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Liquid Waste Certification Plan for Pacific Northwest Nations Laboratory Revision 3

M.Y. Ballinger

September 2002

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Liquid Waste Certification Plan for Pacific Northwest National Laboratory

Revision 3, September 2002

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CERTIFICATION

I certify that, to the best of my knowledge, the information contained in the Pacific Northwest National Laboratory Liquid Waste Certification Plan accurately reflects discharges to the Process and Retention Process Sewers.

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Executive Summary

The Pacific Northwest National Laboratory (PNNL) operates a number of research and development facilities for the U.S. Department of Energy (DOE) in the Hanford Site's 300 Area. The liquid wastes from these facilities are discharged to five liquid effluent systems: the Sanitary Waste System (SNS), the Process Sewer (PS), the Retention Process Sewer (RPS), the 325 Radioactive Liquid Waste System (RLWS),[a] and the 331 Aquaculture System. The wastewater from the PS and RPS systems is treated by the 300 Area Treated Effluent Disposal Facility (TEDF) and discharged to the Columbia River via a National Pollutant Discharge Elimination System-permitted outfall. The SNS discharges to the City of Richland Publicly Owned Treatment Works under a contract with the DOE. The RLWS wastewater is transported to tanks in the 200 Area. The aquaculture system discharges water from fish rearing activities to the Columbia River via an NPDES-exempt outfall. The SNS, RLWS, and aquaculture system do not interface with the 300 Area TEDF.

The following active PNNL facilities currently have the capability to discharge liquid waste to the 300 Area PS or RPS systems:

- 306W Materials Development Laboratory
- 318 Radiological Calibrations Laboratory
- 320 Analytical and Nuclear Research Laboratory
- 323 Mechanical Properties Laboratory
- 325 Radiochemical Processing Laboratory
- 326 Materials Sciences Laboratory
- 329 Chemical Sciences Laboratory
- 331 Life Sciences Laboratory I
- 331D Biomagnetic Effects Laboratory
- 331G Interim Tissue Repository Building
- 331H Aerosol Wind Tunnel Research Facility
- 336 High-Bay Testing Facility
- 337 Technical Management Center
- 338 Prototype Engineering Laboratory
- 3720 Environmental Sciences Laboratory
- 3730 Gamma Irradiation Facility.

The following data are provided in this report for each facility listed above in accordance with RCP-310, *300 LEF Project Administration Procedures*, Section 3.04, Liquid Waste Certification Program, Subsection 4.2 "Liquid Waste Certification Plan Content:"

- Identification of individual waste streams and an estimate of flow in appropriate units. For intermittent sources, estimates of the weekly flow are acceptable.
- Identification of constituents present in each individual waste stream; the maximum contaminant concentration for the constituent.
- The source of the information, either process knowledge or characterization sampling.

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[a] The RLWS as a 300 Area-wide system is no longer operable. A tank system has been set up within the 325 Building to provide for periodic transfers of radioactive liquid wastes to the 200 Area Tank Farms. This system is called the 325 RLWS.

- Description of engineering controls in place to ensure compliance with the Waste Acceptance Criteria.
- A summation of flows and individual contaminant concentrations.
- Rationale for connections to the RPS and type of equipment or process served.

Contents

Executive Summary i

Contents iii

Acronyms and Abbreviations v

1.0 Introduction 1
- 1.1 Scope 2
- 1.2 Engineered and Administrative Controls 4
- 1.3 Effluent Sampling and Monitoring 6
- 1.4 Research and Development Activities 7
- 1.5 Decontamination Activities 7

2.0 Facility-Specific Information 9
- 2.1 306W Materials Development Laboratory 10
- 2.2 318 Radiological Calibrations Laboratory 11
- 2.3 320 Analytical and Nuclear Research Laboratory 12
- 2.4 323 Mechanical Properties Laboratory 13
- 2.5 325 Radiochemical Processing Laboratory 14
- 2.6 326 Materials Sciences Laboratory 15
- 2.7 329 Chemical Sciences Laboratory 17
- 2.8 331 Life Sciences Laboratory I 18
- 2.9 331D Biomagnetic Effects Laboratory 19
- 2.10 331G Interim Tissue Repository Building 20
- 2.11 331H Aerosol Wind Tunnel Research Facility 21
- 2.12 336 High-Bay Testing Facility 21
- 2.13 337 Technical Management Center 22
- 2.14 338 Prototype Engineering Laboratory 23
- 2.15 3720 Environmental Sciences Laboratory 23
- 2.16 3730 Gamma Irradiation Facility 24
- 2.17 Summation of Flows 25

3.0 References 27

Appendix A - 1998 Sampling Event 29

Appendix B – Investigative Sampling Events 33

Appendix C - Treated Effluent Disposal Facility Waste Acceptance Criteria 38

Tables

2.1 Summary of Estimated Flows from PNNL Facilities Discharging to the TEDF 26

Figures

1.1 Active PNNL-Operated Facilities in the 300 Area of the Hanford Site...................................... 3

Acronyms and Abbreviations

DCG	Derived Concentration Guideline
DOE	U.S. Department of Energy
dpm	disintegrations per minute
GEA	gamma energy analysis
gpm	gallons per minute
HEPA	high-efficiency particulate air
mg/L	milligrams per liter
NPDES	National Pollutant Discharge Elimination System
pCi/L	picocuries per liter
ppb	parts per billion
PNNL	Pacific Northwest National Laboratory
PS	Process Sewer
R&D	research and development
RLWS	Radioactive Liquid Waste System
RPS	Retention Process Sewer
SBMS	Standards-Based Management System
SNS	Sanitary Waste System
TEDF	Treated Effluent Disposal Facility
μg/L	microgram per liter

1.0 Introduction

The Pacific Northwest National Laboratory (PNNL) operates a number of research and development (R&D) facilities for the U.S. Department of Energy (DOE) on the Hanford Site's 300 Area (see Figure 1). The liquid wastes from these facilities are discharged to five liquid effluent systems: the Sanitary Waste System (SNS), the Process Sewer (PS), the Retention Process Sewer (RPS), the 325 Radioactive Liquid Waste System (RLWS),[a] and the 331 Aquaculture System. The wastewater from the PS and RPS systems is treated by the 300 Area Treated Effluent Disposal Facility (TEDF) and discharged to the Columbia River via a National Pollutant Discharge Elimination System-permitted outfall. The SNS discharges to the City of Richland Publicly Owned Treatment Works under a contract with the DOE. The RLWS wastewater is transported to tanks in the 200 Area. The aquaculture system discharges water from fish rearing activities to the Columbia River via an NPDES-exempt outfall. The SNS, RLWS, and aquaculture system do not interface with the 300 Area TEDF.

The NPDES permit specifies limits of chemical constituents and requires "proper operation and maintenance" of the TEDF. To meet permit requirements, Fluor Hanford, operator of the TEDF, has developed administrative controls for all waste generators who discharge to the 300 Area TEDF. These administrative controls, which are specified in RCP-310, *300 LEF Project Administration Procedures*, require that a Liquid Waste Certification Plan be prepared for facilities that routinely discharge to the TEDF. PNNL published the original *Liquid Waste Certification Plan for Pacific Northwest National Laboratory* in May 1996. Addendums to the plan were provided in 1997 and 1998. The plan was updated to replace the previous submitted plans and addendums in 1999. This plan is the second revision to the 1999 plan.

The current version of RCP-310 requires that the following type of information, when appropriate, be included in Liquid Waste Certification Plans:

- Identification of individual waste streams and an estimate of flow in appropriate units. For intermittent sources, estimates of the weekly flow are acceptable.
- Identification of constituents present in each individual waste stream; the maximum contaminant concentration for the constituent.
- The source of the information, either process knowledge or characterization sampling.
- Description of engineering controls in place to ensure compliance with the Waste Acceptance Criteria.
- A summation of flows and individual contaminant concentrations.

[a] The RLWS as a 300 Area-wide system is no longer operable. A tank system has been set up within the 325 Building to provide for periodic transfers of radioactive liquid wastes to the 200 Area Tank Farms. This system is called the 325 RLWS.

- Rationale for connections to the RPS and type of equipment or process served.

Most of this information is discussed on a facility-specific basis in Section 2.0. However, engineering controls are discussed for all PNNL facilities in Section 1.2.

