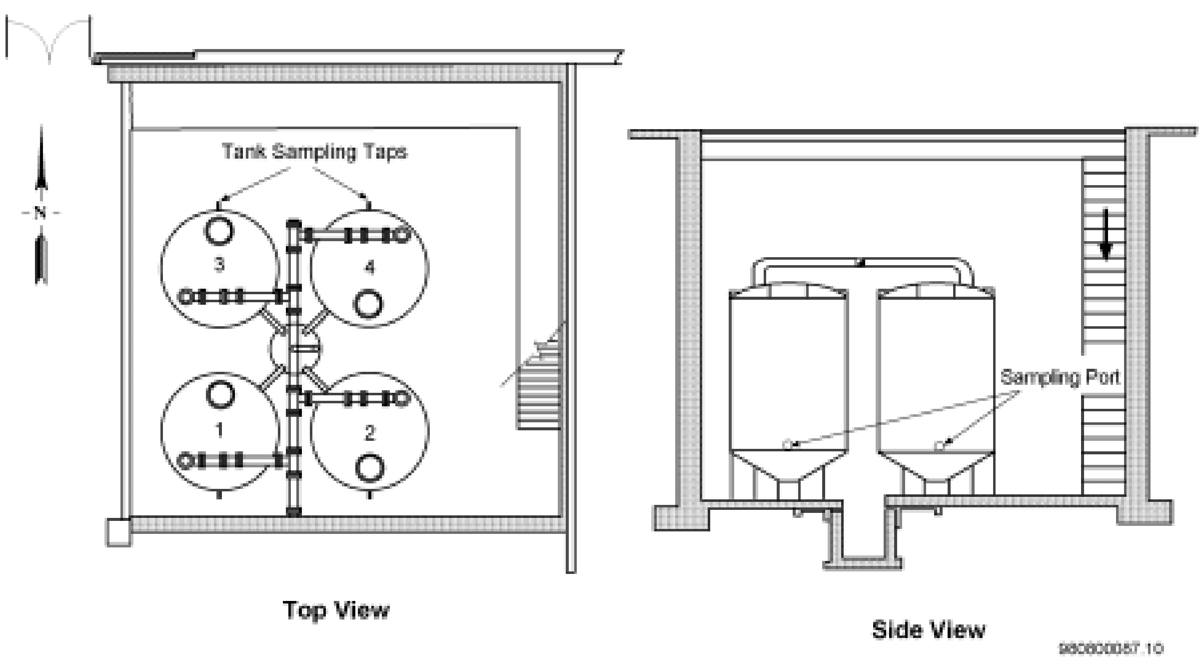

Figure A.5 EMSL Process Sewer Tanks

A.2.15 3718-A & B Buildings

Mission and Activities: As part of Pacific Northwest's cost-efficiency and recycling effort, it is the responsibility of the Laboratory Equipment Pool to bring in equipment that is unused onsite and store it at the 3718-A and –B Buildings for reuse. These buildings also house staff and support general property management functions. The majority of the space is used as general storage of equipment for reuse.

Physical Description: These buildings consist primarily of general warehouse space with some office and shop areas. The 3718-A and -B Buildings are comprised of three separate structures joined together into one building. A total of 9,600 square feet of floor space is provided. All three structures are metal frame and metal covered. It appears that the center structure was added between the two outside structures. This building has its own independent peaked roof.

No central ventilation system is provided; thus, the building is not equipped with filters or sampling systems for airborne emissions. The building is served by the 300 Area SNS and does not have a liquid effluent sampling system.

Radiological Inventory: Equipment with low levels of contamination may be received. Administrative controls are employed to ensure security and little potential of release. Temporary radioactive material areas may be set up due to receiving equipment with internal radioactive sources. A radiation protection technician is contacted to determine the level and the posting that determine the relevant procedure. There was no radioactive inventory reported for the 2000 NESHAP assessment.

Chemical Inventory: Some toxic chemicals may be located in the building, depending on the equipment brought in (e.g., transformers). Maintenance of equipment may generate toxic compounds.

Emission History: N/A. No monitoring or sampling of facility effluents has been required, and no historic data exist.

A.2.16 3718-P Building

Mission and Activities: The 3718-P Building is used as general warehouse space for furniture, filters, and research equipment designated for future use.

Physical Description: The 3718-P Building consists primarily of general warehouse space with 12,000 square feet of floor space. Heaters are available to prevent freezing of the fire sprinkler system. No filtration or sampling system exists for the building. The building is not equipped with process water or sewer systems.

Radiological Inventory: None. Radiological materials are not permitted within this facility.

Chemical Inventory: The 3718-P Building was not designed for storage of chemicals or hazardous materials. Small quantities of hazardous materials may be present in the building for maintenance or repair purposes.

Emission History: N/A. No monitoring or sampling of facility effluents has been required, and no historic data exist.

A.2.17 3718-S Building

Mission and Activities: The 3718-S Building is used as general warehouse space for R&D equipment.

Physical Description: The 3718-S Building consists primarily of general warehouse space with 560 square feet of floor space. The building has a heater, but no active ventilation system and no process water or sewer systems. No effluent sampling systems exist for the building.

Radiological Inventory: None. Radiological materials are not permitted within this facility.

Chemical Inventory: The 3718-S Building was not designed for storage of chemicals or hazardous materials. Small quantities of hazardous materials may be present in the building for maintenance or repair purposes.

Emission History: N/A. No monitoring or sampling of facility effluents has been required, and no historic data exist.

A.2.18 3730 Building

Mission and Activities: The Gamma Irradiation Facility located in the 3730 Building plays an important role in a wide range of programs (e.g., analysis of Hanford waste tank solutions, corrosion and stress-corrosion cracking studies, and the evaluation of various types of probes under irradiated conditions). The effect of gamma radiation on different materials is evaluated. Activities also include measuring the density of materials and the receiving, sorting and shipping of radioactive materials.

Physical Description: The 3730 Building is a one-story concrete block structure of approximately 4,000 square feet and equipped with a hot cell. Exhaust air from the hot cell is HEPA filtered and sampled for radioactive airborne particles before exiting a single emission point. Figure A.6 is a simplified drawing of the ventilation and air emission sampling systems. Sampling system configuration drawings have been developed and are maintained in Pacific Northwest's Essential Drawings System.

The building is served by the 300 Area PS and SNS; the SNS serves the restrooms and lunch rooms, and the PS serves process areas. No liquid effluent sampling system exists for the building.

Radiological Inventory: Curie quantities of radioactive materials in solid form are stored and tested in the building. The 2000 PTE for the building was 3.38E-04 mrem/yr. See Table A.2.

Chemical Inventory: A variety of types and forms of chemicals are used in the building.

Emission History: Radioactive air emissions have been and continue to be measured. Radionuclide air emission data since 1993 are shown in Table 3.1.

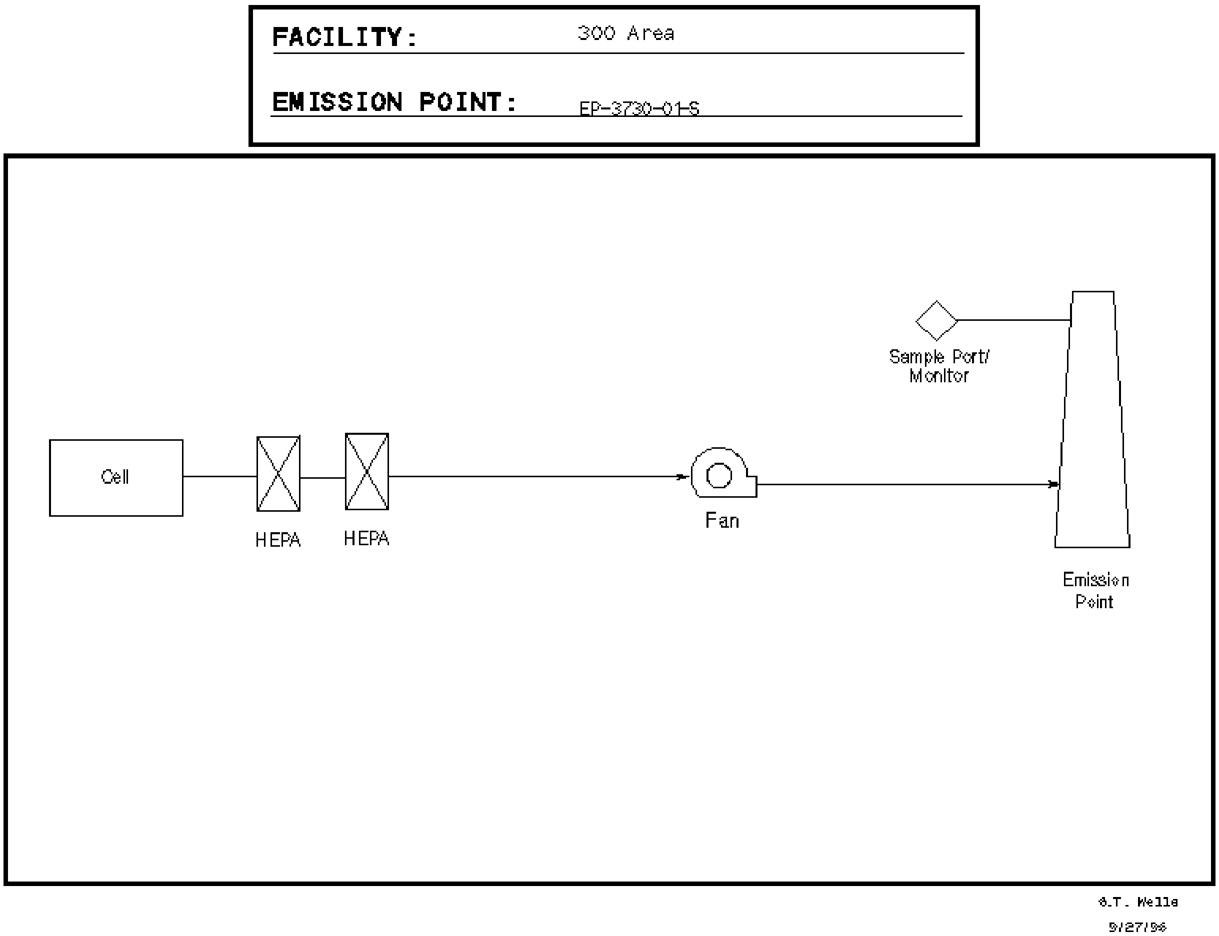

Figure A.6 3730 Building Simplified Ventilation System Drawing

A.2.20 622-A Building

Mission and Activities: The 622-A Building provides housing and protection for the hoisting equipment and electrical controls for the elevator in the adjacent meteorological tower.

Physical Description: The 622-A Building is a small concrete block building with 170 square feet of floor space. The building is not equipped with a ventilation system, water supply, liquid effluent system, or air or liquid sampling systems.

Radiological Inventory: None. Radiological materials are not permitted within this facility.

Chemical Inventory: Chemicals such as oils and grease may be present to support elevator equipment maintenance and repair.

Emission History: N/A. No monitoring or sampling of facility effluents has been required, and no historic data exist.

A.2.21 622-B Building

Mission and Activities: The 622-B Building provides space to store, inflate, and track weather balloons.

Physical Description: The 622-B Building is a small concrete block building with about 150 square feet of floor space. The building is not equipped with a ventilation system, liquid effluent system, or air or liquid sampling systems.

Radiological Inventory: None. Radiological materials are not permitted within this facility.

Chemical Inventory: This building was not designed for storage of chemicals or hazardous materials. Small quantities may be present for maintenance or repair purposes.

Emission History: N/A. No monitoring or sampling of facility effluents has been required, and no historic data exist.

A.2.22 622-C Building

Mission and Activities: The 622-C Building is used for general storage of equipment.

Physical Description: The 622-C Building is a steel storage building with about 1,200 square feet of storage space and a roll-up door. The building is not equipped with ventilation systems, liquid effluent systems, or air or liquid sampling systems.

Radiological Inventory: This building does not normally contain radioactive materials.

Chemical Inventory: This building was not designed for storage of chemicals or hazardous materials. Small quantities of hazardous materials may be present for maintenance or repair purposes.

Emission History: N/A. No monitoring or sampling of facility effluents has been required, and no historic data exist.

A.2.23 622-R Building

Mission and Activities: The 622-R Building is used to store, prepare, and test equipment that is used for measuring meteorological, air quality, atmospheric radiation, and remote sensing before deployment at various field sites. In addition, the building houses the Hanford Meteorology Station (HMS), which includes weather forecasting and observation; data collection, processing, and archival; and instrument calibration and maintenance. The Hanford Meteorology Station (HMS) helps ensure that activities on the Hanford Site that could be severely affected by adverse meteorological conditions can operate in as safe and efficient a manner as possible. In addition, laboratory space is leased to SGN Eurisys Services Group (SESC).

Physical Description: The single-story, concrete block building has about 9,000 square feet of office and laboratory space. Central ventilation is provided, but the building is not equipped with HEPA filtration or a sampling system for airborne emissions. The building is currently connected to a sanitary sewer system in the 600 Area. No liquid effluent sampling system is provided.

Radiological Inventory: The building contains some sealed sources. The 2000 PTE for the building was 0 mrem/yr. See Table A.2.

Chemical Inventory: Chemicals in the building primarily consist of small quantities of laboratory chemicals.

Emission History: N/A. No monitoring or sampling of facility effluents has been required, and no historic data exist. In the past, a septic tank system was used for sanitary sewer, and this tank is still connected. However, the primary path for liquid effluents is to pump waste to a nearby sanitary sewer system.

A.2.24 6652-Dome 1 Building

Mission and Activities: The 6652-Dome 1 Building, an observatory on Rattlesnake Ridge, has been used for atmospheric sciences research.

Physical Description: The 6652-Dome 1 Building has 460 square feet of space. The building has no ventilation or sewer connections and no air or liquid sampling systems.

Radiological Inventory: None

Chemical Inventory: This building was not designed for storing chemicals or hazardous materials. Small quantities of hazardous materials may be present for maintenance or repair purposes.

Emission History: N/A. No monitoring or sampling of facility effluents has been required, and no historic data exist.

A.2.25 6652-E Building

Mission and Activities: The 6652-E Building is used for storage in support of lysimeter measurements, although the lysimeter is currently inactive.

Physical Description: The 6652-E Building is a metal structure with about 600 square feet of floor space. The building has no ventilation or sewer connections and no air or liquid sampling systems.

Radiological Inventory: A few sealed sources associated with lysimeter measuring equipment are stored in the building. There was no inventory reported for the 2000 NESHAP Assessment.

Chemical Inventory: This building was not designed for storing chemicals or hazardous materials. Small quantities of hazardous materials may be present for maintenance or repair purposes.

Emission History: N/A. No monitoring or sampling of facility effluents has been required, and no historic data exist.

A.2.26 6652-L Building

Mission and Activities: The 6652-L Building is used for collaborative physics research on nongravitational interactions and effects between electrically neutral bodies. This work includes two complementary experiments: one to discover whether an undiscovered gravity-like force exists, and another to test part of Newton's law of gravitation.

Physical Description: The 6652-L Building is an underground bunker originally used as a Nike missile launch site. It contains two large underground areas (approximately 4,000 square feet each) that have been converted into labs for the collaborative experiments. The site was selected for the above-mentioned experiments because the bunker was an unused underground structure of adequate size having natural temperature and moisture stability and the site is serviced by electrical power, telephone lines, and an infrequently traveled road (reducing the potential for disturbances).

Radiological Inventory: None. Radiological materials are not permitted within this facility.

Chemical Inventory: Cryogenics only (e.g. nitrogen or helium).

Emission History: N/A. No monitoring or sampling of facility effluents has been required, and no historic data exist.

A.2.27 747-A and TR1 Buildings

Mission and Activities: The 747-A Building is used to provide technical services in internal dosimetry, external dosimetry, instrument calibration, and dosimetry records for 1) protecting the health of workers and the public and 2) providing liability protection for government and industrial customers.

Physical Description: The 747-A Building is a one-story, concrete block building that contains dry laboratory and office space. The adjacent trailer, 747-TR1, contains offices, dry labs, and common space used to support activities conducted within the 747-A Building. The 747-A Building and the adjacent trailer have about 2,000 and 1,600 square feet, respectively. The 747-A Building has a central heating, ventilation, and air conditioning system. Neither building is equipped with a filtration or air sampling system. Sanitary sewer hookup is provided to both buildings to support the change room and bathrooms, but the buildings do not have liquid effluent sampling systems.

Radiological Inventory: The 747-A Building contains a number of sealed sources. The 2000 PTE for the building was 0 mrem/yr. See Table A.2.

Chemical Inventory: Chemicals in the 747-A Building are limited to small quantities of flammable/combustible or corrosive liquids.

Emission History: N/A. No monitoring or sampling of facility effluents has been required, and no historic data exist.

A.2.28 Lysimeters

Mission and Activities: The 100, 300, and 600 Area Lysimeters are used to study the filtration of contaminants through the soil.

Radiological Inventory: Sealed sources may be used at the lysimeter sites to aid in research measurements.

Chemical Inventory: Chemicals are not stored at the lysimeter sites.

Emission History: N/A. No monitoring or sampling of facility effluents has been required, and no historic data exist.

A.2.29 Environmental Monitoring Stations

Mission and Activities: Environmental monitoring stations are positioned at strategic locations around the Hanford Site to aid in sample collection to determine the effects of Hanford Site releases on the environment.

Physical Description: The environmental monitoring stations consist of small enclosures with 50 to 150 square feet of concrete pad as a foundation. No ventilation, water, or sewer systems are provided.