This Liquid Waste Certification Plan covers all PNNL 300 Area facilities that discharge to the PS or RPS. Liquid effluent discharges from these buildings are centrally managed by PNNL. Under normal operating conditions, the combined discharge from all PNNL facilities complies with the TEDF Waste Acceptance Criteria.

1.1 Scope

The following section discusses the purpose and scope of this Liquid Waste Certification Plan. The discharges from all PNNL facilities are managed by a common set of engineered and administrative controls, which are described in Section 1.2. Liquid effluent sampling has been performed to characterize PS and RPS waste streams from the PNNL facilities that are considered the major potential contributors (considering both flow rate and potential chemical content) to the TEDF. Section 1.3 describes this effort and the systems that remain in place to provide sampling and monitoring capabilities. Section 1.4 provides a basis for the facility-specific information given in Section 2.0. Section 1.5 addresses the release of rinse water from minor skin decontamination activities to the PS.

The following active PNNL facilities currently have the capability to discharge liquid waste to the 300 Area PS or RPS systems:

- 306W Materials Development Laboratory
- 318 Radiological Calibrations Laboratory
- 320 Analytical and Nuclear Research Laboratory
- 323 Mechanical Properties Laboratory
- 325 Radiochemical Processing Laboratory
- 326 Materials Sciences Laboratory
- 329 Chemical Sciences Laboratory
- 331 Life Sciences Laboratory I
- 331D Biomagnetic Effects Laboratory
- 331G Interim Tissue Repository Building
- 331H Aerosol Wind Tunnel Research Facility
- 336 High-Bay Testing Facility
- 337 Technical Management Center
- 338 Prototype Engineering Laboratory
- 3720 Environmental Sciences Laboratory
- 3730 Gamma Irradiation Facility.

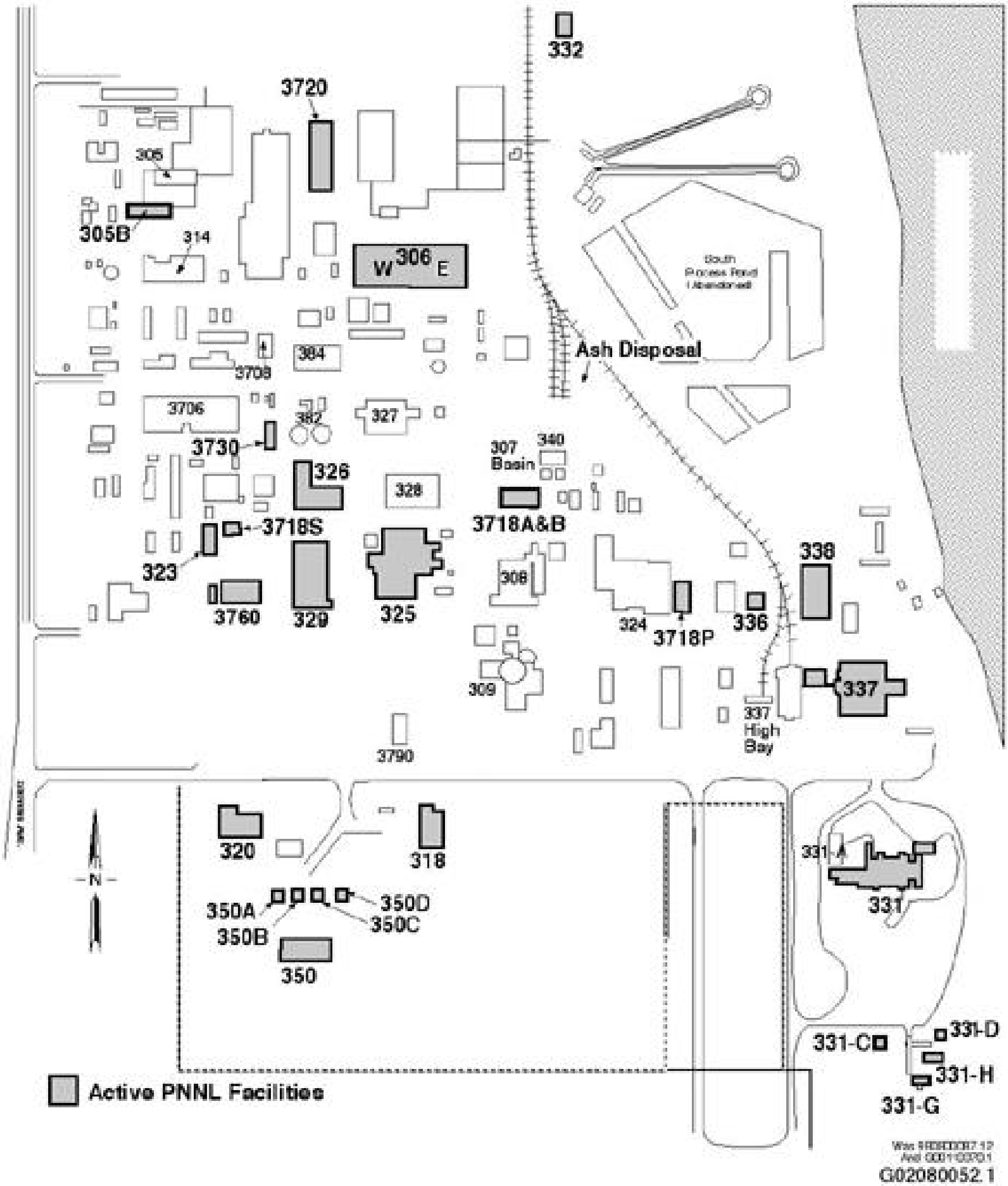

Figure 1.1 Active PNNL-Operated Facilities in the 300 Area of the Hanford Site

The following PNNL facilities, which are connected to the PS, have been vacated and no longer generate liquid effluent discharges. In addition, these facilities have been transferred to other Hanford Site contractors and are no longer PNNL-operated facilities. Therefore, these facilities are not addressed further in this plan:

- 303J Material Storage Building
- 314 Engineering Development Laboratory
- 3708 Radioanalytical Laboratory
- 3745B Positive Ion Accelerator Facility.

In addition, the 305B Hazardous Waste Storage Building has a sump connected to the PS. However, the pump was electrically disconnected and no discharges are provided to the PS. Three facilities, the 324 Waste Technology Engineering Laboratory, 327 Post-Irradiation Testing Laboratory, and 3746A Radiological Physics Laboratory, were transferred to other Hanford Site contractors in the mid-1990s.

1.2 Engineered and Administrative Controls

PNNL uses engineered controls when possible to ensure compliance with the TEDF Waste Acceptance Criteria. Examples of these controls include plugging or capping unnecessary sewer access points and ensuring that normally clean streams that may contain radioactive materials during upset conditions are routed to the RPS, which has diversion capability. Timely notification is made to the operators of the TEDF of any upset or noncompliant discharge.

PNNL has developed a Standards-Based Management System (SBMS), a Web-based system that communicates Laboratory-wide standards, policies, procedures, and guidelines. Procedures and guidelines related to discharges are contained in the SBMS subject area, “Managing Liquid Effluents” (https://sbms.pnl.gov/standard/0q/0q00t010.htm). In this subject area, procedures are provided for planning for liquid effluents, disposing of nonradioactive liquid effluents, disposing of radioactive liquid effluents, and managing liquid waste disposal systems. The following are key elements:

- Releases to liquid waste systems are managed to comply with applicable local, state, and federal requirements.

- Releases to the 300 Area PS or RPS must comply with the TEDF Waste Acceptance Criteria Program, which includes a process to consider waivers from the Waste Acceptance Criteria on a case-by-case basis.

- PNNL’s Environmental Management Services Department staff perform waste designation to determine whether waste is regulated (State of Washington Dangerous Waste/Federal Resource Conservation and Recovery Act) or nonregulated.

- If liquid waste is designated as nonregulated, PNNL's Effluent Management Group staff determine whether the material may be disposed to the PS or RPS, based on the Waste Acceptance Criteria and treatability at the TEDF.

- All sewer system access points in laboratories, shops, and associated areas must be labeled or marked to identify the sewer that the access point serves.