Radiological Inventory: None

Chemical Inventory: No chemicals are stored at the environmental monitoring stations.

Emission History: N/A. No monitoring or sampling of facility effluents has been required, and no historic data exist.

A.2.30 361 Building

Mission and Activities: The 361 Building is used in support of Comprehensive Test Ban Treaty (CBTB) studies. The objective of the CTBT program is to monitor ambient air for the presence of radionuclides that would result from the detonation of nuclear weapons. The 361 Building is used for research and development of the air monitoring equipment as well as a training facility for personnel that may use these systems worldwide. Ambient air is sampled and then routed to the detection instruments. After the analysis is complete then the air is exhausted through stacks that are on the roof of the building.

Physical Description: The 361 Building measures 12 feet by 33 feet and is constructed of prefabricated concrete. It was purchased and erected in 1999. Two small stacks are located at the top of the building. These stacks are not registered with the state.

Radiological Inventory: Sealed Sources for instrument calibrations.

Chemical Inventory: None

Emission History: N/A. No monitoring or sampling of facility effluents has been required.

A.3 References

Ballinger, M.Y., M.J. Sula, K.D. Shields and D.L. Edwards. 1999. Assessment of Unabated Facility Emission Potentials for Evaluating Airborne Radionuclide Monitoring Requirements at Pacific Northwest National Laboratory - 1999. PNL-10855, Rev. 1 AD-902, Pacific Northwest National Laboratory, Richland, Washington.

Appendix B

Supporting Calculations

Building	Emission Point	Sampler Flow, CFM	Stack Flow CFM	Detectable Release		Penetration Efficiency	Transp. Factor
				Alpha, Ci	Beta, Ci		
EMSL	EP-3020-01S	1.8	6780	1.41E-07	5.35E-06	90 - 105	0.9
305-B	EP-305B-01-S	3.5	1100	1.10E-08	4.18E-07	96 - 117	0.96
306-W	EP-306W-03-V	3.2	26800	3.03E-07	1.15E-05	93 - 118	0.93
318	EP-318-01-S	1.6	486	1.10E-08	4.17E-07	93 - 101	0.93
320	EP-320-01-S	2.5	29500	4.31E-07	1.64E-05	92 - 108	0.92
320	EP-320-02-S	1.3	517	1.61E-08	6.12E-07	83 - 97	0.83
320	EP-320-03-S	1.5	432	1.20E-08	4.54E-07	81 - 103	0.81
320	EP-320-04-S	1.5	406	1.12E-08	4.27E-07	81 - 96	0.81
323	EP-323-01-S	1.5	4940	1.58E-07	6.01E-06	70 - 97	0.7
326	EP-326-01-S	2.1	52400	8.92E-07	3.39E-05	94 - 110	0.94
329	EP-329-01-S	2.6	46800	6.58E-07	2.50E-05	92 - 108	0.92
3730	EP-3730-01-S	2.4	348	5.08E-09	1.93E-07	96 - 102	0.96
MDA alpha	1	pCi/sample					
MDA beta	38	pCi/sample					
Yr Fraction	0.04	2 wk sample					
Lab Corr Factor	0.85						
Op Factor	1						
Transp. Factor	as given						
Media Factor	0.91						
Detectable Release =		(MDA / Yr fraction) x (stack flow/sample flow) x 1E-12					
		Lab Corr. factor x Op. Factor x Transport Factor x Media Factor					

EMSL = Environmental Molecular Sciences Laboratory
MDA = Minimum Detectable Activity

Table B.1. Supporting Calculations

(Sampler Flow and Stack Flow from Table C.2, Facility Airborne Particulate Radionuclide Emission Sampling Summary-1999 (Annual Report) (PNNL 2000), Penetration Efficiencies from Appendix A of same report.)

References

PNNL 2000, Battelle's Pacific Northwest National Laboratory Facility Airborne Particulate Radionuclide Emissions Sampling Summary-1999. Pacific Northwest National Laboratory, Richland, Washington.

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Appendix C

306-W Building

C.1.0 Mission and Activities

In the past, the 306-W Building has been used for research programs involving metal processing and component fabrication such as the U.S. Army's depleted uranium penetrator program and the USCAR initiative. The penetrator program involved the heat treatment, forming, and machining of depleted uranium bars into penetrator designs. The USCAR initiative supported the research and development of lightweight metal matrix composite materials and superplastic aluminum material for major domestic automotive manufacturers. This work included advanced casting technology, test-specimen fabrication, and material testing of the metal matrix composite material and the heat treatment, machining, and testing of the superplastic aluminum material. Some metal work and storage of bulk metal still occur in the building, but a large portion of the building has been shut down. In addition to the residual metal work, the building is used for Pacific Northwest National Laboratory (Pacific Northwest) waste operations activities, including catalytic electrochemical oxidation (a waste treatment process); low-level waste repackaging; redistribution of chemical inventories; and waste storage and treatment, shipping, and receiving.

C.2.0 Physical Description

The 306-W Building (Figure C.1) is a two-story, steel-framed structure with about 36,000 square feet of floor space, including large high-clearance process areas for metalworking and a two-story office addition. The building consists primarily of office and dry and wet laboratory space. The building has four emission points for radioactive air emissions, but three of these have been capped when a large portion of the building was shut down in 1996 as part of Pacific Northwest's facility transition project. The single emission point remaining is equipped with HEPA filtration and a sampling system that samples for particulate material.

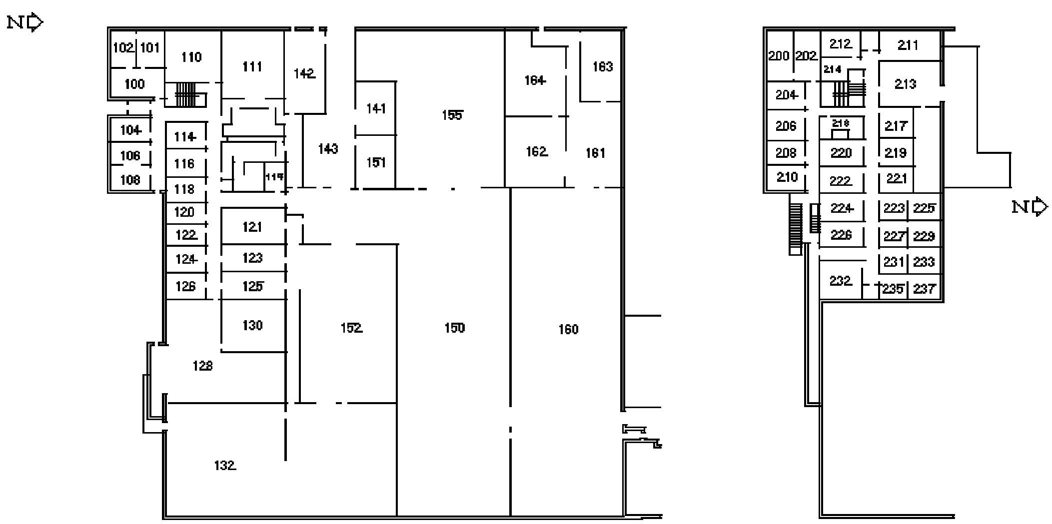

Figure C.1 306-W Building First- and Second-Floor Plans

Figure C.2 is a simplified drawing of the ventilation and air emission sampling systems. Ventilation and sampling system configuration drawings have been developed and are maintained in Pacific Northwest's Essential Drawings System.

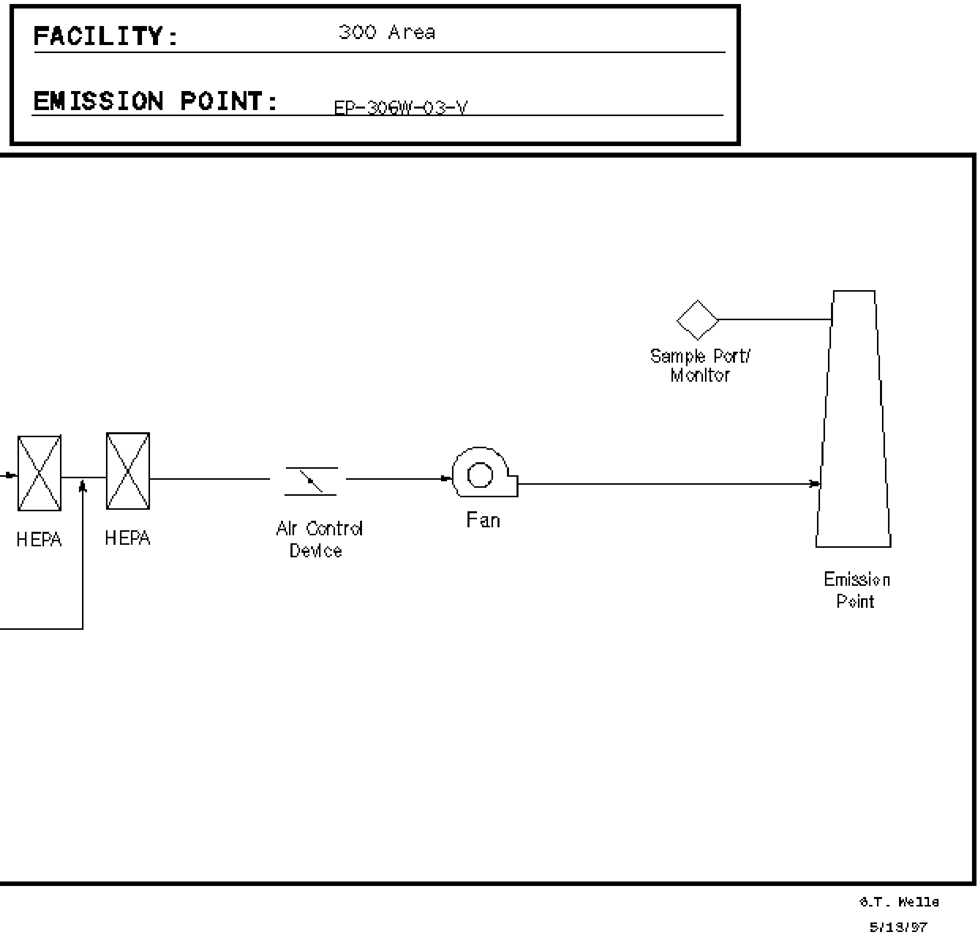

Figure C.2 306-W Building Simplified Ventilation System Drawing

The building is served by the 300 Area PS and SNS; the SNS serves the restrooms and lunchrooms, and the PS serves process areas. The building is also equipped with a closed-loop cooling system. In the past, failure of this system has resulted in the triggering of single-pass cooling, causing large quantities of water to be discharged to the process sewer. However, this failure mode was corrected in 1996, eliminating the potential for this discharge.

C.3.0 Radiological Inventory

Radiological inventories in the 306-W Building include large quantities of depleted uranium bulk metal alloy, smaller quantities of enriched uranium in the building exhaust as holdup from previous operations, and some sealed sources. The 2000 PTE for the building is 1.60E-03 mrem/yr.

C.4.0 Chemical Inventory

A variety of types and forms of chemicals are used in the 306-W Building. A chemical inventory is maintained using Pacific Northwest's CMS. The inventory information includes the location, chemical name, and quantity. In some cases the manufacturer and individual container quantities are also tracked. In addition, the CMS data includes the RQ of the chemical. RQs are obtained from 40 CFR 302 (EPA 1997) and are the amounts that, if released to the environment from a facility, require notification to the National Response Center. DOE/RL-91-50, Rev. 2 (DOE 2000) establishes commitments to prepare FEMPs for any facility with the potential to release any chemical in quantities greater than the RQs. Although it is unlikely that RQ quantities of chemicals could be released from any Pacific Northwest facility, the chemical loading in the 306-W Building is variable and RQ amounts of chemicals could be present in the facility, depending on ongoing research and support activities.

At present, only one chemical (sodium hypochlorite) is listed in the CMS as being present above the RQ of 100 lbs. However, this chemical is in more than one container of cleaning products, is present in low concentrations, and due to engineered and administrative controls, is not likely to be released to the environment.

The CMS listing showing the types and quantities of chemicals in the building with RQ values is provided in Table C.1. This listing was obtained on the date shown on the table and may not be the current inventory, but is indicative of the types of chemicals likely to be found. Current inventory information can be obtained from the CMS.

Table C.1

CMS Reportable Quantity Inventory Listing

For: 306W-MATERIALS DEVELOPMENT LABORATORY
Above 0 % of Reportable Quantity

RQ Grp	Chemical name	CAS No.	Quantity	RQ Value
QB	SODIUM HYPOCHLORITE	7681-52-9	147.51 LBS	100 LBS
QB	XYLENE	1330-20-7	37.93LBS	100 LBS
QC	1,1,1-TRICHLOROETHANE	71-55-6	2.79 LBS	1000 LBS
QC	NITRIC ACID	7697-37-2	0.03 LBS	1000 LBS
QC	POTASSIUM HYDROXIDE	1310-58-3	0.18 LBS	1000 LBS
QC	SODIUM HYDROXIDE	1310-73-2	110.41 LBS	1000 LBS
QC	SULFURIC ACID	7664-93-9	0.43 LBS	1000 LBS
QD	ACETONE	67-64-1	3.39 LBS	5000 LBS
QD	METHYL ALCOHOL	67-56-1	0.09 LBS	5000 LBS
	Last updated 08/07/00.			

C.5.0 Emission History

Radioactive air emissions have been and continue to be measured in the 306-W Building. Radionuclide air emission data since 1993 are shown in Table 3.1. Monitoring of CO_2, total organic carbon, and gas chromatograph measurements of the Catalytic Electrochemical Oxidation Waste Treatment Unit emissions are required by a NOC issued by the Washington State Department of Ecology (WDOE 1998).

Although this building does not have a liquid effluent sampling system, the PS was sampled with a portable sampler during the sampling campaign conducted by Pacific Northwest Effluent Management Group staff in 1994 and 1995 (Thompson et al. 1997). No continued liquid effluent sampling is required for this facility. Table C.2 provides a summary of the results of the sampling campaign. These results show generally low concentrations (parts per billion) of pollutants, less than the sewer system waste acceptance criteria. An additional sample taken in 2000 showed negligible concentrations of tritium, gross alpha, and gross beta (McCarthy and Ballinger 2000, Appendix B).

Table C.2 Constituents Detected in Building 306W Samples

Constituent	Frequency[1]	Concentration (µg/L)[2]		
		Range	Average	Standard Deviation[3]
General Chemical Parameters				
Alkalinity	7/7	60,000 – 120,000	83,000	25,000
Chemical Oxygen Demand	7/7	4500 – 13,000	9000	2800
Conductivity	8/8	170 – 320	230	55
pH	8/8	6.2 – 8.3	7.4	0.87
Total carbon	8/8	18,000 – 30,000	23,000	4500
Total dissolved solids	7/7	100,000 – 180,000	140,000	34,000
Total organic carbon	8/8	2000 – 15,000	4600	4300
Ammonia and Anions				
Ammonia	4/7	40 - 100	58	29
Chloride	7/7	4700 – 12,000	7300	2500
Fluoride	6/7	230 – 460	350	100
Nitrate	7/7	1500 – 14,000	7900	4800
Sulfate	7/7	13,000 – 23,000	17,000	2900
Sulfides	3/7	220 – 300	270	46
Metals				
Aluminum	6/8	33 – 190	74	60
Arsenic	1/8	-	2.8	-
Barium	8/8	26 – 43	34	5
Beryllium	1/8	-	0.19	-
Calcium	8/8	22,000 – 41,000	30,000	6800
Chromium	1/8	-	5.0	-
Copper	8/8	9.4 – 56	20	17
Iron	8/8	160 – 910	350	320
Lead	3/8	3.2 – 7.2	5.4	2.0
Magnesium	8/8	4800 – 8800	6500	1400
Manganese	8/8	7.2 – 27	16	6.4
Mercury	2/8	0.083 – 0.084	0.084	-
Potassium	8/8	1200 – 3100	1900	710
Selenium	1/8	-	0.73	-
Silver	1/8	-	3.6	-
Sodium	8/8	3400 – 11,000	6300	2600
Thallium	1/8	-	0.88	-
Zinc	8/8	66 – 280	110	77
Volatile Organic Compounds				
Acetone	2/9	14 – 15	15	-
Bromoform	1/9	-	2.0	-
Chloroform	8/9	0.9 – 1.8	1.4	0.3
Methylene chloride	2/9	1.1 – 1.2	1.1	-
Radiological Parameters				
Gross Alpha	8/8	0.93 - 6.4	3.5	0.56
Gross beta	6/8	2.4 – 20	7.0	2.7
Tritium	3/8	290 – 690	430	130

1 Number of samples with detectable concentrations/total number of samples analyzed.
2 Conductivity units are µmhos/cm and radiological parameters are pCi/L.
3 Two times the standard error of the mean for radiological parameters.

C.6.0 Facility Effluent Pathway Drawings

The official up-to-date version can be obtained from Battelle Engineering Files.

C.7.0 References

DOE 2000. *Environmental Monitoring Plan,* DOE/RL-91-50, Rev 3, United States Department of Energy, Richland Operations Office, Richland, Washington.

EPA 1997. *Reportable Quantities*. 40 Code of Federal Regulations (CFR) 302.4. U.S. Code of Federal Regulations. U.S. Environmental Protection Agency. Washington D.C.

McCarthy, M.J. and M.Y. Ballinger. 2000. *Liquid Waste Certification Plan for Pacific Northwest National Laboratory*. PNNL-13276, Pacific Northwest National Laboratory, Richland, Washington.