- In areas where hazardous liquid materials could be accidentally spilled or released, all floor drains and other drains must have sufficient engineered controls in place to stop the flow, unless the drains are routed for accumulation in a building collection tank with a manual pump.

- In areas where radioactive or mixed (radioactive and hazardous) liquid materials could be accidentally spilled or released, all floor drains and other drains will have sufficient engineered controls in place to stop the flow.

Training applicable to PNNL staff members' work is identified and implemented through the process described in the SBMS subject area, "Training and Qualification for Staff" (https://sbms.pnl.gov/standard/1e/1e00t010.htm). In addition, for staff who work with hazardous or radioactive materials, training is also required through the SBMS subject area, "Working with Chemicals" (https://sbms.pnl.gov/standard/03/0300t010.htm). This subject area includes procedures and guidelines for planning to use chemicals, acquiring and moving chemicals, storing chemicals, using hazardous chemicals, and responding to spills/adverse conditions. The following are key elements:

- Cradle-to-grave management of chemicals must be planned for, including acquisition, use, storage, and disposal of chemicals.

- An inventory process is used to track chemicals in PNNL's Chemical Management System.

- Chemical storage must be kept to the minimum amount of hazardous chemicals needed to conduct work. Chemicals must be labeled clearly and stored safely, and chemical inventories must be assessed at least annually.

- Store chemicals in a manner that prevents accidental spills or discharges to the sewer system. Store all chemicals away from open floor or sink drains, or if within proximity of the drains, store within secondary containment. Close or properly cap chemicals when not in use.

- Practice "good housekeeping" in storage areas. Stack containers so they are stable and in a way that does not put excess stress on the sides of the container. Remove obstructions and debris. Clean up or report spilled chemicals and broken containers immediately.

- Responding to a spill includes reporting if any material was released to the environment (including the sewer system) to the PNNL emergency single-point-of-contact.

- Staff must manage and dispose of chemical waste in compliance with the SBMS subject areas, "Managing Liquid Effluents," "Managing Waste" (https://sbms.pnl.gov/standard/0f/0f00t010.htm), and "Waste Minimization and Pollution Prevention" (https://sbms.pnl.gov/standard/0z/0z00t010.htm).

1.3 Effluent Sampling and Monitoring

Effluent sampling was performed in 1994 and 1995 (Thompson et al. 1997) to characterize liquid wastes discharged to the PS and RPS from the PNNL facilities that were considered to be the major contributors to the TEDF. Facilities were selected according to their potential for discharging chemicals to the TEDF, and are also the major flow contributors from PNNL. This sampling effort was discontinued at the beginning of Fiscal Year 1995, but the sampling stations remain in standby to be used when needed to determine the source of discharges of concern to the TEDF or to periodically confirm that discharges remain low. For example, sampling was conducted in May 1998 from each of the dedicated sampling stations to affirm that discharges were similar to those characterized in the earlier campaign (see Appendix A), and sampling was conducted in February 2000 to aid in identifying sources of elevated gross alpha and tritium activity at TEDF (see Appendix B). The facilities with dedicated sampling stations are the

- 320 Analytical and Nuclear Research Laboratory
- 325 Radiochemical Processing Laboratory
- 326 Materials Sciences Laboratory
- 329 Chemical Sciences Laboratory
- 331 Life Sciences Laboratory I[(b)]
- 3720 Environmental Sciences Laboratory.

Each sampling station consists of a refrigerated sampler, flow meter, pH meter, and conductivity meter. The refrigerated samplers, which are currently in standby, have the ability to collect flow-proportional composite samples. Flow, and pH data continue to be monitored centrally via the Facility Management Control System at four of these facilities (320 Analytical and Nuclear Research Laboratory, 325 Radiochemical Processing Laboratory, 326 Materials Sciences Laboratory, and 329 Chemical Sciences Laboratory). Data collection at the 331 Life Sciences Laboratory I and 3720 Environmental Sciences Laboratory is provided via stand-alone data-acquisition equipment[(c)].

Sample ports were installed at several locations where the potential for discharges containing hazardous constituents was determined to be minimal. These locations include the 318 Radiological

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b The sampling system at the 331 Building is temporarily out of service and is being repositioned following facility piping modifications. Reinstallation is planned to be completed during FY03.

c When reinstallation is complete, the 331 Life Sciences Laboratory I will also be connected to the Facility Management and Control System.

Calibrations Laboratory and 3730 Gamma Irradiation Facility. These sample ports allow the use of portable, time-proportional sampling equipment, but have no continuous monitoring capabilities. The remaining facilities were determined to have minimal risk of discharges of concern to the TEDF and do not have dedicated sampling capabilities. However, sampling via portable samplers may be possible at some locations if needed.

1.4 Research and Development Activities

Activities in individual facilities range from primarily administrative to laboratory and pilot-scale R&D. R&D activities include 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. Projects are primarily laboratory-scale, with some pilot-scale activities. A wide variety of chemicals and radioactive materials may be used, resulting in the generation of widely varying liquid wastes. The engineered and administrative controls used to ensure adequate disposal of the wastes are described in Section 1.2.

1.5 Decontamination Activities

PNNL plans to release rinse water from minor skin decontamination activities to the PS for treatment at the TEDF. Rinse water releases to the TEDF will be limited to skin decontamination events where the beta/gamma activity is less than 34,000 disintegrations per minute (dpm)/probe area [equivalent to 1,000 picocuries per liter (pCi/L), the Derived Concentration Guideline (DCG) value for ^{90}Sr] and alpha activity less than 2,500 dpm/probe area (equivalent to 30 pCi/L, the DCG value for ^{239}Pu). Skin contamination in excess of these values will be decontaminated at the decontamination facility in the 325 Radiochemical Processing Laboratory or in the 329 Chemical Sciences Laboratory, where rinse water is retained in a holding tank.

The above activity limits were based on an evaluation performed on past skin contamination events that occurred from 1991 through 1996. Releases of beta/gamma activity and alpha activity were estimated and compared to the TEDF Waste Acceptance Criteria. Results indicated that skin contamination events within the above activity limits would not generate rinse water exceeding the DCGs found in DOE 5400.5, "Radiation Protection of the Public and the Environment." Based on this evaluation, skin decontamination events with the above activity limits are considered acceptable for the TEDF.

2.0 Facility-Specific Information

The following data are provided in this section in accordance with RCP-310, *300 LEF Project Administration Procedures*, Section 3.04, Liquid Waste Certification Program, Subsection 4.2 "Liquid Waste Certification Plan Content:"

- Identification of individual waste streams and an estimate of flow in appropriate units. For intermittent sources, estimates of the weekly flow are acceptable.
- Identification of constituents present in each individual waste stream; the maximum contaminant concentration for the constituent.
- The source of the information, either process knowledge or characterization sampling.
- A summation of flows and individual contaminant concentrations.
- Rationale for connections to the RPS and type of equipment or process served.

The description of the mission and activities in each facility are primarily obtained from Facility Use Agreements that are used to document the scope of building work activities and associated hazards; building capabilities and limits; the roles, responsibilities, accountabilities, and authorities for PNNL Facility Operations, support groups, and occupants. The Facility Use Agreements are maintained as part of PNNL's SBMS.

Discharge access points to the PS and RPS from PNNL facilities include sink and hood drains from a large number of laboratories, R&D equipment cooling facility systems (e.g., air conditioning, vacuum systems), drinking fountains, shower and eye-wash stations, and floor drains and trenches. Facilities are also served by individual boilers managed by Johnson Controls under an independent contract with DOE. Those discharges are covered under a separate Liquid Waste Certification Plan. In many facilities, discharges are collected in a sump that is periodically pumped into the 300 Area PS or RPS systems.

For much of the facility-specific data, the potential constituents in the effluent stream are those detected during the sampling campaign conducted by PNNL's Effluent Management Group staff in 1994 and 1995 (Thompson et al. 1997). Data from this campaign include the constituent, the number of times the constituent was detected, the number of samples collected, the range of the constituent, the average value, and the standard deviation. The data from this sampling effort provide the best available information on the constituents present in the sampled waste streams.

The following constituents, which are listed in the TEDF Waste Acceptance Criteria (see Appendix C for current criteria), were not included in the PNNL initial effluent characterization:

- Suspended solids - Visual inspection and process knowledge indicated that PNNL facilities were not a significant source of suspended solids. The major contributors to the PS and RPS are cooling waters and sink drains, neither of which contains measurable quantities of suspended solids.

- Gamma energy analysis (GEA) - Due to the low gross beta analytical results, GEA analyses were not performed on the PNNL characterization samples. Gross beta measurements were less than 30 pCi/L in samples collected from all facilities; therefore, GEA results in excess of the 9,000 pCi/L TEDF Waste Acceptance Criteria were not considered credible.

- Total radium - Due to the low gross alpha analytical results, total radium analyses were not performed on the PNNL characterization samples. Gross alpha measurements were below 15 pCi/L in all samples collected, except for several at the 3720 Environmental Sciences Laboratory. The highest gross alpha value for the 3720 Environmental Sciences Laboratory was 44 pCi/L, and the average value for the 52 samples collected at that facility was 12 pCi/L.

The pH data in the sampling campaign were obtained from 24-hour composite samples. These data were selected to avoid short-term fluctuations that are not significant to the TEDF. Mixing of the various facilities' effluent streams and residence time in both the waste collection sump and the TEDF Equalization Tank accommodate short-term fluctuations in pH.

Most PNNL-operated facilities discharge effluents that are not directly related to an R&D activity to the PS. For example, the major source of effluent from the 3730 Gamma Irradiation Facility is steam condensate from the building steam heating system. In these cases, process knowledge is the basis for the data, rather than characterization sampling.

Flow rate data for the PNNL facilities with dedicated sampling stations were obtained from the flow measuring equipment. For those facilities that do not have installed flow measuring equipment, the data provided are the estimates used in the 300 Area Process Sewer Piping Upgrade, Project L-070.[d] For this project, PNNL provided estimates of a maximum flow rate for each facility based upon normal operations and upset conditions, a duration for the maximum flow rate, and a frequency at which the maximum flow rate would occur.

2.1 306W Materials Development Laboratory

Mission and Activities: In the past, the 306W Materials Development Laboratory was 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 super-plastic aluminum material for major domestic automotive manufacturers. This work included

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[d] Attachment to letter from T. B. Veneziano to T. D. Chikalla, "Design Flowrates for Replacement 300 Area Process Sewer System," Project L-070, dated September 23, 1994.

advanced casting technology; test-specimen fabrication; material testing of the metal matrix composite material; and the heat treatment, machining, and testing of the super-plastic aluminum material. Some metal work and storage of bulk metal still occurs 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 PNNL 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.

Physical Description: The 306W Materials Development Laboratory is a two-story, steel-framed structure containing about 34,000 ft^2 of floor space, including large high-clearance process areas for metal-working activities, laboratories, and a two-story office addition. 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.

Radiological Inventory: Radiological inventories in the 306W Materials Development Laboratory 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.

Chemical Inventory: A review of the Chemical Management System for the 306W Materials Development Laboratory indicated that acids, bases, organics, and metals may be present in the building.

Effluent Characterization: Although the 306W Materials Development Laboratory does not have a liquid effluent sampling system, the PS from the building was sampled with a portable sampler during the sampling campaign conducted by PNNL's Effluent Management Group staff in 1994 and 1995 (Thompson et al. 1997). Results from this sampling campaign are provided in Appendix D of the cited report. These results show generally low concentrations [parts per billion (ppb)] of pollutants, less than the TEDF Waste Acceptance Criteria.

Estimated flow rates from the 306W Materials Development Laboratory are 5 gallons per minute (gpm) average. An estimated maximum of 100 gpm was used as the design flow rate range that was provided in conjunction with Project L-070, the replacement 300 Area Process Sewer System. However, the failure mode that allowed large discharges from the closed loop cooling system was corrected, and the maximum is now believed to be a much smaller figure of 20 gpm.

2.2 318 Radiological Calibrations Laboratory

Mission and Activities: The 318 Radiological Calibrations Laboratory is primarily used to provide technical services in internal dosimetry; external dosimetry; and 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 this building includes development of radiation detection and measuring instruments.

Physical Description: The 318 Radiological Calibrations Laboratory contains about 37,000 ft^2 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.

The 318 Radiological Calibrations Laboratory is served by the 300 Area PS and SNS; the SNS serves the restrooms and lunchrooms, and the PS serves process areas. The facility does not have an installed liquid effluent sampling system.

Radiological Inventory: Most of the radiological inventory in the 318 Radiological Calibrations Laboratory is in the form of sealed sources, although very small quantities of radon and thoron 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.

Chemical Inventory: A review of the Chemical Management System for the 318 Radiological Calibrations Laboratory indicated that acids, bases, organics, and inorganics may be present in the building.

Effluent Characterization: Liquid effluents from the 318 Radiological Calibrations Laboratory 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.

The 318 Radiological Calibrations Laboratory does not possess flow rate measuring equipment; therefore, flow rate estimates are the design flow rates that were provided in conjunction with Project L-070, the replacement 300 Area Process Sewer System. These are approximately an average of 2 to 10 gpm with a maximum of 60 gpm. Cooling water for the x-ray machine requires about 2-gpm continuous flow, and the estimated maximum flow rate is based on a number of sinks being used simultaneously.

2.3 320 Analytical and Nuclear Research Laboratory

Mission and Activities: Research activities conducted in the 320 Analytical and Nuclear Research Laboratory 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 instruments that are used for sample analysis include various mass spectrometers, electron-beam microscopes, x-ray diffraction, and radiation counters.

Physical Description: The 320 Analytical and Nuclear Research Laboratory consists primarily of two floors: one ground-level floor and a basement. A newer self-contained addition consists of laboratories and 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 occupying the southeast corner of the basement. Half of the older portion ground-level laboratory space consists of "clean zone" modular rooms with high-efficiency particulate air- (HEPA-) filtered supply air. The building contains about 31,000 total ft^2 of floor space.

The 320 Analytical and Nuclear Research Laboratory 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 west discharge line of the PS that includes capability for continuously monitoring pH, conductivity, and flow, as well as capability for obtaining flow-composite samples.

Radiological Inventory: The 320 Analytical and Nuclear Research Laboratory contains small quantities (millicuries or less) of radioactive materials in various forms.

Chemical Inventory: A review of the Chemical Management System for the 320 Analytical and Nuclear Research Laboratory indicated that acids, bases, organics, and inorganics may be present in the building.

Effluent Characterization: The 320 Analytical and Nuclear Research Laboratory is equipped with a liquid effluent sampling system for the PS discharges from the west side of the building. Sampling was performed from this line during the sampling campaign conducted by PNNL's Effluent Management Group staff in 1994 and 1995 (Thompson et al. 1997). Results from this sampling campaign are provided in Appendix D of the cited report. These results show generally low concentrations (ppb) of pollutants, less than the TEDF Waste Acceptance Criteria.

The 320 Analytical and Nuclear Research Laboratory contains two discharge lines from the building. Discharge flows from the west discharge line have been measured and average 1 to 5 gpm, most of which is cooling water. Flows from the east discharge line are estimated at about 20 gpm. Maximum potential flow rates from the east and west discharge lines are estimated at 50 and 75 gpm, respectively, based on pumping abilities from the sump.

2.4 323 Mechanical Properties Laboratory

Mission and Activities: Work in the 323 Mechanical Properties Laboratory 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 Mechanical Properties Laboratory 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 contains about 4,200 ft^2 of floor space including an office, laboratory, and high bay. 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: In the 323 Mechanical Properties Laboratory, small samples of activated reactor structural components are tested in the hot cell. Radioactivity present is contained within a metal matrix and is not dispersible.

Chemical Inventory: A review of the Chemical Management System for the 323 Mechanical Properties Laboratory indicated that only small quantities of chemicals (mostly organics) are used in the building.

Effluent Characterization: The only work performed in the 323 Mechanical Properties Laboratory involves the hot cell. Liquid wastes are not generated during these operations; therefore, no effluent sampling or monitoring has been performed. The major source of effluent from this building is storm water. Effluent from this building discharges to a sump equipped with two pumps that are float-switch-controlled. The sump is estimated to discharge about once per week for five minutes with an estimated average daily flow rate of 1 gpm and maximum of 30 gpm.