Thompson, C.J., M.Y. Ballinger, E.G. Damberg, and R.G. Riley. 1997. *Characterization and Monitoring of 300 Area Facility Liquid Waste Streams During 1994 and 1995*. PNNL-11552, Pacific Northwest National Laboratory, Richland, Washington.

Washington Department of Ecology. 1998. *A Nonradioactive Air Emissions Notice of Construction for the 306-W Building and Catalytic Electorchemical Oxidation Unit for the Department of Energy-RL*. DE 98NWP-002. Washington State Department of Ecology, Kennewick, Washington.

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Appendix D

320 Building

D.1.0 Mission and Activities

Research activities conducted in the 320 Building involve special-purpose separation and analytical chemistry techniques that allow measurement of low-level and ultra-trace levels of material in environmental samples. Working with samples containing low/trace levels requires special building features, such as a clean zone. A class 10000 clean zone allows for contamination-free preparation and analysis of samples containing extremely low levels of indicator radionuclides and trace organic compounds. Special instrumentation that is used for sample analysis includes various mass spectrometers, electron-beam microscopes, X-ray diffraction, and radiation counters.

D.2.0 Physical Description

The 320 Building consists primarily of two floors, one at ground level and a basement (see Figures D.1 and D.2). A self- contained addition was added consisting of four labs and eight offices attached at both levels to the west end of the older building. Three small equipment rooms are located in the new addition with one large equipment room in the older portion using the southeast corner of the basement. Half of the older portion ground-level laboratory space is "clean zone" modular rooms with HEPA filtered supply air. The total square footage for the building is about 31,000.

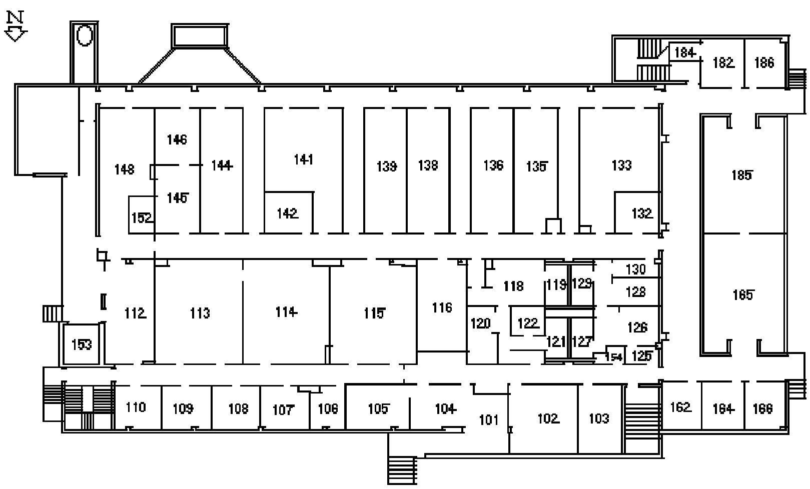

Figure D.1 320 Building – First Floor

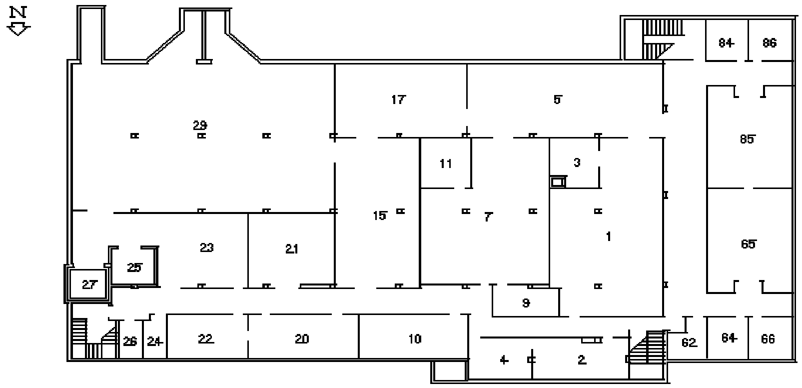

Figure D.2 320 Building – Basement

The 320 Building has four emission points, and each emission point has a particulate sampling system. All four emission points are HEPA filtered. Figures D.3 through D.6 are simplified drawings of the ventilation and air-emission sampling systems. Sampling system configuration drawings have been developed and are maintained in Pacific Northwest National Laboratory's (Pacific Northwest's) Essential Drawings System.

The 320 Building is served by the 300 Area PS and SNS; the SNS serves the restrooms and lunchrooms, and the PS serves process areas. The building is equipped with a liquid effluent sampling system on the PS that includes capability for continuously monitoring pH, conductivity, and flow, as well as capability for obtaining flow-composite samples.

D.3.0 Radiological Inventory

The 320 Building contains small quantities (millicuries or less) of radioactive materials in various forms. The 2000 PTE for the building is 7.76E-04 mrem/year.

D.4.0 Chemical Inventory

A variety of types and forms of chemicals are used in the 320 Building. A chemical inventory is maintained using Pacific Northwest's CMS. The inventory information includes the location, chemical name, and quantity. In some cases the manufacturer and individual container quantities are also tracked. In addition, the CMS data includes the RQ of the chemical. RQs are obtained from 40 CFR 302 (EPA 1997) and are the amounts that, if released to the environment from a facility, require notification to the National Response Center. DOE/RL-91-50, Rev. 2 (DOE 2000) establishes commitments to prepare Facility Effluent Monitoring Plans for any facility with the potential to release any chemical in quantities greater than RQs. Although it is unlikely that RQ quantities of chemicals could be released from any Pacific Northwest facility, the chemical loading in the 320 Building is variable and RQ amounts of chemicals could be present in the facility depending on ongoing research and support activities.

A few chemicals are currently present above their RQ values (see Table D.1). However, these chemicals are in more than one container and many containers have reduced concentrations. Due to these factors and engineered and administrative controls, there is little potential to release RQ amounts of chemicals to the environment.

The CMS listing showing the types and quantities of chemicals in the building with RQ values is provided in Table D.2. This listing was obtained on the date shown on the table and may not be the current inventory but is indicative of the types of chemicals likely to be found. Current inventory information can be obtained from the CMS.

D.5.0 Emission History

Radioactive air emissions have been and continue to be measured. Radionuclide air emission data since 1993 are shown in Table 3.1.

This building is equipped with a liquid effluent sampling system for the PS and was sampled during the sampling campaign conducted by Pacific Northwest's Effluent Management staff in 1994 and 1995 (Thompson et al. 1997). No continued liquid effluent sampling is required for this facility. Table D.3 provides a summary of the results of the sampling campaign. These results show generally low concentrations (parts per billion) of pollutants, less than the sewer system waste acceptance criteria. Additional sampling in 1998 and 2000 confirm the low concentrations of pollutants (McCarthy and Ballinger 2000, Appendices A and B).

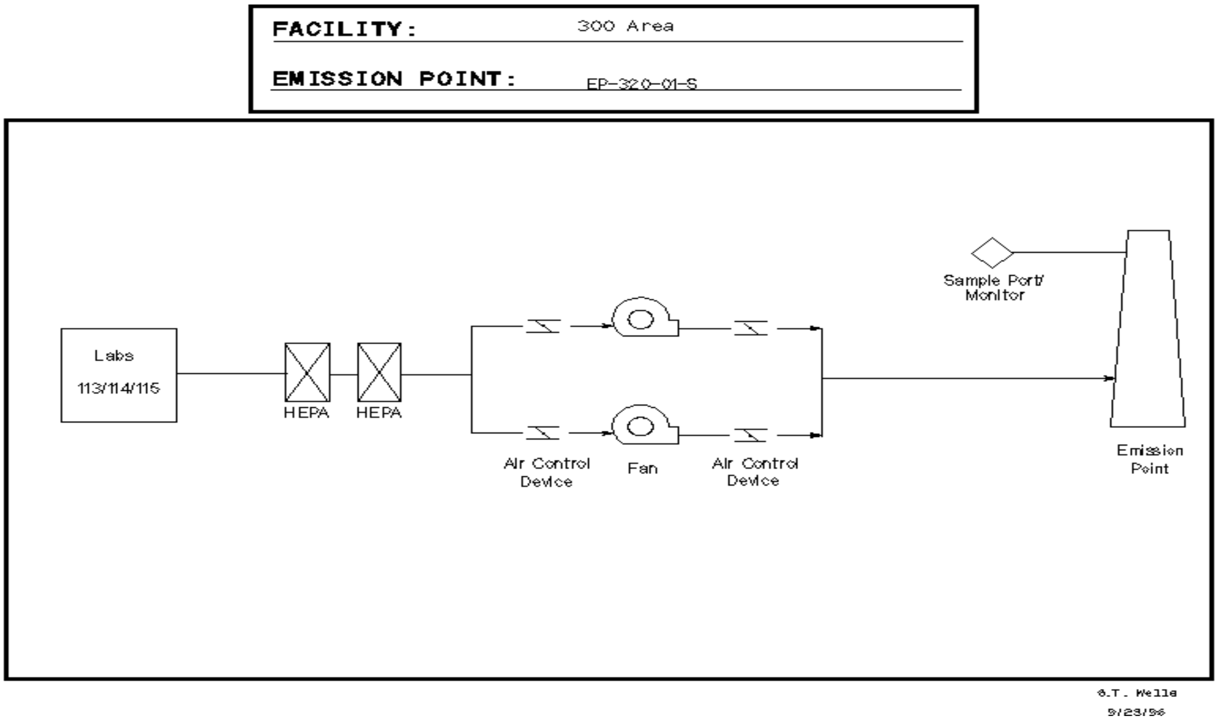

Figure D.3 EP-320-01-S Simplified Ventilation System Drawing

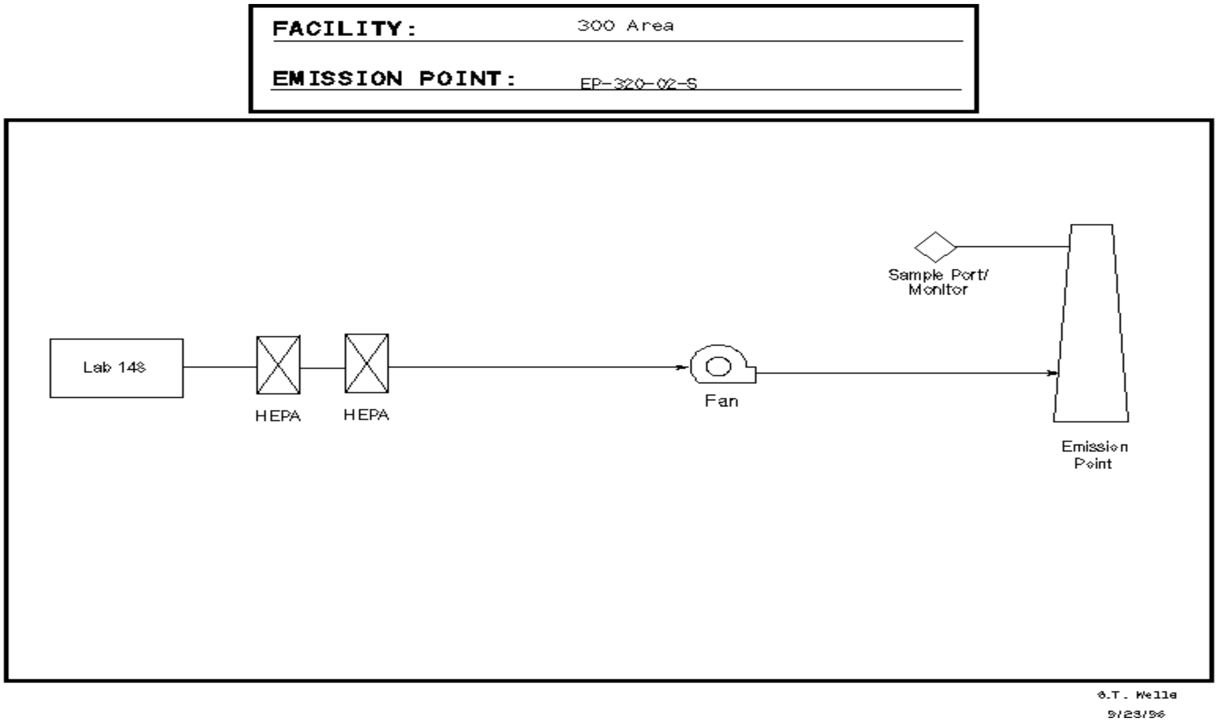

Figure D.4 EP-320-02-S Simplified Ventilation System Drawing

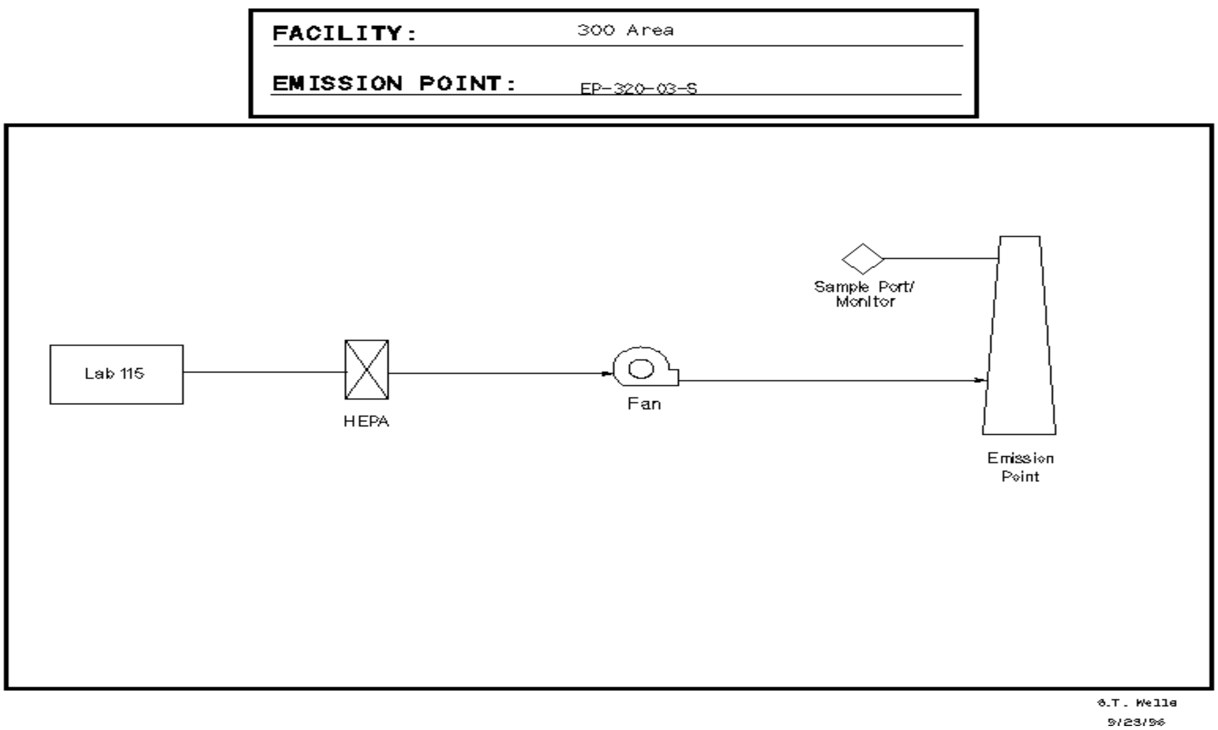

Figure D.5 EP-320-03-S Simplified Ventilation System Drawing

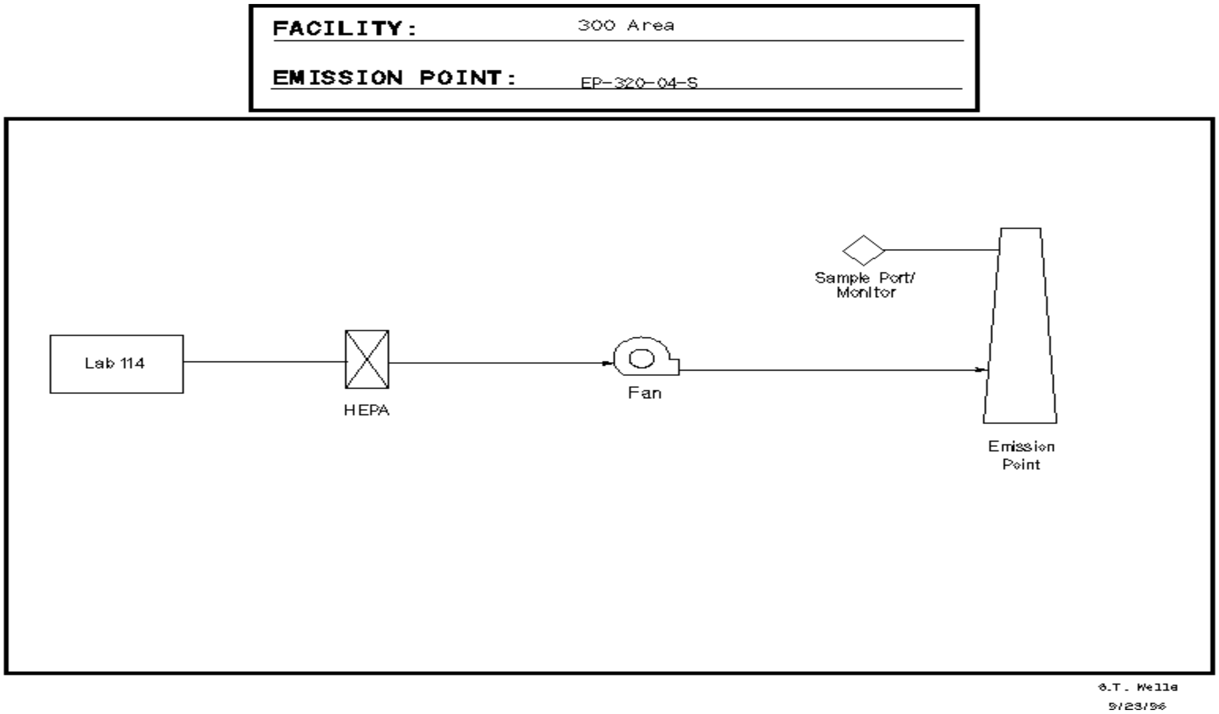

Figure D.6 EP-320-04-S Simplified Ventilation System Drawing

Table D.1

CMS Reportable Quantity Inventory Listing

For: 320-ANALYTICAL AND NUCLEAR RESEARCH LABORATORY
Above 100 % of Reportable Quantity

RQ Grp	Chemical Name	CAS No.	Quantitiy	RQ Value
QX	CHLORPYRIFOS	2921-88-2	1.09 LBS	1 LB
QX	SILVER NITRATE	7761-88-8	3.8 LBS	1 LB
QA	CARBON TETRACHLORIDE	56-23-5	13.27 LBS	10 LBS
QA	CHLOROFORM	67-66-3	17.81 lbs	10 LBS
QB	SODIUM HYPOCHLORITE	7681-52-9	148.71 LBS	100 LBS

Last updated 08/22/00.

Table D.2

CMS Reportable Quantity Inventory Listing

For: 320-ANALYTICAL AND NUCLEAR RESEARCH LABORATORY
Above 0 % of Reportable Quantity

RQ Grp	Chemical Name	CAS No	Quantity Units	RQ Value
QX	ACROLEIN	107-02-8	0.02 LBS	1 LB
QX	ALDICARB	116-06-3	0.00 LBS	1 LB
QX	BENZO(A)PYRENE	50-32-8	0.00 LBS	1 LB
QX	CHLORPYRIFOS	2921-88-2	1.09 LBS	1 LB
QX	DDT	50-29-3	0.00 LBS	1 LB
QX	DIAZINON	333-41-5	0.33 LBS	1 LB
QX	DISULFOTON	298-04-4	0.01 LBS	1 LB
QX	ENDRIN	72-20-8	0.00 LBS	1 LB
QX	HEPTACHLOR	76-44-8	0.00 LBS	1 LB
QX	LINDANE	58-89-9	0.01 LBS	1 LB
QX	METHOXYCHLOR	72-43-5	0.00 LBS	1 LB
QX	SILVER NITRATE	7761-88-8	3.80 LBS	1 LB
QA	1,2-BENZANTHRACENE	56-55-3	0.00 LBS	10 LBS
QA	2,4-DINITROPHENOL	51-28-5	0.01 LBS	10 LBS
QA	2,4-DINITROTOLUENE	121-14-2	0.00 LBS	10 LBS
QA	2-AMINONAPHTHALENE	91-59-8	0.00 LBS	10 LBS
QA	BENZENE	71-43-2	1.92 LBS	10 LBS
QA	BERYLLIUM	7440-41-7	0.00 LBS	10 LBS
QA	CARBOFURAN	1563-66-2	0.00 LBS	10 LBS
QA	CARBON TETRACHLORIDE	56-23-5	13.27 LBS	10 LBS
QA	CHLOROFORM	67-66-3	17.81 LBS	10 LBS
QA	CHROMIUM (VI) OXIDE	1333-82-0	0.06 LBS	10 LBS
QA	COPPER (I) CYANIDE	544-92-3	1.00 LBS	10 LBS
QA	COPPER(II) CHLORIDE	7447-39-4	0.06 LBS	10 LBS
QA	COUMAPHOS	56-72-4	0.01 LBS	10 LBS
QA	CUPRIC SULFATE	7758-98-7	1.00 LBS	10 LBS
QA	DIBUTYL PHTHALATE	84-74-2	1.09 LBS	10 LBS
QA	DIMETHOATE	60-51-5	0.01 LBS	10 LBS
QA	ETHION	563-12-2	0.01 LBS	10 LBS
QA	HEXACHLOROBENZENE	118-74-1	0.01 LBS	10 LBS
QA	LEAD	7439-92-1	1.14 LBS	10 LBS
QA	LEAD CHLORIDE	7758-95-4	1.00 LBS	10 LBS
QA	LEAD NITRATE	10099-74-8	2.00 LBS	10 LBS
QA	MERCURIC NITRATE, MONOHYDRATE	10045-94-0	0.25 LBS	10 LBS
QA	METHYL ISOCYANATE	624-83-9	0.00 LBS	10 LBS
QA	NITROGEN DIOXIDE	10102-44-0	5.00 LBS	10 LBS
QA	NITROGLYCERIN	55-63-0	0.03 LBS	10 LBS
QA	PARATHION	56-38-2	0.02 LBS	10 LBS
QA	PENTACHLOROBENZENE	608-93-5	0.01 LBS	10 LBS
QA	PENTACHLOROPHENOL	87-86-5	0.05 LBS	10 LBS
QA	PHORATE	298-02-2	0.01 LBS	10 LBS
QA	POTASSIUM CHROMATE	7789-00-6	0.25 LBS	10 LBS
QA	POTASSIUM CYANIDE	151-50-8	1.10 LBS	10 LBS
QA	POTASSIUM DICHROMATE	7778-50-9	1.00 LBS	10 LBS
QA	THIOACETAMIDE	62-55-5	0.44 LBS	10 LBS

RQ Grp	Chemical Name	CAS No	Quantity Units	RQ Value
QB	1,2,4-TRICHLOROBENZENE	120-82-1	1.62 LBS	100 LBS
QB	1,2-DICHLOROBENZENE	95-50-1	0.01 LBS	100 LBS
QB	1,3-DICHLOROBENZENE	541-73-1	0.01 LBS	100 LBS
QB	1,4-DIETHYLENE DIOXIDE	123-91-1	2.27 LBS	100 LBS
QB	2,4-DICHLOROPHENOXYACETIC ACID	94-75-7	0.01 LBS	100 LBS
QB	2,6-DINITROTOLUENE	606-20-2	0.06 LBS	100 LBS
QB	4-NITROPHENOL	100-02-7	0.12 LBS	100 LBS
QB	AMMONIUM FLUORIDE	12125-01-8	2.55 LBS	100 LBS
QB	AMMONIUM SULFIDE	12135-76-1	1.00 LBS	100 LBS
QB	BIPHENYL	92-52-4	0.01 LBS	100 LBS
QB	BIS(2-ETHYLHEXYL) PHTHALATE	117-81-7	0.02 LBS	100 LBS
QB	CATECHOL	120-80-9	0.01 LBS	100 LBS
QB	CHLOROACETIC ACID	79-11-8	2.44 LBS	100 LBS
QB	CHLOROBENZENE	108-90-7	0.07 LBS	100 LBS
QB	CHRYSENE	218-01-9	0.00 LBS	100 LBS
QB	CROTONALDEHYDE	4170-30-3	0.01 LBS	100 LBS
QB	CUPRIC NITRATE	3251-23-8	0.80 LBS	100 LBS
QB	CYSTEINE, N-ACETYL-, L-	63-25-2	0.00 LBS	100 LBS
QB	DICHLOROPROPENE	542-75-6	0.01 LBS	100 LBS
QB	DIURON	330-54-1	0.00 LBS	100 LBS
QB	ETHYL ETHER	60-29-7	0.16 LBS	100 LBS
QB	ETHYLENE DICHLORIDE	107-06-2	0.87 LBS	100 LBS
QB	FERROUS CHLORIDE	7758-94-3	5.00 LBS	100 LBS
QB	FORMALDEHYDE W/O METHANOL	50-00-0	0.49 LBS	100 LBS
QB	HYDROFLUORIC ACID		5.22 LBS	100 LBS
QB	HYDROQUINONE	123-31-9	4.30 LBS	100 LBS
QB	IODOMETHANE	74-88-4	0.44 LBS	100 LBS
QB	MALATHION	121-75-5	0.02 LBS	100 LBS
QB	METHYL PARATHION	298-00-0	0.01 LBS	100 LBS
QB	NAPHTHALENE	91-20-3	0.55 LBS	100 LBS
QB	NICKEL	7440-02-0	0.75 LBS	100 LBS
QB	NICKEL (II) SULFATE	7786-81-4	1.00 LBS	100 LBS
QB	NICKEL NITRATE	14216-75-2	0.02 LBS	100 LBS
QB	NICKEL(II) CHLORIDE	7718-54-9	2.11 LBS	100 LBS
QB	NICOTINE	54-11-5	0.00 LBS	100 LBS
QB	PHENOL, 2,2'-METHYLENEBIS(3,4,6-TRICHLOR	70-30-4	0.00 LBS	100 LBS
QB	POTASSIUM PERMANGANTE	7722-64-7	2.00 LBS	100 LBS
QB	SELENIUM	7782-49-2	1.21 LBS	100 LBS
QB	SODIUM HYPOCHLORITE	7681-52-9	148.71 LBS	100 LBS
QB	SODIUM NITRITE	7632-00-0	3.48 LBS	100 LBS
QB	THALLIUM CHLORIDE	7791-12-0	0.02 LBS	100 LBS
QB	TRICHLORO PHENOXYPROPIONIC ACID	93-72-1	0.00 LBS	100 LBS
QB	XYLENE	1330-20-7	4.50 LBS	100 LBS
QB	XYLENE, P-	106-42-3	0.04 LBS	100 LBS
QC	1,1,1-TRICHLOROETHANE	71-55-6	0.03 LBS	1000 LBS
QC	2,2,4-TRIMETHYLPENTANE, HYDROCARBON KIT	540-84-1	108.25 LBS	1000 LBS
QC	2,4,5-TRICHLOROPHENOXYACETIC ACID	93-76-5	0.00 LBS	1000 LBS
QC	3,6-DICHLORO-2-METHOXYBENZOIC ACID	1918-00-9	0.00 LBS	1000 LBS
QC	ACETALDEHYDE	75-07-0	0.01 LBS	1000 LBS
QC	AMMONIUM HYDROXIDE	1336-21-6	46.45 LBS	1000 LBS
QC	ANTIMONY TRICHLORIDE	10025-91-9	1.00 LBS	1000 LBS
QC	ANTIMONY TRIOXIDE	1309-64-4	1.10 LBS	1000 LBS

RQ Grp	Chemical Name	CAS No	Quantity Units	RQ Value
QC	CYCLOHEXANE	110-82-7	5.29 LBS	1000 LBS
QC	DIETHYL PHTHALATE	84-66-2	0.04 LBS	1000 LBS
QC	ETHYLBENZENE	100-41-4	0.04 LBS	1000 LBS
QC	FERRIC NITRATE CRYSTALLINE AR GRADE	10421-48-4	1.00 LBS	1000 LBS
QC	FERRIC SULFATE	10028-22-5	1.00 LBS	1000 LBS
QC	GLYCOL ETHER	110-80-5	2.05 LBS	1000 LBS
QC	HYDROGEN PEROXIDE	7722-84-1	1.82 LBS	1000 LBS
QC	IRON(II) SULFATE	7720-78-7	1.00 LBS	1000 LBS
QC	IRON(III) CHLORIDE	7705-08-0	3.02 LBS	1000 LBS
QC	M-XYLENE	108-38-3	0.04 LBS	1000 LBS
QC	METHYL METHACRYLATE	80-62-6	1.10 LBS	1000 LBS
QC	METHYLENE CHLORIDE	75-09-2	127.01 LBS	1000 LBS
QC	NITRIC ACID	7697-37-2	95.97 LBS	1000 LBS
QC	NITROBENZENE	98-95-3	0.01 LBS	1000 LBS
QC	O-XYLENE	95-47-6	0.06 LBS	1000 LBS
QC	PHENOL	108-95-2	1.10 LBS	1000 LBS
QC	PHENOL LIQUID		0.00 LBS	1000 LBS
QC	PHOSPHOROTHIOIC ACID, O,O-DIMETHYL O-[P-	52-85-7	0.00 LBS	1000 LBS
QC	POTASSIUM HYDROXIDE	1310-58-3	1.77 LBS	1000 LBS
QC	PROPIONALDEHYDE	123-38-6	0.01 LBS	1000 LBS
QC	PYRIDINE SILYLATION GRADE	110-86-1	2.10 LBS	1000 LBS
QC	SILVER	7440-22-4	0.34 LBS	1000 LBS
QC	SODIUM AZIDE	26628-22-8	0.06 LBS	1000 LBS
QC	SODIUM FLUORIDE	7681-49-4	1.33 LBS	1000 LBS
QC	SODIUM HYDROXIDE	1310-73-2	32.78 LBS	1000 LBS
QC	SULFURIC ACID	7664-93-9	21.17 LBS	1000 LBS
QC	TETRAHYDROFURAN	109-99-9	3.91 LBS	1000 LBS
QC	TOLUENE	108-88-3	23.92 LBS	1000 LBS
QC	VANADIUM PENTAOXIDE	1314-62-1	1.00 LBS	1000 LBS
QC	ZINC BROMIDE	7699-45-8	0.06 LBS	1000 LBS
QC	ZINC CHLORIDE	7646-85-7	0.06 LBS	1000 LBS
QD	1,2,4,5-TETRACHLOROBENZENE	95-94-3	0.00 LBS	5000 LBS
QD	1,3-DICHLOROPROPANE	142-28-9	0.01 LBS	5000 LBS
QD	4-NITROANILINE	100-01-6	0.22 LBS	5000 LBS
QD	ACETIC ACID	64-19-7	40.55 LBS	5000 LBS
QD	ACETIC ANHYDRIDE	108-24-7	1.19 LBS	5000 LBS
QD	ACETONE	67-64-1	62.48 LBS	5000 LBS
QD	ACETONITRILE	75-05-8	89.08 LBS	5000 LBS
QD	ALUMINUM SULPHATE	10043-01-3	1.00 LBS	5000 LBS
QD	AMMONIUM ACETATE	631-61-8	0.11 LBS	5000 LBS
QD	AMMONIUM BICARBONATE	1066-33-7	1.10 LBS	5000 LBS
QD	AMMONIUM CARBONATE	506-87-6	6.61 LBS	5000 LBS
QD	AMMONIUM CHLORIDE	12125-02-9	2.00 LBS	5000 LBS
QD	AMMONIUM CITRATE, DIBASIC	3012-65-5	2.00 LBS	5000 LBS
QD	AMMONIUM OXALATE MONOHYDRATE, 99+%, A.C.	6009-70-7	3.30 LBS	5000 LBS
QD	AMMONIUM THIOCYANATE	1762-95-4	3.00 LBS	5000 LBS
QD	ANTHRACENE	120-12-7	0.50 LBS	5000 LBS
QD	ANTIMONY	7440-36-0	0.30 LBS	5000 LBS
QD	BENZOIC ACID	65-85-0	1.10 LBS	5000 LBS
QD	BUTYRIC ACID	107-92-6	0.22 LBS	5000 LBS
QD	CHROMIUM	7440-47-3	0.39 LBS	5000 LBS
QD	COPPER	7440-50-8	3.28 LBS	5000 LBS

RQ Grp	Chemical Name	CAS No	Quantity Units	RQ Value
QD	CUMENE	98-82-8	0.05 LBS	5000 LBS
QD	CYCLOHEXANONE	108-94-1	2.03 LBS	5000 LBS
QD	DICHLORODIFLUOROMETHANE	75-71-8	0.00 LBS	5000 LBS
QD	ETHYL ACETATE	141-78-6	19.82 LBS	5000 LBS
QD	ETHYLENE GLYCOL	107-21-1	2.20 LBS	5000 LBS
QD	ETHYLENEDIAMINE	107-15-3	0.50 LBS	5000 LBS
QD	FORMIC ACID	64-18-6	2.10 LBS	5000 LBS
QD	HEXANE	110-54-3	103.41 LBS	5000 LBS
QD	HYDROCHLORIC ACID		37.66 LBS	5000 LBS
QD	MALEIC ACID	110-16-7	0.22 LBS	5000 LBS
QD	METHYL ALCOHOL	67-56-1	106.22 LBS	5000 LBS
QD	METHYL ETHYL KETONE	78-93-3	0.02 LBS	5000 LBS
QD	N-BUTYL ALCOHOL	71-36-3	4.40 LBS	5000 LBS
QD	PENTYL ACETATE	628-63-7	8.05 LBS	5000 LBS
QD	PHENANTHRENE	85-01-8	0.07 LBS	5000 LBS
QD	PHOSPHORIC ACID	7664-38-2	8.72 LBS	5000 LBS
QD	PYRENE	129-00-0	0.01 LBS	5000 LBS
QD	RESERPINE	50-55-5	0.00 LBS	5000 LBS
QD	RESORCINOL	108-46-3	0.22 LBS	5000 LBS
QD	SODIUM PHOSPHATE DIBASIC	7558-79-4	3.30 LBS	5000 LBS
QD	TRIETHYLAMINE	121-44-8	0.11 LBS	5000 LBS

Last updated 08/22/2000.