2.5 325 Radiochemical Processing Laboratory

Mission and Activities: The 325 Radiochemical Processing Laboratory was designed to accommodate general radiochemical research, development, demonstration, and analytical services. Current work at the facility includes analytical activities related to radioactive and hazardous waste, nuclear fuel, other areas associated with the Hanford Site characterization and remediation effort, tritium extraction and permeation tests, and medically usable radioisotopes. Work is typically divided among the two hot cell complexes, gloveboxes, fume hoods, and laboratory benches, depending on the radioactive or hazardous nature of the work.

Physical Description: The 325 Radiochemical Processing Laboratory is a three-story, welded metal frame structure with insulated metal siding erected on reinforced concrete footings, walls, and slabs. The building contains about 144,000 ft^2 of floor space, of which a third is laboratory space. The building consists of

- a central section containing general purpose laboratories modified for low-level radiochemical work
- a south (front) wing containing office space, locker rooms, a lunchroom, and maintenance shops
- a high-level radiochemistry facility in the east wing and a shielded analytical laboratory in the west wing providing shielded enclosures (hot cells) with remote manipulators for high-level radiochemical work

- a filter addition area that provides a final testable HEPA filtration stage for ventilation exhaust air

- an outside radioactive materials storage area and cargo containers.

The first floor of the building contains approximately 100 laboratories and offices; the laboratories contain numerous fume hoods and gloveboxes for working safely with radioactive and hazardous materials. Offices are also located on the second floor and on a mezzanine area between the first floor and the basement. The basement contains several laboratories in addition to a portion of the ventilation and waste-handling systems. Instrument rooms, certain isolated laboratories, and the basement mezzanine office area have refrigerated air conditioning for temperature and humidity control.

The 325 Radiochemical Processing Laboratory is served by the 300 Area RPS and SNS. The SNS serves the restrooms, some shop areas, and lunchrooms, and the RPS serves the process areas. The PS system formerly used in the building was converted to an RPS system in the early 1990s because of the potential for radioactive contamination. The building is equipped with a liquid effluent sampling system on the RPS that includes the capability for continuously monitoring pH, and flow, as well as the capability for obtaining flow-composite samples. In addition, the building contains an RLWS for disposing radioactive liquid waste. The RLWS is independent and does not contribute to the PS or RPS systems.

Radiological Inventory: The laboratories and specialized facilities in the 325 Radiochemical Processing Laboratory enable work with picogram to kilogram quantities of fissionable materials and up to megacurie quantities of other radionuclides. Radioactive materials present include fission and activation products, tritium, plutonium, and uranium.

Chemical Inventory: Chemical storage and usage are dispersed throughout the 325 Radiochemical Processing Laboratory and consist of bulk materials, small volume chemicals, and standards used in conducting laboratory analyses and experiments. Almost all classes of chemicals may be present, including acids, bases, organics, and inorganics.

Effluent Characterization: The 325 Radiochemical Processing Laboratory is equipped with a liquid effluent sampling system for the RPS and was sampled during the sampling campaign conducted by PNNL's Effluent Management Group staff in 1994 and 1995 (Thompson et al. 1997). Results from this sampling campaign are provided in Appendix D of the cited report. These results show low concentrations (ppb) of pollutants, generally less than the TEDF Waste Acceptance Criteria.

RPS flow rates have been measured, and the monthly averages range from less than 1 to 3 gpm. Maximum flows from the sump may be up to 50 gpm.

2.6 326 Materials Sciences Laboratory

Mission and Activities: The 326 Materials Sciences Laboratory is used to conduct R&D in the following areas:

- Development and calibration of fiber optic chemical sensors, electrical and mechanical engineering support for nuclear instrumentation development and fabrication, design and engineering of special purpose radiation detectors and sampling systems

- Analytical biology and chemistry research (includes biosafety level II research)

- Fundamental research of supercritical fluids to understand supercritical fluid solvation and chemistry mechanisms and processes

- Development and characterization of structural materials including fusion and fission reactor systems, lightweight transportation materials for automotive applications, and high-temperature materials for multiple applications.

Physical Description: The 326 Materials Sciences Laboratory is a two-story building with a basement. The framework is bolted-steel and exterior walls are fluted steel insulated panels. Floors are reinforced concrete finished with vinyl asbestos tile with access trenches for utility distribution under the main floor. The building contains about 63,000 ft^2 of floor space and is equipped with gloveboxes, fume hoods, and hot cells.

The 326 Materials Sciences Laboratory 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 that have a greater potential to discharge radioactive materials. 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. An RLWS that served the building in the past has been disconnected; thus, radioactive liquid wastes may be transported to the 325 RLWS system.

Radiological Inventory: Radioactive material in the 326 Materials Sciences Laboratory is primarily generated 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 also be present.

Chemical Inventory: A review of the Chemical Management System for the 326 Materials Sciences Laboratory indicated that a wide variety of chemicals are used in the building, including acids, bases, organics, and inorganics.

Effluent Characterization: The 326 Materials Sciences Laboratory is equipped with liquid effluent sampling systems for both the PS and RPS and was sampled during the sampling campaign conducted by PNNL's Effluent Management Group staff in 1994 and 1995 (Thompson et al. 1997). Results from this sampling campaign are provided in Appendix D of the cited report. These results show low concentrations (ppb) of pollutants, generally less than the TEDF Waste Acceptance Criteria.

Liquid effluent flow rates from the 326 Materials Sciences Laboratory are low. Measured discharges from the PS have monthly averages ranging from 0.2 to 5.6 gpm. Measured discharges from the RPS range from monthly averages of 0.1 to 0.5 gpm. Maximum flows are estimated at 20 gpm for the PS and 30 gpm for the RPS.

2.7 329 Chemical Sciences Laboratory

Mission and Activities: Work in the 329 Chemical Sciences Laboratory includes the following types of R&D activities:

- Research and development of special purpose radiation detection and sampling systems, the development of electronics to enhance gamma and neutron detector performance, and the associated software to support operation of these unique systems. Solid, liquid, and gas samples are analyzed in the specialized laboratories and counting rooms.

- Wet chemistry techniques and the operation of specialized analytical instrumentation such as mass spectrometers, organic mass spectrometers, and the Inductively Coupled Plasma Spectrometers. Analyses are conducted on both radioactive and nonradioactive samples.

Physical Description: The 329 Chemical Science Laboratory contains about 39,000 ft^2 of floor space on two floors. The building contains general electronics, low-level radiochemistry, analytical chemistry laboratory space, and associated offices and storage space on the first floor. The second floor consists primarily of mechanical and electrical rooms.

The 329 Chemical Sciences Laboratory 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 janitor's main sink. The RPS serves process areas in the other two corridors (A- and B-sections) that have a greater potential to discharge radioactive materials. The RPS also serves the sink in a room on a separate branch that used to contain a neutron multiplier facility. Radioactive work in C-Section is primarily with sealed sources. The PS connections serve equipment such as air handling units and drains from an air compressor and vacuum pump. 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. Because laboratory sinks are not connected to the PS, the risk of inadvertent discharge of inappropriate materials is low. No permanent sampling station has been installed on the PS system.

Radiological Inventory: A variety of radionuclides may be present in the 329 Chemical Sciences Laboratory. Inventories are generally in small quantities (microcurie to millicurie) and can be in solid, liquid, powder, or sealed source form. In addition, larger quantities (kilograms or greater) of uranium and thorium may be present as fuel rods, fuel pellets, or powder. Some plutonium may also be present.

Chemical Inventory: A variety of types and forms of chemicals are used in the 329 Chemical Sciences Laboratory, including acids, bases, organics, and inorganics.

Effluent Characterization: The 329 Chemical Sciences Laboratory is equipped with liquid effluent sampling and monitoring (pH, conductivity, and flow) systems for the RPS, but was not sampled during the sampling campaign conducted by PNNL's Effluent Management Group staff in 1994 and 1995 (Thompson et al. 1997). The building was undergoing extensive remodeling during that campaign, and no R&D work was being conducted in the RPS wings.

Flow rates from the 329 Chemical Sciences Laboratory PS are estimated as approximately 3 gpm and measured flow rates from the RPS are less than 0.1 gpm monthly average. Estimated maximum flow rates are 20 gpm for the PS and 10 gpm for the RPS.

2.8 331 Life Sciences Laboratory I

Mission and Activities: One of the primary functions of the 331 Life Sciences Laboratory I is to provide research capabilities for studying the health effects of chemicals and radiation and the uptake and transformation effects in soils, plants, animals, microorganisms, and solutions when they are exposed to radiation. Current projects are being conducted to examine these effects in animals and in cells grown in culture. Much of this work focuses on molecular level changes and uses very small amounts of radioactive materials for tracing biological molecules.

Another function of the 331 Life Sciences Laboratory I is to provide aquaculture research capabilities, which offer an integrated approach to characterizing and monitoring aquatic ecosystems by developing and deploying new technologies and methods. Research focuses on the impacts of water-use practices on fisheries and the response of the aquatic ecosystems to engineered structures and to natural and man-induced stresses.

Additionally, research work in the 331 Life Sciences Laboratory I is conducted to promote an understanding of the chemical and biological processes that govern the mobility and degradation of a range of inorganic, organic, and radioactive contaminants in soils, sediments, and groundwater systems. This work may use radioactive materials in more significant quantities.

Finally, research in the 331 Life Sciences Laboratory I is conducted to obtain measurements of exposures to physical and chemical agents. This includes associated research to interpret and validate measurements for providing customers with more accurate and relevant information on worker and public exposures and to provide assistance in radioisotope technology to the medical community for diagnosing and treating diseases. For example, a cobalt irradiator is used for a wide variety of exposures from cell cultures to food.

Physical Description: The 331 Life Sciences Laboratory I consists primarily of two laboratory floors with a mechanical-electrical service floor sandwiched in between. Blending into the building to the west and north is additional single-story laboratory space. From the west end of the building, two wings that were animal kennels extend south; these kennels are currently being dismantled. The administrative office area is a three-story building with a two-story addition on the northeast side of the building. The total facility usable area is about 115,000 ft^2 with about 100 laboratories and animal care rooms and more than 100 offices.

The 331 Life Sciences Laboratory I is served by the 300 Area PS, SNS, and aquaculture system. The SNS serves the restrooms and lunchrooms, the aquaculture system serves the indoor and outdoor sections of the aquaculture research laboratories and some storm drains, and the PS serves the other process areas. Some of the equipment room and storm water discharges to the aquaculture system were rerouted to the PS in 1998. An animal waste system was also previously used to discharge effluents from animal research areas. This system consisted of a series of connections in the southwest quadrant of the first floor of the facility and a septic tank located northwest of the 331D Biomagnetic Effects Laboratory. In 1998, modifications were made to reroute animal waste lines to the PS after removing restrooms that connected to it in the north wing of building. Samples were taken to confirm the absence of coliform in the effluent stream following the system modifications.

The building was equipped with a liquid effluent sampling system on the PS that included capability for continuously monitoring pH, conductivity, and flow, as well as the capability for obtaining flow-composite samples. This system was removed from the original sampling location because of the previously described facility modifications and is in the process of being installed in a new location. Completion of this activity is scheduled for FY03.

Radiological Inventory: A variety of radionuclides may be present in the 331 Life Sciences Laboratory I. Inventories are generally in small quantities (microcurie to millicurie) and can be in solid, liquid, powder, or sealed source form. In addition, larger quantities (grams) of fissionable materials (uranium, neptunium, plutonium) may also be present in gloveboxes.

Chemical Inventory: Chemical storage and usage are dispersed throughout the 331 Life Sciences Laboratory I and consist primarily of small volume chemicals and standards used in conducting laboratory analyses and experiments. Almost all classes of chemicals may be present, including acids, bases, organics, and inorganics.

Effluent Characterization: The 331 Life Sciences Laboratory I is equipped with a liquid effluent sampling system for the PS and was sampled during the sampling campaign conducted by PNNL's Effluent Management Group staff in 1994 and 1995 (Thompson et al. 1997). Results from this sampling campaign are provided in Appendix D of the cited report. These results show low concentrations (ppb) of pollutants, generally less than the TEDF Waste Acceptance Criteria. PS flow rates are currently estimated at 25 to 30 gpm. Maximum flows may be up to 150 gpm.

2.9 331D Biomagnetic Effects Laboratory

Mission and Activities: The 331D Building, which was used in the past as a biomagnetic effects laboratory, is currently used to store equipment and supplies, including portable samplers, pH meters, bottles, buffer solutions, and concentrated dyes in support of PNNL- and Battelle-compliance monitoring activities. Nonradioactive wastewater samples are temporarily stored at this facility before shipment to various analytical laboratories. Additionally, chemicals used in facility and 300 Area mechanical systems are stored in a back room for PNNL's Maintenance Services Organization.

Physical Description: The 331D Biomagnetic Effects Laboratory is a semi-high-bay, prefabricated, metal Butler building erected on a concrete slab. It is located to the southeast of the 331 Life Sciences Laboratory I. The structure is approximately 42 ft by 32 ft (1300 ft^2 of floor space) and was originally built as an animal waste treatment facility. It has three large rooms; one is equipped with a sink, cabinets, and a counter top. This room, with about one-third of the floor space, is considered to be a wet and dry lab, and has one drain to the PS. The other two rooms, which constitute the remaining two-thirds of the floor space, are used for storage.

Radiological Inventory: No radiological materials are permitted within the 331D Biomagnetic Effects Laboratory.

Chemical Inventory: Small quantities of chemicals may be present in the 331D Biomagnetic Effects Laboratory to support effluent sampling and monitoring operations (e.g., pH buffers, standards, preservatives in sampling bottles). Bulk chemicals that are used for facility operations are also stored in the building.

Effluent Characterization: The 331D Biomagnetic Effects Laboratory is primarily used for storage, with very minor and periodic discharges from the use of one lab sink. Discharge flow rates are estimated at less than 1 gpm, and no effluent sampling or monitoring has been performed. A maximum flow rate of 10 gpm was used as the design maximum for Project L-070.

2.10 331G Interim Tissue Repository Building

Mission and Activities: In the past, the 331G Interim Tissue Repository Building provided research capabilities for conducting radioactive tracer studies using animals, biota, vegetation, and soils. However, the building was vacated and cleaned in 1999 and all ventilation shut down. It is currently used for research with radiation detectors, only requiring the use of radioactive sealed sources and water.

Physical Description: The 331G Interim Tissue Repository Building is a 60-ft by 20-ft (1200 ft^2) concrete block structure positioned on a concrete slab. It is located to the extreme southeast of the 331 Life Sciences Laboratory I. The building was originally built to house laboratory animals (primarily swine) while they were giving birth. Almost all of the floor space is considered dry laboratory. A sink and two floor trenches from this facility were routed to the PS, but the sink was removed during the cleanout and the trenches were plugged.

Radiological Inventory: Only sealed sources may be used in or around the 331G Interim Tissue Repository Building.

Chemical Inventory: No chemicals are stored or used in the 331G Interim Tissue Repository Building.

Effluent Characterization: No effluents are discharged from the 331G Interim Tissue Repository Building, and no effluent sampling or monitoring has been performed.

2.11 331H Aerosol Wind Tunnel Research Facility

Mission and Activities: In the 331H Aerosol Wind Tunnel Research Facility, research is conducted to evaluate the effects and changes in plants, animals, and the surface geologic materials occurring as a result of airborne deposition of windblown materials, chemical constituents, or wind erosion. The facility houses a wind tunnel, associated measurement equipment, and a lab area to perform these studies.

Physical Description: The 331H Aerosol Wind Tunnel Research Facility is a one-story, concrete block structure on concrete foundations and a concrete slab. It is located southeast of the 331 Life Sciences Laboratory I. The building has a flat, built-up roof covered with gravel. A metal lean-to is attached to the northwest corner of the building to provide additional research space. A little more than half of the 3600-ft^2 floor space is considered dry or wet laboratory; the remainder is considered common space. A humidifier and condensate drains are routed to the PS from this facility. The 331H Aerosol Wind Tunnel Research Facility is served by the 300 Area PS and SNS. The SNS serves the restroom in the facility.

Radiological Inventory: Sealed sources for measurement equipment are the only radiological materials in the 331H Aerosol Wind Tunnel Research Facility.

Chemical Inventory: A wide variety of chemicals may be present in the 331H Aerosol Wind Tunnel Research Facility in support of or as part of the wind tunnel experiments.