Table D.3 Constituents Detected in Building 320 Samples

Constituent	Frequency[1]	Concentration (µg/L)[2]		
		Range	Average	Standard Deviation[3]
General Chemical Parameters				
Alkalinity	38/38	6,000 – 130,000	58,000	20,000
Chemical Oxygen Demand	9/38	2600 – 13,000	6300	3400
Conductivity	31/31	58 – 940	200	180
pH	31/31	5.5 – 10	7.9	0.8
Total carbon	38/38	11,000 – 31,000	16,000	4000
Total dissolved solids	38/38	70,000 – 210,000	100,000	31,000
Total organic carbon	39/39	1000 – 3000	1800	630
Ammonia and Anions				
Ammonia	4/43	30 – 40	33	5
Chloride	41/41	2100 – 12,000	4700	1800
Cyanide	2/39	2 – 20	11	-
Fluoride	38/41	230 – 700	480	130
Nitrate	41/41	100 – 16,000	1700	3200
Sulfate	41/41	10,000 – 24,000	16,000	2200
Sulfides	9/38	220 – 400	300	50
Metals				
Aluminum	39/43	29 – 170	66	34
Antimony	2/43	37 – 39	38	-
Arsenic	1/39	-	0.73	-
Barium	43/43	16 – 46	29	5
Beryllium	5/43	0.17 – 0.68	0.34	0.21
Cadmium	2/43	3.5 – 4.3	3.9	-

Constituent	Frequency[1]	Concentration (μg/L)[2]		
		Range	Average	Standard Deviation[3]
Calcium	43/43	16,000 – 44,000	21,000	5500
Chromium	5/43	5.7 – 18	11	5
Cobalt	2/43	7.5 – 7.6	7.5	-
Copper	40/43	2.9 – 13	6.8	2.3
Iron	37/43	8.7 – 170	36	29
Lead	21/39	0.6 – 15	2.1	3.1
Magnesium	43/43	3600 – 9300	4800	1100
Manganese	29/43	0.89 – 7.1	1.5	1.2
Mercury	8/39	0.052 – 0.46	0.15	0.13
Nickel	2/43	13 – 16	15	-
Potassium	28/43	860 – 2900	1400	480
Selenium	8/43	0.66 – 2.3	1.1	0.60
Silicon	1/1	-	2800	-
Sodium	43/43	2300 – 11,000	3400	1800
Strontium	2/2	92 – 100	96	-
Thallium	7/39	0.62 – 1.6	0.85	0.37
Tin	4/43	26 – 82	46	25
Vanadium	2/43	3.3 – 3.5	3.4	-
Zinc	43/43	11 – 120	29	18
Volatile Organic Compounds				
1,1,1-Trichloroethane	3/62	1.2 – 2.6	1.8	0.7
2-Butanone	1/62	-	26	-
Acetone	5/62	8.8 – 43	26	13
Acetonitrile	1/27	-	170	-
Bromodichloromethane	25/36	0.7 – 3.3	1.6	0.7
Bromoform	1/36	-	0.5	-
Chloroform	62/62	6.9 – 32	19	6.6
Dibromochloromethane	3/36	1.4 – 2.0	1.8	0.3
Ethylbenzene	4/36	0.5 – 4.9	1.7	2.1
Hexone	6/62	1.4 – 110	37	41
Methylene chloride	40/62	0.4 – 1.6	1.1	0.4
Tetrahydrofuran	1/62	-	36	-
Toluene	2/62	0.14 – 0.18	0.16	-
Xylenes (total)	8/62	0.48 – 12	4.8	4.6
Semivolatile Organic Compounds (Acids/Bases/Neutrals)				
Di-n-butylphthalate	2/14	2.5 – 2.6	2.5	-
Phenol	1/43	-	1.8	-
Radiological Parameters				
Gross Alpha	8/43	0.87 – 2.9	1.7	0.26
Gross beta	11/43	2.1 – 4.3	3.2	0.2

[1] Number of samples with detectable concentrations/total number of samples analyzed.
[2] Conductivity units are μmhos/cm and radiological parameters are pCi/L.
[3] Two times the standard error of the mean for radiological parameters.

D.6.0 Facility Effluent Pathway Drawings

The official up-to-date version can be obtained from Battelle Engineering Files.

D.7.0 References

DOE 2000. *Environmental Monitoring Plan,* DOE/RL-91-50, Rev 3, United States Department of Energy, Richland Operations Office, Richland, Washington.

EPA 1997. *Reportable Quantities*. 40 Code of Federal Regulations (CFR) 302.4. U.S. Code of Federal Regulations. U.S. Environmental Protection Agency. Washington D.C.

McCarthy, M.J. and M.Y. Ballinger. 2000. *Liquid Waste Certification Plan for Pacific Northwest National Laboratory*. PNNL-13276, Pacific Northwest National Laboratory, Richland, Washington.

Thompson, C.J., M.Y. Ballinger, E.G. Damberg, and R.G. Riley. 1997. *Characterization and Monitoring of 300 Area Facility Liquid Waste Streams During 1994 and 1995*. PNNL-11552, Pacific Northwest National Laboratory, Richland, Washington.

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Appendix E

326 Building

E.1.0 Mission and Activities

The 326 Building is used to conduct mechanical testing of metallic and ceramic composite materials, specimen preparation for optical/electron beam microscopes and the subsequent examination/characterization of these specimens, and the preparation of specimens for X-ray diffraction analysis. Sample preparation activities include sample receiving and sample-size reduction (cutting, grinding, punching, breaking, electropolishing, and ion micromilling). In addition, analytical characterization of samples from radioactive waste tank is performed. There are two hot cells located in the basement (Rooms 15A/17A and 11A) that are used for sample preparation activities.

In February 1999, the health physics counting laboratory was moved from the 3745 Building to Rooms 47-C and 48-C in the 326 Building. The counting laboratory is used for counting radiological control samples, air samples, and smears.

E.2.0 Physical Description

The 326 Building has two-stories and a basement (see Figures E.1 to E.3). The framework is bolted-steel and exterior walls are fluted steel-insulted panels. Floors are reinforced concrete finished with vinyl asbestos tile with access trenches for utility distribution under the main floor. The building has about 63,000 square feet of floor space and is equipped with glove boxes, fume hoods, and hot cells. Exhaust air is HEPA filtered and sampled for radioactive particles before exiting through a single emission point from the building. Figure E.4 is a simplified drawing of the ventilation and air emission sampling systems. Ventilation and sampling system configuration drawings have been developed and are maintained in the Pacific Northwest National Laboratory's (Pacific Northwest's) Essential Drawings System.

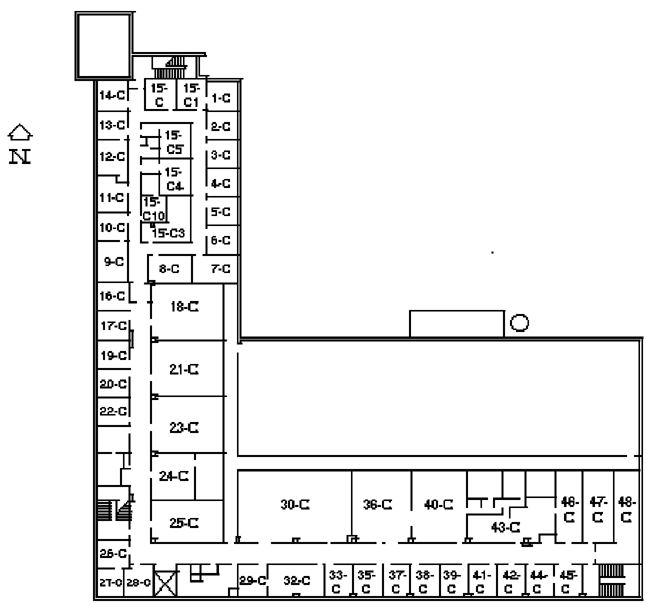

Figure E.1 326 Building Second Floor

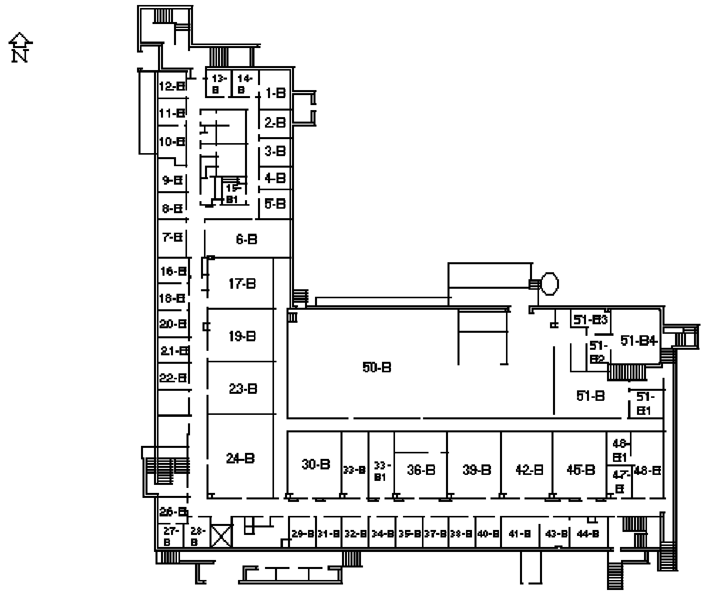

Figure E.2 326 Building First Floor

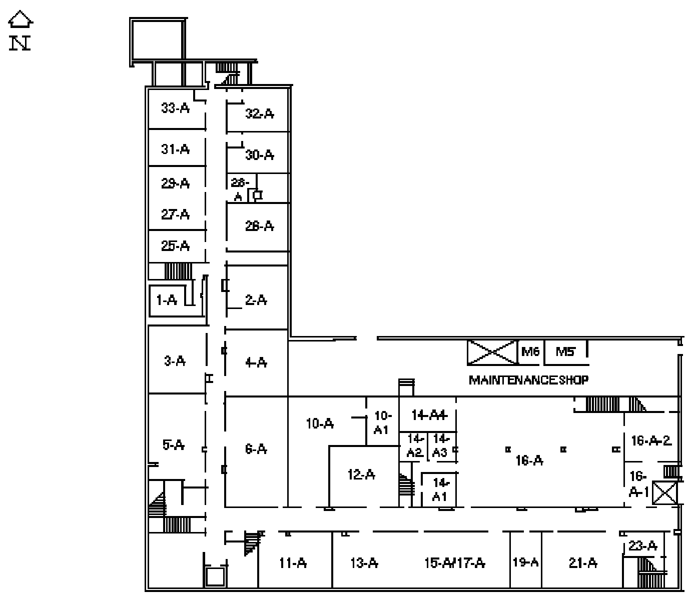

Figure E.3 326 Building Basement

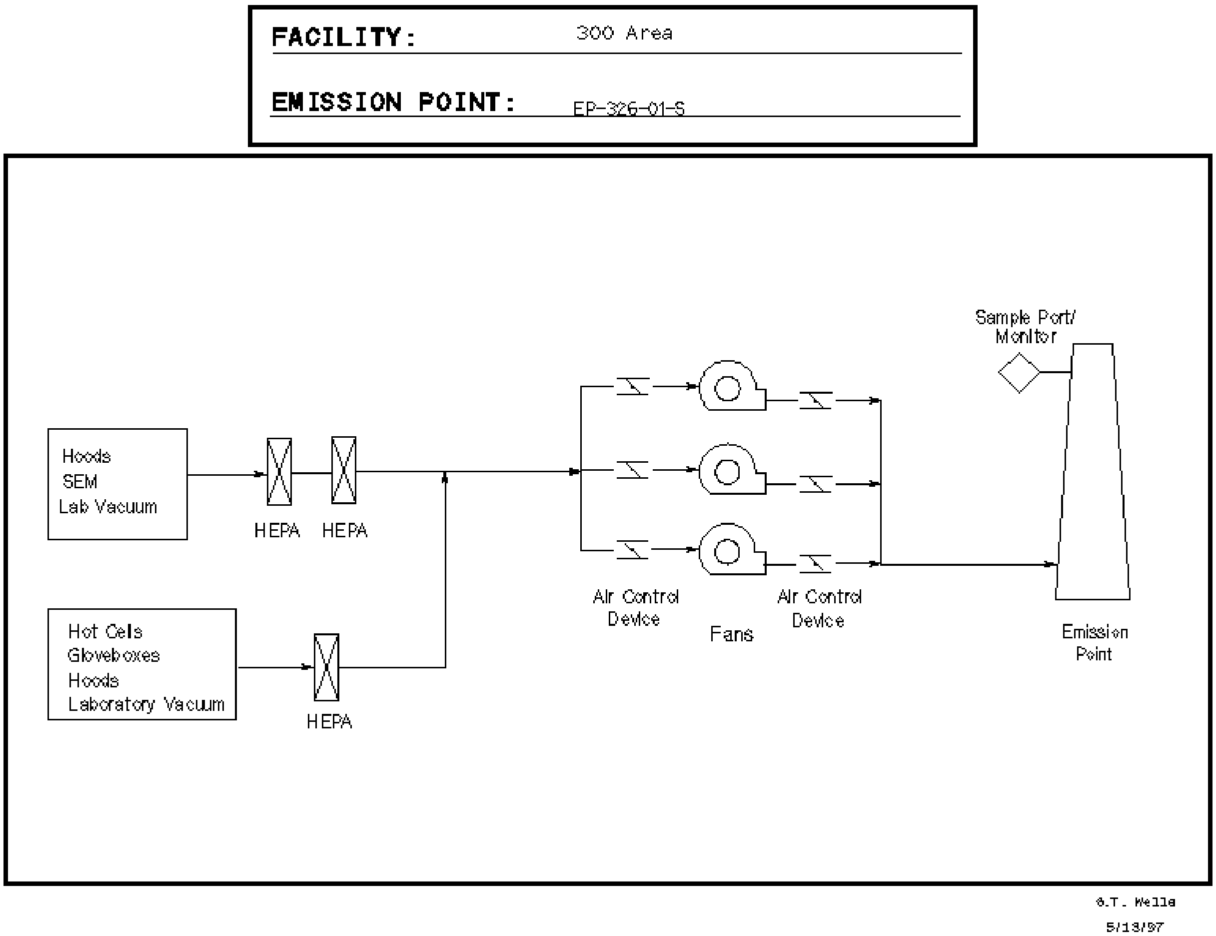

Figure E.4 326 Building Simplified Ventilation System Drawing

The 326 Building is served by the 300 Area PS, RPS, and SNS. The SNS serves the restrooms and lunchrooms, the PS serves process areas, and the RPS serves process areas with a greater potential to discharge radioactive materials. As-built drawings of the building's liquid effluent systems have been developed and are maintained in Pacific Northwest's Essential Drawings System. The building is equipped with a liquid effluent sampling system on the PS and RPS that includes the capability for continuously monitoring pH, conductivity, and flow, as well as the capability for obtaining flow-composite samples.

E.3.0 Radiological Inventory

Radioactive material is primarily from samples that may be in the form of solid, powder, fragments, and monoliths. The materials include solid samples containing activation products resulting from irradiation in reactors and spent fuel powders/fragments. A wide range of radionuclides may be present. The 2000 PTE for the building is 4.69E-05 mrem/year.

E.4.0 Chemical Inventory

A variety of types and forms of chemicals are used in the building. A chemical inventory is maintained using Pacific Northwest's CMS. The inventory information includes the location, chemical name, and quantity. In some cases the manufacturer and individual container quantities are also tracked. In addition, the CMS data includes the RQ of the chemical. RQs are obtained from 40 CFR 302 (EPA 1997) and are the amounts that, if released to the environment from a facility, require notification to the National Response Center. DOE/RL-91-50, Rev. 2 (DOE 2000) establishes commitments to prepare Facility Effluent Monitoring Plans for any facility with the potential to release any chemical in quantities greater than RQs. Although it is unlikely that RQ quantities of chemicals could be released from any Pacific Northwest facility, the chemical loading in the 326 Building is variable and RQ amounts of chemicals could be present in the facility depending on ongoing research and support activities.

At present, only two chemicals (chloroform and sodium hypochlorite) are listed in the CMS as being present above the RQ amounts (10 lbs and 100 lbs, respectively). These chemicals are in more than one container of cleaning products, are present in low concentrations, and due to engineered and administrative controls, are not likely to be released to the environment.

The CMS listing showing the types and quantities of chemicals in the building with RQ values is provided in Table E.1. This listing was obtained on the date shown on the table and may not be the current inventory but is indicative of the types of chemicals likely to be found. Current inventory information can be obtained from the CMS.