Effluent Characterization: Very minor quantities of effluent are generated in the 331H Aerosol Wind Tunnel Research Facility, and no effluent sampling or monitoring has been performed.

2.12 336 High-Bay Testing Facility

Mission and Activities: The primary mission of the 336 High-Bay Testing Facility 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 within this building's Fluid Dynamics Laboratory include bubble dynamics experiments, slurry transport/resuspension studies, and waste tank mixing/mitigation/retrieval experiments using a variety of nonradioactive physical simulants. Major building equipment and 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 multiscale 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 pulsed-air, pneumatic conveyance, and extendable nozzle retrieval technologies. 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 High-Bay Testing Facility provides staff with a three-story high bay and a 20-ft-diameter circular pit, approximately 50-ft deep. The approximately 6,400-ft^2 building houses a high bay with supporting office and shop. The high bay contains a series of tanks up to about a 25,000-gallon capacity for scale-model tank research. The southwest corner of the building provides two supporting laboratories.

The 336 High-Bay Testing Facility 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: Radiological materials are not permitted within the 336 High-Bay Testing Facility.

Chemical Inventory: Bulk chemicals are used in the slurry studies and smaller quantities also are used to support research activities. A variety of types and forms of chemicals are used in the 336 High-Bay Testing Facility.

Effluent Characterization: Discharges from the 336 High-Bay Testing Facility are very low (< 1 gpm), and no effluent sampling monitoring has been performed.

2.13 337 Technical Management Center

Mission and Activities: The 337 Technical Management Center is primarily an office complex that houses PNNL support groups (e.g., Environment, Safety, Health and Quality; Facilities and Operations). The only sources of effluents are steam condensate and cooling water from two equipment rooms.

Physical Description: The 337 Technical Management Center is a large, three-story structure that provides staff with office space, conference rooms, and a cafeteria. A large mechanical equipment room serves the main building, and a smaller mechanical equipment room serves the cafeteria. The total facility usable area is about 78,000 ft^2. Although most wastewater from the building is discharged to the SNS, the two equipment rooms have discharges to the PS.

Radiological Inventory: No radiological material is permitted in the 337 Technical Management Center other than sealed sources for radiological training purposes.

Chemical Inventory: The only chemicals used in the 337 Technical Management Center are those needed for cleaning or in support of facility equipment.

Effluent Characterization: Estimated flow rates from the 337 Technical Management Center are about 5 gpm from one equipment room and about 3 gpm from the other. Both equipment rooms have sumps that periodically pump to the PS. Therefore, maximum flow rates may be 50 gpm. No effluent sampling or monitoring has been performed.

2.14 338 Prototype Engineering Laboratory

Mission and Activities: The principal effort in the 338 Prototype Engineering Laboratory is focused on assembling and testing equipment to be used by the DOE client. The work uses nonradioactive materials, although a portable x-ray machine may be used at times. The building also houses a Thermomechanical Processing Laboratory that consists of a rolling mill, heat-treating furnaces, and brake shear. This laboratory supports various aluminum, light metal, and advanced metal composite materials development projects.

Physical Description: The 338 Prototype Engineering Laboratory is a one-story building containing about 18,000 ft^2 of floor space. The building consists of office, high-bay, and support space. The building also contains a large basement area.

The 338 Prototype Engineering Laboratory 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: Radiological materials are not permitted within the 338 Prototype Engineering Laboratory.

Chemical Inventory: Very few chemicals are used in the 338 Prototype Engineering Laboratory other than a few organics and bottled gases.

Effluent Characterization: Average flow rates from the 338 Prototype Engineering Laboratory are very low (estimated at < 1 gpm) and are primarily from lunchroom sinks and air conditioner condensate. The estimated maximum flow rate is 20 gpm. No effluent sampling or monitoring has been performed.

2.15 3720 Environmental Sciences Laboratory

Mission and Activities: The 3720 Environmental Sciences Laboratory provides office and laboratory space for PNNL scientific and engineering staff conducting multidisciplinary research in the areas of materials characterization and testing and waste management. The building is designed to accommodate the use of radioactive and hazardous materials to conduct these activities. The building is currently in the process of being vacated. However, there is no current schedule on removal of several activities from the building, and these activities include those that generate liquid effluents. Therefore, the building is still considered a potentially significant contributor to the PS effluent stream.

Physical Description: The 3720 Environmental Sciences Laboratory contains over 29,000 ft^2 of floor space, primarily laboratories and support offices. The building is an all-metal frame construction erected on concrete foundations, footings, and floor slab. The facility also contains a 24-ft x 109-ft basement area at the southwest corner. An annex that contains laboratories has been added to the north end of the building. Currently, only a small portion of the building is used.

The 3720 Environmental Sciences Laboratory is served by the 300 Area PS and SNS; the SNS serves the restrooms, lunchrooms, and one laboratory, and the PS serves all other process areas. PS effluents are discharged to a sump that is emptied using an eductor. 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 the capability for obtaining flow-composite samples.

Radiological Inventory: A wide variety of radionuclides and forms may be present in the 3720 Environmental Sciences Laboratory. The counting laboratory has smaller (microcurie to millicurie) quantities of radionuclides, and research activities may involve several grams. Materials may be present as powders/soils, liquids, in a glass matrix, or as sealed sources.

Chemical Inventory: Chemical storage and usage were dispersed throughout the 3720 Environmental Sciences Laboratory when the building was fully staffed. Now chemicals are located primarily in the remaining occupied areas. These chemicals may include bulk materials (solvents, acids, bases), specimen materials used in materials characterization, substrate materials used to perform laboratory experiments (e.g., chelating agents, salts, inorganics), and standards used for instrument calibration.

Effluent Characterization: The 3720 Environmental Sciences Laboratory is equipped with a liquid effluent sampling system for the PS and was sampled during the sampling campaign conducted by PNNL's Effluent Management Group staff in 1994 and 1995 (Thompson et al. 1997). Results from this sampling campaign are provided in Appendix D of the cited report. These results show low concentrations (ppb) of pollutants, generally less than the TEDF Waste Acceptance Criteria. PS flow rates have been measured and the monthly averages range from <1 to 6 gpm. With the current limited activities in the building, flows have been < 1 gpm for the past year. Maximum flows may be up to 75 gpm.

2.16 3730 Gamma Irradiation Facility

Mission and Activities: The 3730 Gamma Irradiation Facility 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 the degradation of materials such as adhesives, grout, and polymers is also examined in this building. Activities also include measuring the density of materials and the receiving, sorting, and shipping of radioactive materials.

Physical Description: The 3730 Gamma Irradiation Facility is a one-story, concrete block structure with approximately 3,100 ft^2 of floor space and is equipped with a laboratory and a hot cell. 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 building.

Radiological Inventory: Curie quantities of radioactive materials in solid form are stored and tested in the 3730 Gamma Irradiation Facility.

Chemical Inventory: A review of the Chemical Management System for the 3730 Gamma Irradiation Facility indicated that very few chemicals (mostly organics) are used within the facility.

Effluent Characterization: The average daily flow rate is very low (< 1 gpm) with an estimated maximum of 10 gpm. No effluent sampling or monitoring has been performed.

2.17 Summation of Flows

A wide range of activities occurs in the PNNL-operated facilities that discharge to the TEDF, as described in the previous subsections. These facilities range from office buildings that discharge only cooling water to large multipurpose laboratories with more than 100 sinks and drains. The controls used to manage the varied discharges are described in Section 1.2. An estimated summary of discharge volumes as required by RCP-310 is provided in Table 2.1.