Table E.1

CMS Reportable Quantity Inventory Listing

For: 326-MATERIAL SCIENCE LABORATORY
Above 0 % of Reportable Quantity

RQ Grp	Chemical Name	CAS No.	Quantity	RQ Value
QX	ARSENIC TRIOXIDE	1327-53-3	0.25 LBS	1 LB
QX	SILVER NITRATE	7761-88-8	0.48 LBS	1 LB
QA	CARBON TETRACHLORIDE	56-23-5	1.05 LBS	10 LBS
QA	CHLOROFORM	67-66-3	55.54 LBS	10 LBS
QA	CHROMIUM (VI) OXIDE	1333-82-0	0.01 LBS	10 LBS
QA	COPPER(II) CHLORIDE	7447-39-4	1.11 LBS	10 LBS
QA	CUPRIC SULFATE	7758-98-7	1.10 LBS	10 LBS
QA	LEAD	7439-92-1	4.00 LBS	10 LBS
QA	LEAD FLUORIDE	7783-46-2	0.66 LBS	10 LBS
QA	NICKEL (II) HYDROXIDE	12054-48-7	0.55 LBS	10 LBS
QA	SODIUM	7440-23-5	9.00 LBS	10 LBS
QA	SODIUM DICHROMATE	10588-01-9	1.00 LBS	10 LBS
QB	2-NITROPHENOL	88-75-5	0.02 LBS	100 LBS
QB	CARBON DISULFIDE	75-15-0	4.18 LBS	100 LBS
QB	CUPRIC NITRATE	3251-23-8	0.22 LBS	100 LBS
QB	DIMETHYLFORMAMIDE	68-12-2	0.04 LBS	100 LBS
QB	ETHYL ETHER	60-29-7	0.16 LBS	100 LBS
QB	ETHYLENE DICHLORIDE	107-06-2	2.77 LBS	100 LBS
QB	FERROUS CHLORIDE	7758-94-3	0.09 LBS	100 LBS
QB	FORMALDEHYDE W/O METHANOL	50-00-0	1.21 LBS	100 LBS
QB	HYDROFLUORIC ACID		25.86 LBS	100 LBS
QB	IODOMETHANE	74-88-4	0.22 LBS	100 LBS
QB	NAPHTHALENE	91-20-3	0.57 LBS	100 LBS
QB	NICKEL	7440-02-0	1.00 LBS	100 LBS
QB	NICKEL (II) SULFATE	7786-81-4	3.30 LBS	100 LBS
QB	NICKEL(II) CHLORIDE	7718-54-9	6.61 LBS	100 LBS
QB	SODIUM HYPOCHLORITE	7681-52-9	442.53 LBS	100 LBS
QB	SODIUM NITRITE	7632-00-0	1.43 LBS	100 LBS
QB	THALLIUM (III) OXIDE	1314-32-5	0.11 LBS	100 LBS
QB	XYLENE	1330-20-7	36.73 LBS	100 LBS
QC	1,1,1-TRICHLOROETHANE	71-55-6	2.79 LBS	1000 LBS
QC	2,2,4-TRIMETHYLPENTANE, HYDROCARBON KIT	540-84-1	6.10 LBS	1000 LBS

QC	AMMONIUM HYDROXIDE	1336-21-6	13.35 LBS	1000 LBS
QC	DODECYLBENZENESULFONIC ACID, SODIUM SALT	25155-30-0	0.66 LBS	1000 LBS
QC	FERRIC NITRATE CRYSTALLINE AR GRADE	10421-48-4	0.22 LBS	1000 LBS
QC	HYDROGEN PEROXIDE	7722-84-1	2.00 LBS	1000 LBS
QC	IRON(II) SULFATE	7720-78-7	0.00 LBS	1000 LBS
QC	IRON(III) CHLORIDE	7705-08-0	1.55 LBS	1000 LBS
QC	METHYL METHACRYLATE	80-62-6	1.97 LBS	1000 LBS
QC	METHYLENE CHLORIDE	75-09-2	8.17 LBS	1000 LBS
QC	NITRIC ACID	7697-37-2	76.49 LBS	1000 LBS
QC	POTASSIUM HYDROXIDE	1310-58-3	9.47 LBS	1000 LBS
QC	SODIUM HYDROXIDE	1310-73-2	21.48 LBS	1000 LBS
QC	SULFURIC ACID	7664-93-9	34.67 LBS	1000 LBS
QC	TETRAHYDROFURAN	109-99-9	0.71 LBS	1000 LBS
QC	TOLUENE	108-88-3	2.81 LBS	1000 LBS
QD	ACETIC ACID	64-19-7	48.27 LBS	5000 LBS
QD	ACETONE	67-64-1	34.85 LBS	5000 LBS
QD	ACETONITRILE	75-05-8	3.46 LBS	5000 LBS
QD	ACRYLIC ACID	79-10-7	1.10 LBS	5000 LBS
QD	AMMONIUM CHLORIDE	12125-02-9	2.15 LBS	5000 LBS
QD	ANTHRACENE	120-12-7	0.02 LBS	5000 LBS
QD	BUTYRIC ACID	107-92-6	1.10 LBS	5000 LBS
QD	COPPER	7440-50-8	0.15 LBS	5000 LBS
QD	DICHLORODIFLUOROMETHANE	75-71-8	0.02 LBS	5000 LBS
QD	ETHYLENE GLYCOL	107-21-1	16.57 LBS	5000 LBS
QD	ETHYLENEDIAMINE	107-15-3	0.22 LBS	5000 LBS
QD	FORMIC ACID	64-18-6	1.10 LBS	5000 LBS
QD	HEXANE	110-54-3	12.54 LBS	5000 LBS
QD	HYDROCHLORIC ACID		39.73 LBS	5000 LBS
QD	ISOBUTYL ALCOHOL	78-83-1	0.71 LBS	5000 LBS
QD	MALEIC ACID	110-16-7	0.20 LBS	5000 LBS
QD	MALEIC ANHYDRIDE	108-31-6	0.06 LBS	5000 LBS
QD	METHYL ALCOHOL	67-56-1	78.81 LBS	5000 LBS
QD	METHYL ISOBUTYL KETONE	108-10-1	6.68 LBS	5000 LBS
QD	N-BUTYL ALCOHOL	71-36-3	16.38 LBS	5000 LBS
QD	PENTYL ACETATE	628-63-7	0.38 LBS	5000 LBS
QD	PHENANTHRENE	85-01-8	0.22 LBS	5000 LBS
QD	PHOSPHORIC ACID	7664-38-2	31.63 LBS	5000 LBS
QD	PHTHALIC ANHYDRIDE	85-44-9	0.26 LBS	5000 LBS
QD	PYRENE	129-00-0	0.22 LBS	5000 LBS
QD	RESORCINOL	108-46-3	0.02 LBS	5000 LBS
QD	SODIUM PHOSPHATE DIBASIC	7558-79-4	2.10 LBS	5000 LBS
QD	TRICHLOROFLUOROMETHANE	75-69-4	0.33 LBS	5000 LBS
QD	TRIETHYLAMINE	121-44-8	0.24 LBS	5000 LBS

Last updated 08/08/00.

E.7.0 Emission History

Radioactive air emissions have been and continue to be measured. Radionuclide air emission data since 1993 are shown in Table 3.1.

The 326 Building is equipped with liquid effluent sampling systems for both the PS and RPS and was sampled during the sampling campaign conducted by Pacific Northwest's Effluent Management staff in 1994 and 1995 (Thompson et al. 1997). No continued liquid effluent sampling is required for this facility. Tables E.2 and E.3 provide a summary of the results of the sampling campaign. These results show low concentrations (ppb) of pollutants, generally less than the sewer system waste acceptance criteria. Additional sampling in 1998 and 2000 confirm the low concentrations of pollutants (McCarthy and Ballinger 2000, Appendices A and B).

Table E.2 Constituents Detected in Building 326 PS Samples

CONSTITUENT	Frequency[1]	Concentration (μg/L)[2]		
		Range	Average	Standard Deviation[3]
General Chemical Parameters				
Alkalinity	13/13	20,000 – 130,000	71,000	33,000
Chemical Oxygen Demand	12/13	4000 – 360,000	50,000	100,000
Conductivity	23/23	98 – 350	200	71
PH	23/23	1.8 – 8.9	7.3	1.5
Total carbon	13/13	13,000 – 120,000	31,000	29,000
Total dissolved solids	13/13	80,000 – 210,000	130,000	49,000
Total organic carbon	20/20	2000 – 110,000	11,000	24,000
Ammonia and Anions				
Ammonia	14/24	40 – 500	190	140
Chloride	21/21	2900 – 85,000	9500	17,000
Fluoride	21/21	270 – 600	400	98
Nitrate	21/21	400 – 12,000	3500	3600
Nitrite	3/12	-	200	-
Phosphate	1/21	-	1100	-
Sulfate	21/21	13,000 – 53,000	23,000	12,000
Sulfides	3/13	220 – 400	300	90
Metals				
Aluminum	19/24	29 – 180	64	38
Barium	24/24	21 – 100	33	17
Beryllium	4/24	0.19 – 0.26	0.21	0.03
Cadmium	6/24	1 – 14	4.2	5.0
Calcium	24/24	14,000 – 43,000	24,000	8,000
Chromium	8/24	3.7 – 7.7	5.5	1.3
Cobalt	1/24	-	8.4	-
Copper	24/24	31 – 1400	160	300
Iron	24/24	23 – 6000	480	1200
Lead	14/20	1.5 – 8.6	3.4	2.3
Magnesium	24/24	2400 – 9100	5100	1600
Manganese	24/24	2.2 – 1500	96	300
Mercury	5/20	0.026 – 0.23	0.11	0.075
Nickel	5/24	14 – 340	89	140
Potassium	22/24	840 – 3900	1700	910
Selenium	3/24	0.73 – 1.2	1.0	0.27
Silicon	3/23	2200 – 2600	2500	230
Sodium	24/24	2600 – 24,000	6500	5100
Strontium	5/5	90 – 100	94	5

CONSTITUENT	Frequency[1]	Concentration (μg/L)[2]		
		Range	Average	Standard Deviation[3]
Thallium	5/20	0.93 – 2.9	1.5	0.80
Tin	2/24	34 – 49	42	-
Vanadium	6/24	2 – 4	2.5	0.8
Zinc	24/24	48 – 6100	470	1300
Volatile Organic Compounds				
2-Butanone	1/22	-	48	-
Acetone	20/22	5.5 – 2500	280	560
Chloroform	19/22	0.6 – 4.3	1.7	0.9
Hexone	2/22	1.7 – 2.0	1.9	-
Isopropyl alcohol	1/22	-	41,000	-
Methylene Chloride	2/22	-	1.2	-
Tetrachloroethene	1/22	-	0.51	-
Tetrahydrofuran	17/22	2.8 – 22	10.4	6.5
Trichloroethene	3/22	0.95 – 5.9	2.9	2.6
Semivolatile Organic Compounds (Acids/Bases/Neutrals)				
Bis(2-ethylhexyl) phthalate	2/24	0.88 – 1.7	1.29	-
Di-n-octylphthalate	1/6	-	1.3	-
Diethylphthalate	1/6	-	6.6	-
Phenol	4/24	0.83 – 3.7	1.8	1.3
Semivolatile Organic Compounds (Pesticides)				
Aldrin	1/9	-	0.0041	-
Alpha-BHC	2/9	0.0011 – 0.0025	0.0018	-
Delta-BHC	1/9	-	0.0041	-
Radiological Parameters				
Gross Alpha	3/24	1.2 – 1.7	1.4	0.14
Gross beta	8/24	2.4 – 7.9	5.0	0.73
Tritium	7/24	250 – 560	380	38

[1] Number of samples with detectable concentrations/total number of samples analyzed.
[2] Conductivity units are μmhos/cm and radiological parameters are pCi/L.
[3] Two times the standard error of the mean for radiological parameters.

Table E.3 Constituents Detected in Building 326 RPS Samples

CONSTITUENT	Frequency[1]	Concentration (μg/L)[2]		
		Range	Average	Standard Deviation[3]
General Chemical Parameters				
Conductivity	2/2	191 – 200	200	-
PH	2/2	7.7 – 8	7.9	-
Total organic carbon	2/2	3000 – 20,000	12,000	-
Ammonia and Anions				
Ammonia	1/2	-	40	-
Bromide	1/2	-	40	-
Chloride	2/2	3100 – 3800	3500	-
Fluoride	2/2	300 – 500	400	-
Nitrate	2/2	390 – 400	400	-
Phosphate	1/2	-	700	-
Sulfate	2/2	14,000 – 20,000	17,000	-
Metals				
Aluminum	1/2	-	120	-
Barium	2/2	20 – 27	24	-
Boron	1/2	-	210	-

CONSTITUENT	Frequency[1]	Concentration (µg/L)[2]		
		Range	Average	Standard Deviation[3]
Cadmium	1/2	-	4.9	-
Calcium	2/2	20,000 – 21,000	21,000	-
Copper	2/2	32 – 72	52	-
Iron	2/2	270 – 290	280	-
Lead	2/2	1.8 – 2.0	1.9	-
Magnesium	2/2	-	4500	-
Manganese	2/2	20 – 29	25	-
Mercury	2/2	0.043 – 1.3	0.67	-
Nickel	1/2	-	15	-
Potassium	2/2	700 – 940	820	-
Silicon	2/2	2200 – 2400	2300	-
Silver	1/2	-	56	-
Sodium	2/2	3800 – 11,000	7400	-
Strontium	2/2	95 – 97	96	-
Tin	1/2	-	36	-
Zinc	2/2	250 – 440	350	-
Volatile Organic Compounds				
Acetone	2/2	7.1 – 9.9	8.5	-
Chloroform	2/2	1.3 – 2	1.6	-
Ethanol	1/2	-	54	-
Trichloroethene	2/2	0.94 – 1.3	1.1	-
Semivolatile Organic Compounds (Acids/Bases/Neutrals)				
Bis(2-ethylhexyl) phthalate	2/2	1.4 – 2.0	1.7	-
Diethylphthalate	1/2	-	0.81	-

1 Number of samples with detectable concentrations/total number of samples analyzed.
2 Conductivity units are µmhos/cm and radiological parameters are pCi/L.
3 Two times the standard error of the mean for radiological parameters.

E.7.0 Facility Effluent Pathway Drawings

The official up-to-date version can be obtained from Battelle Engineering Files.

E.7.0 References

DOE 2000. *Environmental Monitoring Plan,* DOE/RL-91-50, Rev 3, United States Department of Energy, Richland Operations Office, Richland, Washington.

EPA 1997. *Reportable Quantities*. 40 Code of Federal Regulations (CFR) 302.4. U.S. Code of Federal Regulations. U.S. Environmental Protection Agency. Washington D.C.

McCarthy, M.J. and M.Y. Ballinger. 2000. *Liquid Waste Certification Plan for Pacific Northwest National Laboratory*. PNNL-13276, Pacific Northwest National Laboratory, Richland, Washington.

Thompson, C.J., M.Y. Ballinger, E.G. Damberg, and R.G. Riley. 1997. *Characterization and Monitoring of 300 Area Facility Liquid Waste Streams During 1994 and 1995*. PNNL-11552, Pacific Northwest National Laboratory, Richland, Washington.

Appendix F

329 Building

F.1.0 Mission and Activities

The 329 Building conducts measurements and procedure development in support of Hanford Site environmental restoration and waste management activities. Environmental samples, including soils, vegetation, water, decommissioning materials, and samples of high-level tank waste are analyzed for all radionuclides and hazardous constituents. Advanced analytical procedures are also developed, tested, and applied.

Staff in the building also conduct R&D activities in the nuclear sciences, particularly in the areas of radiation instrumentation development and applications, low-level radioactive waste characterization and management, radiological decommissioning, environmental radioactivity measurements, radiochemical separations and measurements, and basic nuclear chemistry and physics.

F.2.0 Physical Description

The 329 Building has about 40,000 square feet of floor space on two floors (see Figures F.1, F.2, F.3). The building contains general electronics, low-level radiochemistry, and analytical chemistry laboratory space; a neutron multiplier (currently out of service and being dismantled); and associated offices and storage space on the first floor. The second floor is primarily mechanical and electrical rooms. Exhaust air is HEPA filtered and sampled for radioactive airborne particles before exiting the building at a single emission point. Figure F.4 is a simplified drawing of the ventilation and air emission sampling systems. Ventilation and sampling system configuration drawings have been developed and are maintained in Pacific Northwest National Laboratory's (Pacific Northwest's) Essential Drawings System.

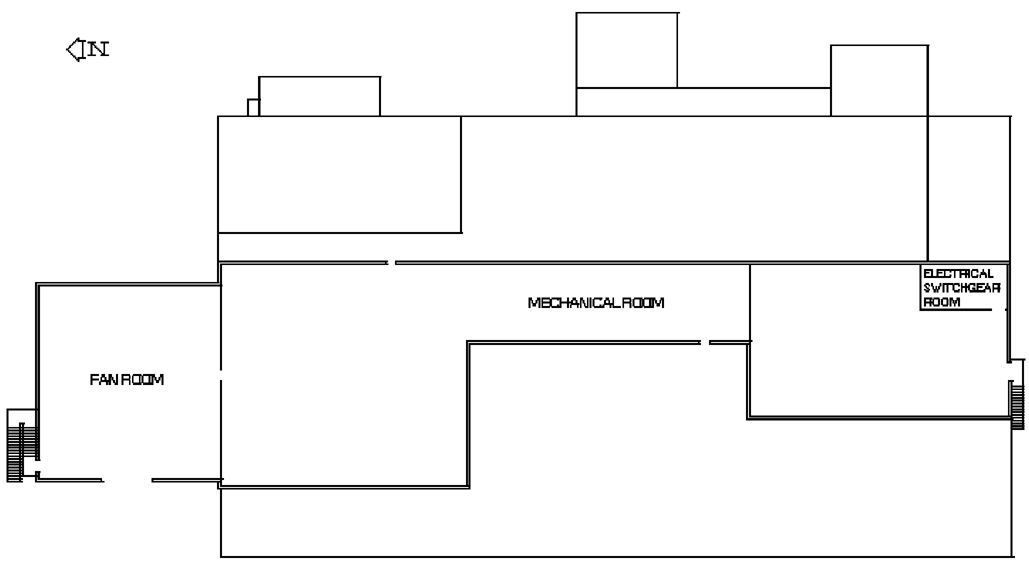

Figure F.1 329 Building Second Floor

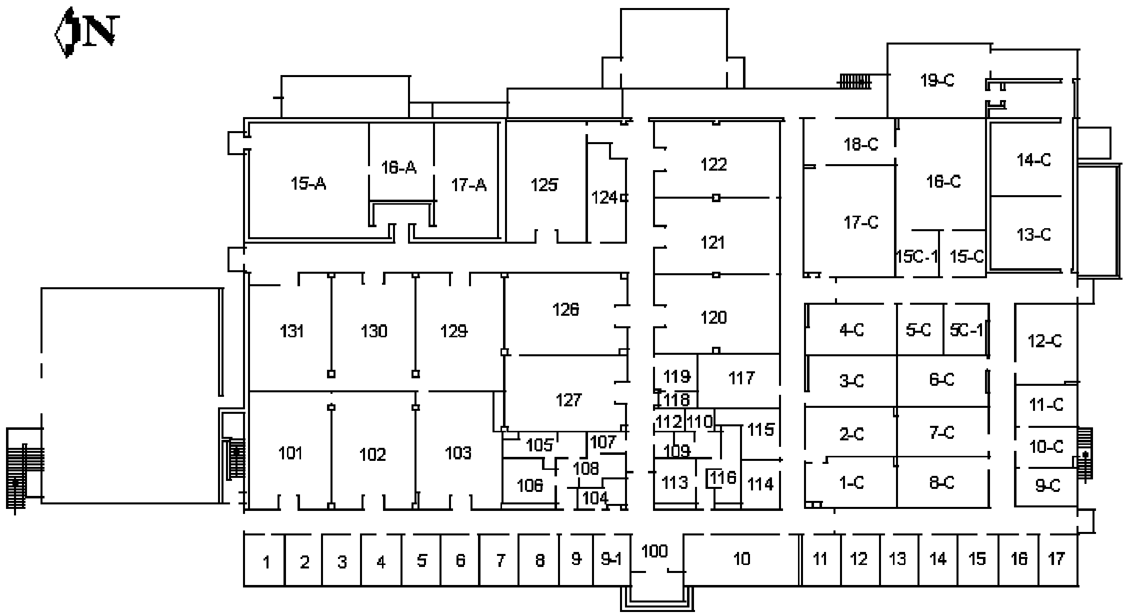

Figure F.2 329 Building First Floor

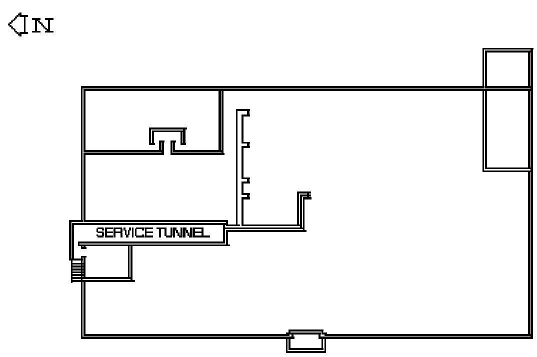

Figure F.3 329 Building Basement

The building is served by the 300 Area PS, RPS, and SNS. The SNS serves the restrooms and lunchrooms and is also tied into one corridor of the building (C-section), and the RPS serves process areas in the other two corridors (A- and B- sections). The PS serves the equipment room. In addition, as-built drawings of the building's liquid effluent systems have been developed and are maintained in Pacific Northwest's Essential Drawings System. The building is equipped with a liquid effluent sampling system on the RPS that includes capability for continuously monitoring pH, conductivity, and flow, as well as the capability for obtaining flow-composite samples.

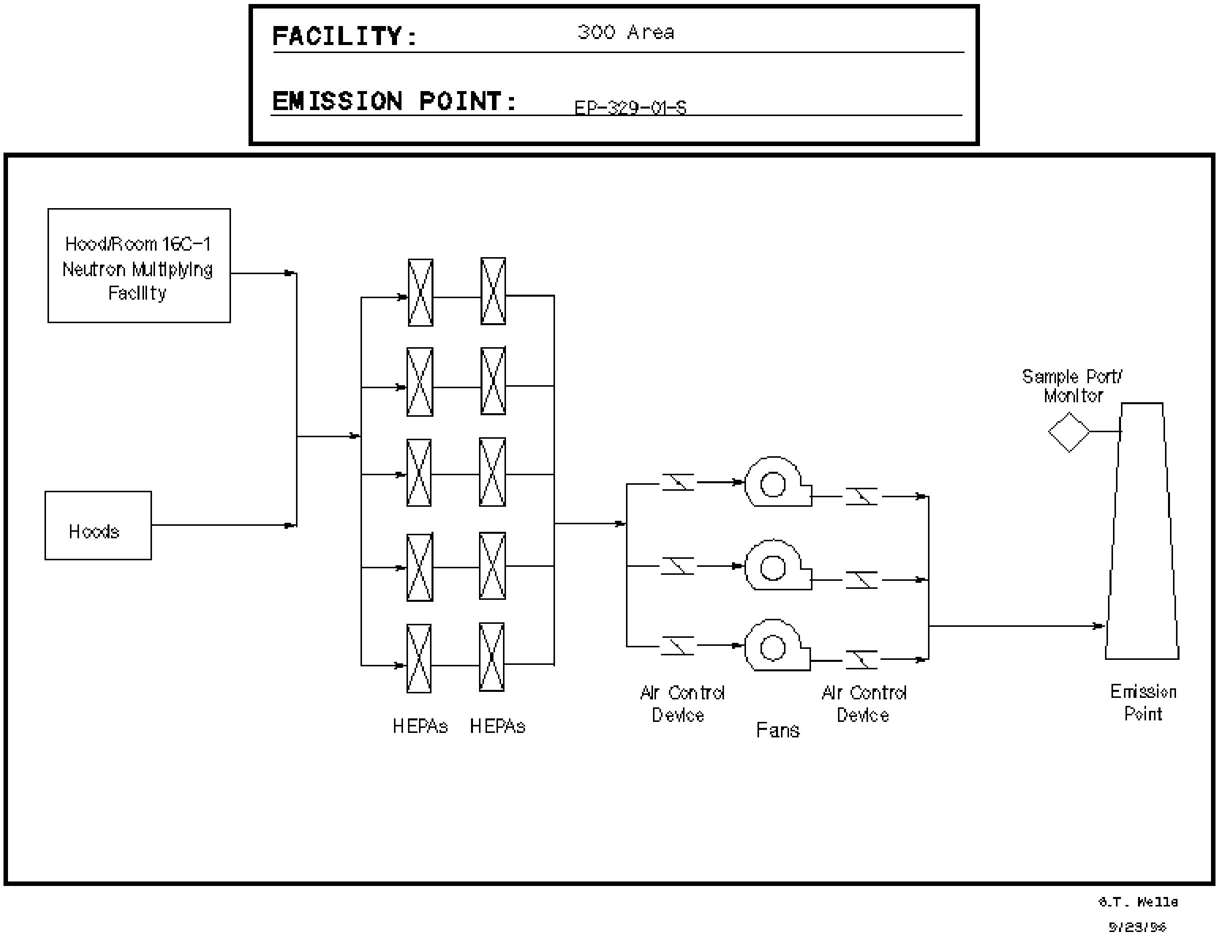

Figure F.4 329 Building Simplified Ventilation System Drawing

F.3.0 Radiological Inventory

A variety of radionuclides may be present in the building. Inventories are generally in small quantities (microcurie to millicurie) and can be in solid, liquid, powder, or sealed source form. In addition, larger quantities (kilogram or greater) of uranium and thorium may be present as fuel rods or pellets or powder. Some plutonium may also be present. The 2000 PTE for the building is 3.74E-03 mrem/year.

F.4.0 Chemical Inventory

A variety of types and forms of chemicals are used in the 329 Building. A chemical inventory is maintained using Pacific Northwest's CMS. The inventory information includes the location, chemical name, and quantity. In some cases the manufacturer and individual container quantities are also tracked. In addition, the CMS data includes the reportable quantity RQ of the chemical. RQs are obtained from 40 CFR 302 (EPA 1997) and are the amounts that, if released to the environment from a facility, require notification to the National Response Center. DOE/RL-91-50, Rev. 2 (DOE 2000) establishes commitments to prepare Facility Effluent Monitoring Plans for any facility with the potential to release any chemical in quantities greater than RQs. Although it is unlikely that RQ quantities of chemicals could be released from any Pacific Northwest facility, the chemical loading in the 329 Building is variable and RQ amounts of chemicals could be present in the facility depending on ongoing research and support activities.

A few chemicals are currently present above their RQ values (see Table F.1). However, these chemicals are in more than one container and many containers have reduced concentrations. Due to these factors and engineered and administrative controls, there is little potential to release RQ amounts of chemicals to the environment.

The CMS listing showing the types and quantities of chemicals in the building with RQ values is provided in Table F.2. This listing was obtained on the date shown on the table and may not be the current inventory but is indicative of the types of chemicals likely to be found. Current inventory information can be obtained from the CMS.

F.5.0 Emission History

Radioactive air emissions have been and continue to be measured. Radionuclide air emission data since 1993 are shown in Table 3.1.

This building is equipped with liquid effluent sampling and monitoring (pH, conductivity, and flow) systems for the retention process sewer, but was not sampled during the sampling campaign conducted by Pacific Northwest's Effluent Management staff in 1994 and 1995 (Thompson et al. 1997). The 329 Building was undergoing extensive remodeling during the campaign, and R&D work was not being conducted in the RPS wings. Sampling in 1998 and 2000 indicated that concentrations of contaminants were low and below the Waste Acceptance Criteria for the Treated Effluent Disposal Facility (McCarthy and Ballinger 2000, Appendices A and B).

Table F.1

CMS Reportable Quantity Inventory Listing

For: 329-CHEMICAL SCIENCE LABORATORY
Above 100 % of Reportable Quantity

RQ Grp	Chemical Name	CAS No.	Quantity	RQ Value
QX	ARSENIC	7440-38-2	2.12 LBS	1 LB
QX	MERCURY	7439-97-6	14.92 LBS	1 LB
QX	SILVER NITRATE	7761-88-8	1.2 LBS	1 LB
QA	BENZENE	71-43-2	33.41 LBS	10 LBS
QA	CARBON TETRACHLORIDE	56-23-5	45.81 LBS	10 LBS
QA	CHLOROFORM	67-66-3	150.73 LBS	10 LBS
QA	LEAD	7439-92-1	12.44 LBS	10 LBS
QB	SODIUM HYPOCHLORITE	7681-52-9	148.51 LBS	100 LBS

Last updated 08/22/00.

Table F.2

CMS Reportable Quantity Inventory Listing

For: 329-CHEMICAL SCIENCE LABORATORY
Above 0 % of Reportable Quantity

RQ Grp	Chemical Name	CAS No	Quantity Units	RQ Value
QX	2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN	1746-01-6	0.02 LBS	1 LB
QX	2,3-BENZFLUORANTHENE	205-99-2	0.00 LBS	1 LB
QX	4,4'-BIPHENYLENEDIAMINE	92-87-5	0.00 LBS	1 LB
QX	4-AMINOBIPHENYL	92-67-1	0.01 LBS	1 LB
QX	9,10-DIMETHYLBENZ(A)ANTHRACENE	57-97-6	0.02 LBS	1 LB
QX	ADIPONITRILE	111-69-3	0.04 LBS	1 LB
QX	AROCLOR 1232	11141-16-5	0.00 LBS	1 LB
QX	ARSENIC	7440-38-2	2.12 LBS	1 LB
QX	ARSENIC TRIOXIDE	1327-53-3	0.07 LBS	1 LB
QX	ASBESTOS	1332-21-4	0.26 LBS	1 LB
QX	BENZO(A)PYRENE	50-32-8	0.02 LBS	1 LB
QX	CHLORDANE	57-74-9	0.00 LBS	1 LB
QX	DDD	72-54-8	0.00 LBS	1 LB
QX	DDT	50-29-3	0.00 LBS	1 LB
QX	DIAZINON	333-41-5	0.00 LBS	1 LB
QX	DIBENZ[A,H]ANTHRACENE	53-70-3	0.00 LBS	1 LB
QX	ENDOSULFAN	115-29-7	0.00 LBS	1 LB
QX	ENDOSULFAN SULFATE	1031-07-8	0.00 LBS	1 LB
QX	ENDRIN	72-20-8	0.00 LBS	1 LB
QX	ENDRIN ALDEHYDE	7421-93-4	0.00 LBS	1 LB
QX	HEPTACHLOR	76-44-8	0.00 LBS	1 LB
QX	HEXACHLOROBUTADIENE	87-68-3	0.02 LBS	1 LB
QX	ISODRIN	465-73-6	0.00 LBS	1 LB
QX	KEPONE	143-50-0	0.00 LBS	1 LB
QX	MERCURY	7439-97-6	14.92 LBS	1 LB
QX	METHOXYCHLOR	72-43-5	0.01 LBS	1 LB
QX	PLPTACHLOR EPOXIDE	1024-57-3	0.00 LBS	1 LB
QX	POLYCHLORINATED BIPHENYLS	1336-36-3	0.04 LBS	1 LB
QX	SILVER NITRATE	7761-88-8	1.20 LBS	1 LB
QX	SODIUM ARSENATE	7631-89-2	1.00 LBS	1 LB
QA	1,1-BIS(4-CHLOROPHENYL)-2,2,2-TRICHLOROE	115-32-2	0.00 LBS	10 LBS
QA	1,2-BENZANTHRACENE	56-55-3	0.00 LBS	10 LBS
QA	2,4,5-TRICHLOROPHENOL	95-95-4	0.06 LBS	10 LBS
QA	2,4,6-TRICHLOROPHENOL	88-06-2	0.03 LBS	10 LBS
QA	2,4-DINITROTOLUENE	121-14-2	0.22 LBS	10 LBS
QA	2-AMINONAPHTHALENE	91-59-8	0.00 LBS	10 LBS
QA	2-NITROPROPANE	79-46-9	0.04 LBS	10 LBS
QA	4-NITROBIPHENYL	92-93-3	0.25 LBS	10 LBS
QA	BENZENE	71-43-2	33.41 LBS	10 LBS
QA	BERYLLIUM	7440-41-7	0.06 LBS	10 LBS
QA	CADMIUM	7440-43-9	0.02 LBS	10 LBS
QA	CADMIUM DIACETATE	543-90-8	1.04 LBS	10 LBS
QA	CALCIUM HYPOCHLORITE, DRY, INCLUDING MIX	7778-54-3	0.18 LBS	10 LBS
QA	CARBON TETRACHLORIDE	56-23-5	45.81 LBS	10 LBS
QA	CHLOROFORM	67-66-3	150.73 LBS	10 LBS

RQ Grp	Chemical Name	CAS No	Quantity Units	RQ Value
QA	CHROMIUM (VI) OXIDE	1333-82-0	2.15 LBS	10 LBS
QA	CUPRIC SULFATE	7758-98-7	9.20 LBS	10 LBS
QA	DIMETHYLHYDRAZINE	57-14-7	0.03 LBS	10 LBS
QA	DINITROCRESOL	534-52-1	0.00 LBS	10 LBS
QA	ETHION	563-12-2	0.00 LBS	10 LBS
QA	ETHYL SULFATE	64-67-5	0.04 LBS	10 LBS
QA	HEXACHLOROBENZENE	118-74-1	1.10 LBS	10 LBS
QA	LEAD	7439-92-1	12.44 LBS	10 LBS
QA	LEAD NITRATE	10099-74-8	2.00 LBS	10 LBS
QA	MERCURY (I) NITRATE	10415-75-5	0.26 LBS	10 LBS
QA	PENTACHLOROPHENOL	87-86-5	0.02 LBS	10 LBS
QA	POTASSIUM CHROMATE	7789-00-6	1.37 LBS	10 LBS
QA	POTASSIUM CYANIDE	151-50-8	0.79 LBS	10 LBS
QA	POTASSIUM DICHROMATE	7778-50-9	7.30 LBS	10 LBS
QA	PROPARGITE	2312-35-8	0.00 LBS	10 LBS
QA	PROPIONITRILE	107-12-0	0.01 LBS	10 LBS
QA	SELENIUM(IV) OXIDE	8/4/46	0.03 LBS	10 LBS
QA	SODIUM CHROMATE	11/3/75	1.04 LBS	10 LBS
QA	SODIUM CYANIDE	143-33-9	0.02 LBS	10 LBS
QA	SODIUM DICHROMATE	10588-01-9	1.04 LBS	10 LBS
QA	TETRAETHYLEAD	78-00-2	0.02 LBS	10 LBS
QA	THIOACETAMIDE	62-55-5	1.32 LBS	10 LBS
QA	THIOUREA	62-56-6	0.29 LBS	10 LBS
QA	TRIS	126-72-7	1.10 LBS	10 LBS
QB	1,1,1,2-TETRACHLOROETHANE	630-20-6	0.02 LBS	100 LBS
QB	1,1,2-TRICHLOROETHANE	79-00-5	0.22 LBS	100 LBS
QB	1,2,4-TRICHLOROBENZENE	120-82-1	0.86 LBS	100 LBS
QB	1,2-DICHLOROBENZENE	95-50-1	0.02 LBS	100 LBS
QB	1,4-DIETHYLENE DIOXIDE	123-91-1	0.05 LBS	100 LBS
QB	1-NAPHTHYLAMINE	134-32-7	0.06 LBS	100 LBS
QB	2,3-DICHLOROPROPENE	78-88-6	0.00 LBS	100 LBS
QB	2,4-DICHLOROPHENOL	120-83-2	0.02 LBS	100 LBS
QB	2,4-DICHLOROPHENOXYACETIC ACID	94-75-7	0.04 LBS	100 LBS
QB	2,6-DINITROTOLUENE	606-20-2	0.06 LBS	100 LBS
QB	2-CHLOROPHENOL	95-57-8	0.02 LBS	100 LBS
QB	3-METHYLPHENOL	108-39-4	0.05 LBS	100 LBS
QB	3-NITROPHENOL	554-84-7	0.00 LBS	100 LBS
QB	4-HYDROXYTOLUENE	106-44-5	0.02 LBS	100 LBS
QB	4-NITROPHENOL	100-02-7	0.22 LBS	100 LBS
QB	4-TOLUIDINE	106-49-0	0.03 LBS	100 LBS
QB	ACENAPHTHENE	83-32-9	0.04 LBS	100 LBS
QB	ALLYL ALCOHOL	107-18-6	0.01 LBS	100 LBS
QB	AMMONIA ANHYDROUS	7664-41-7	0.75 LBS	100 LBS
QB	AMMONIUM FLUORIDE	12125-01-8	1.00 LBS	100 LBS
QB	AMMONIUM HYDROGEN DIFLUORIDE	1341-49-7	4.10 LBS	100 LBS
QB	AMMONIUM SULFIDE	12135-76-1	0.22 LBS	100 LBS
QB	BENZYL CHLORIDE	100-44-7	0.03 LBS	100 LBS
QB	BIPHENYL	92-52-4	2.23 LBS	100 LBS
QB	BIS(2-ETHYLHEXYL) PHTHALATE	117-81-7	1.33 LBS	100 LBS
QB	BROMOFORM	75-25-2	0.01 LBS	100 LBS
QB	BUTYL BENZYL PHTHALATE	85-68-7	0.01 LBS	100 LBS
QB	CARBON DISULFIDE	75-15-0	2.71 LBS	100 LBS

RQ Grp	Chemical Name	CAS No	Quantity Units	RQ Value
QB	CHLOROACETIC ACID	79-11-8	1.03 LBS	100 LBS
QB	CHLOROBENZENE	108-90-7	0.01 LBS	100 LBS
QB	CHRYSENE	218-01-9	0.11 LBS	100 LBS
QB	CRESOL, O-	95-48-7	0.02 LBS	100 LBS
QB	CROTONALDEHYDE	4170-30-3	0.01 LBS	100 LBS
QB	CUPRIC ACETATE	142-71-2	1.10 LBS	100 LBS
QB	CYCLOHEXANECARBOXYLIC ACID	98-89-5	0.01 LBS	100 LBS
QB	CYSTEINE, N-ACETYL-, L-	63-25-2	0.00 LBS	100 LBS
QB	DIBENZOFURAN	132-64-9	1.65 LBS	100 LBS
QB	DIETHANOLAMINE	111-42-2	0.02 LBS	100 LBS
QB	DIMETHYL SULFATE	77-78-1	1.54 LBS	100 LBS
QB	DIMETHYLFORMAMIDE	68-12-2	7.97 LBS	100 LBS
QB	DINITROBENZENE(ALL ISOMERS)	25154-54-5	0.00 LBS	100 LBS
QB	EPICHLOROHYDRIN	106-89-8	0.04 LBS	100 LBS
QB	ETHYL ETHER	60-29-7	1.96 LBS	100 LBS
QB	ETHYLENE DICHLORIDE	107-06-2	2.77 LBS	100 LBS
QB	FERROUS CHLORIDE	7758-94-3	2.55 LBS	100 LBS
QB	FLUORANTHENE	206-44-0	0.46 LBS	100 LBS
QB	FORMALDEHYDE W/O METHANOL	50-00-0	1.66 LBS	100 LBS
QB	FORMALDEHYDE WITH METHANOL		0.98 LBS	100 LBS
QB	HEXACHLOROETHANE	67-72-1	0.02 LBS	100 LBS
QB	HYDROFLUORIC ACID		12.92 LBS	100 LBS
QB	HYDROQUINONE	123-31-9	2.24 LBS	100 LBS
QB	IODOMETHANE	74-88-4	0.82 LBS	100 LBS
QB	METHYL PARATHION	298-00-0	0.00 LBS	100 LBS
QB	N-NITROSODIPHENYLAMINE	86-30-6	0.01 LBS	100 LBS
QB	NAPHTHALENE	91-20-3	1.10 LBS	100 LBS
QB	NICKEL	7440-02-0	6.06 LBS	100 LBS
QB	NICKEL (II) SULFATE	7786-81-4	1.00 LBS	100 LBS
QB	NICKEL(II) CHLORIDE	7718-54-9	0.53 LBS	100 LBS
QB	O-ANISIDINE	90-04-0	0.04 LBS	100 LBS
QB	PERCHLOROETHYLENE	127-18-4	0.04 LBS	100 LBS
QB	PHENYLTHIOURMA	103-85-5	0.01 LBS	100 LBS
QB	POTASSIUM PERMANGANTE	7722-64-7	6.10 LBS	100 LBS
QB	PROPYLENE OXIDE	75-56-9	0.04 LBS	100 LBS
QB	SELENIUM	7782-49-2	0.00 LBS	100 LBS
QB	SODIUM HYPOCHLORITE	7681-52-9	148.51 LBS	100 LBS
QB	SODIUM NITRITE	7632-00-0	21.73 LBS	100 LBS
QB	STYRENE OXIDE	96-09-3	0.05 LBS	100 LBS
QB	THALLIUM (III) OXIDE	1314-32-5	0.02 LBS	100 LBS
QB	THIOFANOX	39196-18-4	0.00 LBS	100 LBS
QB	THIOSEMICARBAZIDE	79-19-6	0.02 LBS	100 LBS
QB	TRICHLORO PHENOXYPROPIONIC ACID	93-72-1	0.00 LBS	100 LBS
QB	TRICHLOROETHYLENE	79-01-6	6.50 LBS	100 LBS
QB	TRIMETHYLAMINE	75-50-3	0.00 LBS	100 LBS
QB	URANYL NITRATE HEXAHYDRATE	13520-83-7	0.22 LBS	100 LBS
QB	URETHANE 99%	51-79-6	0.02 LBS	100 LBS
QB	WARFARIN	81-81-2	0.00 LBS	100 LBS
QB	XYLENE	1330-20-7	12.12 LBS	100 LBS
QB	XYLENE, P-	106-42-3	0.01 LBS	100 LBS
QC	1,1,1-TRICHLOROETHANE	71-55-6	11.80 LBS	1000 LBS
QC	1-ACETYL-2-TRIOUREA	591-08-2	0.01 LBS	1000 LBS

RQ Grp	Chemical Name	CAS No	Quantity Units	RQ Value
QC	2,2,4-TRIMETHYLPENTANE, HYDROCARBON KIT	540-84-1	8.41 LBS	1000 LBS
QC	2,4,5-TRICHLOROPHENOXYACETIC ACID	93-76-5	0.09 LBS	1000 LBS
QC	3,4-XYLENOL	95-65-8	0.01 LBS	1000 LBS
QC	3-CHLOROPROPIONITRILE	542-76-7	0.01 LBS	1000 LBS
QC	4-CHLOROANILINE	106-47-8	0.01 LBS	1000 LBS
QC	AMMONIUM HYDROXIDE	1336-21-6	12.55 LBS	1000 LBS
QC	CYCLOHEXANE	110-82-7	29.03 LBS	1000 LBS
QC	ETHYL METHACRYLATE	97-63-2	0.04 LBS	1000 LBS
QC	FERRIC NITRATE CRYSTALLINE AR GRADE	10421-48-4	2.10 LBS	1000 LBS
QC	FERRIC SULFATE	10028-22-5	2.00 LBS	1000 LBS
QC	GLYCOL ETHER	110-80-5	0.03 LBS	1000 LBS
QC	HYDROGEN PEROXIDE	7722-84-1	11.88 LBS	1000 LBS
QC	IRON(II) SULFATE	7720-78-7	1.00 LBS	1000 LBS
QC	IRON(III) CHLORIDE	7705-08-0	2.50 LBS	1000 LBS
QC	METHYL METHACRYLATE	80-62-6	0.04 LBS	1000 LBS
QC	METHYLENE CHLORIDE	75-09-2	445.28 LBS	1000 LBS
QC	NITRIC ACID	7697-37-2	166.86 LBS	1000 LBS
QC	NITROBENZENE	98-95-3	1.35 LBS	1000 LBS
QC	OSIUM TETROXIDE	20816-12-0	0.02 LBS	1000 LBS
QC	PARAFORMALDEHYDE	30525-89-4	0.02 LBS	1000 LBS
QC	PHENOL	108-95-2	0.02 LBS	1000 LBS
QC	PHENOL LIQUID		0.01 LBS	1000 LBS
QC	POTASSIUM HYDROXIDE	1310-58-3	53.80 LBS	1000 LBS
QC	PROPARGYL ALCOHOL	107-19-7	0.02 LBS	1000 LBS
QC	PROPIONALDEHYDE	123-38-6	0.02 LBS	1000 LBS
QC	PROPYLENE DICHLORIDE	78-87-5	0.02 LBS	1000 LBS
QC	PYRIDINE SILYLATION GRADE	110-86-1	5.95 LBS	1000 LBS
QC	PYRIDINE, 4-AMINO-	504-24-5	0.00 LBS	1000 LBS
QC	SILVER	7440-22-4	1.12 LBS	1000 LBS
QC	SODIUM AZIDE	26628-22-8	0.56 LBS	1000 LBS
QC	SODIUM FLUORIDE	7681-49-4	3.10 LBS	1000 LBS
QC	SODIUM HYDROXIDE	1310-73-2	72.06 LBS	1000 LBS
QC	SODIUM METHOXIDE	124-41-4	0.48 LBS	1000 LBS
QC	STYRENE	100-42-5	0.22 LBS	1000 LBS
QC	SULFURIC ACID	7664-93-9	134.79 LBS	1000 LBS
QC	TETRAHYDROFURAN	109-99-9	6.21 LBS	1000 LBS
QC	THALLIUM	7440-28-0	0.55 LBS	1000 LBS
QC	TOLUENE	108-88-3	99.54 LBS	1000 LBS
QC	VANADIUM PENTAOXIDE	1314-62-1	0.11 LBS	1000 LBS
QC	ZINC CHLORIDE	7646-85-7	2.10 LBS	1000 LBS
QC	ZINC NITRATE	7779-88-6	1.00 LBS	1000 LBS
QC	ZINC SULFATE	7733-02-0	1.00 LBS	1000 LBS
QD	1,3-DICHLOROPROPANE	142-28-9	0.00 LBS	5000 LBS
QD	1,4-NAPHTHALENEDIONE	130-15-4	0.02 LBS	5000 LBS
QD	2-PICOLINE	109-06-8	0.00 LBS	5000 LBS
QD	4-CHLORO-3-METHYLPHENOL	59-50-7	0.02 LBS	5000 LBS
QD	4-NITROANILINE	100-01-6	0.02 LBS	5000 LBS
QD	ACENAPHTHYLENE	208-96-8	0.22 LBS	5000 LBS
QD	ACETIC ACID	64-19-7	63.11 LBS	5000 LBS
QD	ACETIC ANHYDRIDE	108-24-7	2.33 LBS	5000 LBS
QD	ACETONE	67-64-1	140.33 LBS	5000 LBS
QD	ACETONITRILE	75-05-8	90.14 LBS	5000 LBS

RQ Grp	Chemical Name	CAS No	Quantity Units	RQ Value
QD	ACETOPHENONE	98-86-2	0.06 LBS	5000 LBS
QD	ACRYLAMIDE	79-06-1	0.24 LBS	5000 LBS
QD	ACRYLIC ACID	79-10-7	1.16 LBS	5000 LBS
QD	ADIPIC ACID	124-04-9	0.48 LBS	5000 LBS
QD	AMMONIUM ACETATE	631-61-8	12.46 LBS	5000 LBS
QD	AMMONIUM BENZOATE	1863-63-4	1.25 LBS	5000 LBS
QD	AMMONIUM BICARBONATE	1066-33-7	0.06 LBS	5000 LBS
QD	AMMONIUM CARBONATE	506-87-6	2.10 LBS	5000 LBS
QD	AMMONIUM CHLORIDE	12125-02-9	7.53 LBS	5000 LBS
QD	AMMONIUM CITRATE, DIBASIC	3012-65-5	4.00 LBS	5000 LBS
QD	AMMONIUM SULFAMATE	7773-06-0	1.10 LBS	5000 LBS
QD	AMMONIUM TARTRATE	14307-43-8	3.00 LBS	5000 LBS
QD	AMMONIUM THIOCYANATE	1762-95-4	6.63 LBS	5000 LBS
QD	ANILINE	62-53-3	1.06 LBS	5000 LBS
QD	ANTHRACENE	120-12-7	0.00 LBS	5000 LBS
QD	ANTIMONY	7440-36-0	1.39 LBS	5000 LBS
QD	BENZO(G,H,I)PERYLENE	191-24-2	0.00 LBS	5000 LBS
QD	BENZOIC ACID	65-85-0	1.19 LBS	5000 LBS
QD	BENZONITRILE	100-47-0	1.15 LBS	5000 LBS
QD	BUTYL ACETATE	123-86-4	0.03 LBS	5000 LBS
QD	CAPROLACTAM, DUST	105-60-2	0.02 LBS	5000 LBS
QD	CHROMIUM	7440-47-3	41.73 LBS	5000 LBS
QD	COPPER	7440-50-8	8.87 LBS	5000 LBS
QD	CYCLOHEXANONE	108-94-1	0.04 LBS	5000 LBS
QD	DI-N-OCTYL PHTHALATE	117-84-0	0.03 LBS	5000 LBS
QD	DIMETHYL PHTHALATE	131-11-3	0.01 LBS	5000 LBS
QD	ETHYL ACETATE	141-78-6	22.43 LBS	5000 LBS
QD	ETHYLENE GLYCOL	107-21-1	6.80 LBS	5000 LBS
QD	ETHYLENEDIAMINE	107-15-3	0.46 LBS	5000 LBS
QD	FLUORENE	86-73-7	0.23 LBS	5000 LBS
QD	FORMIC ACID	64-18-6	2.75 LBS	5000 LBS
QD	FUMARIC ACID	110-17-8	0.01 LBS	5000 LBS
QD	FURFURAL	98-01-1	0.05 LBS	5000 LBS
QD	HEXANE	110-54-3	107.65 LBS	5000 LBS
QD	HYDROCHLORIC ACID		60.71 LBS	5000 LBS
QD	ISOBUTYL ALCOHOL	78-83-1	7.98 LBS	5000 LBS
QD	ISOBUTYRIC ACID	79-31-2	0.03 LBS	5000 LBS
QD	ISOPHORONE	78-59-1	0.04 LBS	5000 LBS
QD	MALEIC ACID	110-16-7	0.04 LBS	5000 LBS
QD	MALEIC ANHYDRIDE	108-31-6	0.02 LBS	5000 LBS
QD	MALEIC HYDRAZIDE	123-33-1	0.02 LBS	5000 LBS
QD	METHYL ALCOHOL	67-56-1	155.22 LBS	5000 LBS
QD	METHYL ETHYL KETONE	78-93-3	2.19 LBS	5000 LBS
QD	METHYL ISOBUTYL KETONE	108-10-1	8.86 LBS	5000 LBS
QD	N-BUTYL ALCOHOL	71-36-3	13.46 LBS	5000 LBS
QD	PENTYL ACETATE	628-63-7	1.81 LBS	5000 LBS
QD	PHENANTHRENE	85-01-8	0.22 LBS	5000 LBS
QD	PHOSPHORIC ACID	7664-38-2	20.38 LBS	5000 LBS
QD	PHTHALIC ANHYDRIDE	85-44-9	0.06 LBS	5000 LBS
QD	PROPIONIC ANHYDRIDE	123-62-6	1.13 LBS	5000 LBS
QD	PYRENE	129-00-0	0.01 LBS	5000 LBS
QD	QUINOLINE	91-22-5	0.00 LBS	5000 LBS

RQ Grp	Chemical Name	CAS No	Quantity Units	RQ Value
QD	SODIUM BISULFITE	7631-90-5	3.10 LBS	5000 LBS
QD	SODIUM PHOSPHATE DIBASIC	7558-79-4	6.30 LBS	5000 LBS
QD	SODIUM PHOSPHATE, TRIBASIC	7601-54-9	1.00 LBS	5000 LBS
QD	TRICHLOROFLUOROMETHANE	75-69-4	13.16 LBS	5000 LBS
QD	TRIETHYLAMINE	121-44-8	1.21 LBS	5000 LBS
QD	VINYL ACETATE	108-05-4	0.04 LBS	5000 LBS

Last updated 08/22/2000.

Send questions or comments to the CMS Support Team.

Facility Effluent Pathway Drawings

The official up-to-date version can be obtained from Battelle Engineering Files.

F.6.0 References

DOE 2000. *Environmental Monitoring Plan,* DOE/RL-91-50, Rev 3, United States Department of Energy, Richland Operations Office, Richland, Washington.

EPA 1997. *Reportable Quantities*. 40 Code of Federal Regulations (CFR) 302.4. U.S. Code of Federal Regulations. U.S. Environmental Protection Agency. Washington D.C.

McCarthy, M.J. and M.Y. Ballinger. 2000. *Liquid Waste Certification Plan for Pacific Northwest National Laboratory*. PNNL-13276, Pacific Northwest National Laboratory, Richland, Washington.

Thompson, C.J., M.Y. Ballinger, E.G. Damberg, and R.G. Riley. 1997. *Characterization and Monitoring of 300 Area Facility Liquid Waste Streams During 1994 and 1995*. PNNL-11552, Pacific Northwest National Laboratory, Richland, Washington.