Table 2.1 Summary of Estimated Flows from PNNL Facilities Discharging to the TEDF

Building	Average, gpm	Basis for Avg	Maximum gpm	Basis for Maximum	Comments
306W	5	Estimated	20		
318	2 – 10	Estimated	60	L-070 (Max from number of sinks used simultaneously)	
320 (West line)	1 – 5	Measured	75	L-070 (Max from discharge sump)	Primarily cooling water
320 (East line)	20	Estimated	50	L-070 (Max from discharge sump)	
323	1	Estimated	30	L-070 (Max from discharge sump)	Primarily storm water
325 RPS	<1 – 3	Measured	50	L-070 (Max from discharge sump)	325 Only has RPS
326 PS	0.2 – 5.6	Measured	20	L-070	
326 RPS	0.1 – 0.5	Measured	30	L-070	
329 PS	3	Estimated	20	L-070	
329 RPS	<0.1	Measured	10	L-070	
331	25 – 30	Estimated	150	Estimated	
331D	<1	Estimated	10	L-070	One drain only
331G	0		0		No discharges; drains blocked
331H	<1	Estimated	<1		Humidifier
336	<1	Estimated	30	L-070 (Batch release from simulant tanks)	
337 (Eqt Rm 1)	5	Estimated	50	L-070 (Max from discharge sump)	Steam condensate & cooling water
337 (Eqt Rm 2)	3	Estimated	50	L-070 (Max from discharge sump)	Steam condensate & cooling water
338	<1	Estimated	20	L-070	
3720	<1 – 6	Measured	75	L-070 (Max from induction pump)	
3730	<1	Estimate	10	L-070	
Total	~65 – 100				

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Appendix A

1998 Sampling Event

Appendix A

1988 Sampling Event

In May 1998, a single sampling event was conducted at each of the Pacific Northwest National Laboratory (PNNL) dedicated sampling stations to affirm that liquid effluents were not significantly different from previous characterization efforts. During this effort, a series of grab samples were taken at selected times over a two-week period and then composited and analyzed for total organic carbon, ammonia, cyanide, and metals. Samples were taken from Process Sewer sampling stations at the 320, 326, 331, and 3720 buildings and the Retention Process Sewer (RPS) sampling stations at the 325, 326, and 329 at 11:00 a.m. and at 3:00 p.m. from May 11 to May 15 and from May 18 to May 22. These times were selected to maximize potential laboratory discharges over the two-week period. Screening for radiological constituents (gross alpha and gross beta) were performed for effluent samples from the RPS and from the 3720 Environmental Sciences Laboratory. Table A.1 shows the results that confirm previous sampling performed in 1994 and 1995 from the PNNL 300 Area facilities. Concentrations for metals were low, in the micrograms per liter (µg/L) range. Some metals, such as copper and zinc, may be above the Treated Effluent Disposal Facility Waste Acceptance Criteria in facility discharges, but are not expected to be above the Waste Acceptance Criteria when flows from all PNNL facilities are combined. These metals are believed to originate from facility piping.

Table A.1. Analytical Results for 1998 Single Event Sampling

Constituent	Concentration in Facility Effluent [Units are milligrams per liter (mg/L) unless otherwise provided]						
	320	**325**	**326 PS**	**326 RPS**	**329**	**331**	**3720**
Total Organic Carbon	2.2	5.5	4.4	130	7.8	7.1	2.6
N-Ammonia, mg-N/L	0.015	0.070	0.040	0.057	0.3	0.018	0.011
Total Cyanide	<0.004 U	<0.004 U	<0.004 U	<0.004 U	<0.004 U	<0.004 U	<0.004 U
Aluminum	0.03	0.04	0.20	0.10	0.14	0.14	0.04
Antimony	<0.001 U	<0.001 U	<0.001 U	<0.001 U	<0.001 U	<0.001 U	<0.001 U
Arsenic	<0.001 U	<0.001 U	<0.001 U	<0.001 U	<0.001 U	<0.001 U	<0.001 U
Beryllium	<0.001 U	<0.001 U	<0.001 U	<0.001 U	<0.001 U	<0.001 U	<0.001 U
Cadmium	<0.0002 U	<0.0002 U	0.006	0.0047	0.0013	0.0003	<0.0002 U
Chromium	<0.005 U	<0.005 U	0.006	<0.005 U	<0.005 U	<0.005 U	<0.005 U
Copper	0.01	0.027	0.248	0.437	0.482	0.021	0.011
Iron	0.07	0.31	1.40	0.77	0.11	0.03	0.08
Lead	<0.001 U	0.002	0.005	0.030	0.03	0.002	<0.001 U
Manganese	0.002	0.014	0.021	0.039	0.004	0.002	0.005
Mercury	<0.0001 U	0.0010	<0.0001 U	0.0022	0.0004	<0.0001 U	<0.0001 U
Nickel	<0.01 U	<0.01 U	<0.01 U	0.01	0.02	<0.01 U	<0.01 U
Selenium	<0.001 U	<0.001 U	<0.001 U	<0.001 U	<0.001 U	<0.001 U	<0.001 U
Silver	<0.0002 U	0.0004	0.070	0.0037	0.0022	<0.0002 U	0.0006
Thallium	<0.001 U	<0.001 U	<0.001 U	<0.001 U	<0.001 U	<0.001 U	<0.001 U
Zinc	0.078	0.171	0.338	2.35	0.067	0.064	0.044
Gross Alpha, picocuries per milliliter (pCi/mL)		<2E-3		<2E-3	<2E-3		<2E-3
Gross Beta, pCi/mL		4.63E-3		<3E-3	8.30E-3		1.46E-2
U = Analyte undetected at given reporting limit.							

Appendix B

Investigative Sampling Events

Appendix B

Investigative Sampling Events

B.1 2000 Sampling Event

In February 2000, a single sampling event was conducted at each of the Pacific Northwest National Laboratory (PNNL) dedicated sampling stations in response to an occurrence declared by the Treated Effluent Disposal Facility (TEDF) for elevated alpha levels in the Process Sewer (PS). Sampling took place on February 8 and 9, and samples were analyzed at the 325 Building analytical laboratory for gross alpha, gross beta, and tritium. The location, type of sample, and results are shown in Table B.1.

With the exception of the 3720 Environmental Sciences Laboratory, all gross alpha analyses indicate no contamination or levels below the TEDF baseline for gross alpha in the PS (~3 picocuries per liter [pCi/L]). Similarly, all gross beta analyses except that in the 3720 Environmental Sciences Laboratory indicate either no detectable contamination or contamination at levels far below the TEDF Waste Acceptance Criteria for gross beta levels in the PS (15 pCi/L). Although levels found in the manhole used to collect the 3720 Environmental Sciences Laboratory sample are significantly higher than levels at other sample locations, they are not high enough to have caused the elevated alpha contamination levels seen at the TEDF. Additional sampling performed at the TEDF indicate that sediments in the 300 Area PS were the most likely the source of the contamination.

B.2 2002 Sampling Event

In July 2002, a sample was collected from the 326 Materials Sciences Laboratory RPS following a diverter alarm to verify that discharges did not contain radioactive material. The wastewater sample was collected and submitted to the PNNL onsite analytical laboratory. No activity was detected after directly counting an aliquot or after preparing a subsample and using a low-background alpha beta proportional counter. Alpha activity in the sample was less than the detection limit of 3E-9 microcuries per liter (ìCi/ml). Beta activity of 7 to 9 ìCi/ ml was comparable to the activity seen in a laboratory blank sample of distilled water.

Table B.1. Analytical Results for 2000 Sampling Event

Building	System	Location	Sample Type	Tritium[(a)] [picocuries per liter (pCi/L)]	Gross α (pCi/L)	Gross β (pCi/L)
306	PS	PS-4	Grab[(b)]	<600	<2	2.5
318/320[(c)]	PS	PS-33	24-hr Composite	<600	<2	<3
325	Retention Process Sewer (RPS)	In building[(d)]	24-hr Composite	<600	<2	<3
325	Process Water[(e)]	In building	Grab	<600	<2	<3
326	PS	In building (PS-82)	24-hr Composite	<600	<2	3.2
326	RPS	In building	24-hr Composite	<600	<2	3.4
329	RPS	In building	24-hr Composite	<600	2.4	3.8
3720	PS	PS-16	Grab[(f)]	<600[(g)]	341 ± 11%[(h)] 257 ± 12%	182 ± 13% 188 ± 12%

(a) Samples run in duplicate.
(b) Combined 306W/306E stream. Too little flow for composite sampling.
(c) Combined stream from both buildings.
(d) Samples collected at established PNNL sampling locations.
(e) Process source water to determine background level.
(f) Too little flow for composite sampling at established sampling location. Sample collected further upstream at a different manhole. This sample not believed to be representative of normal discharges from the 3720 Environmental Sciences Laboratory because it was a single grab sample at a low spot in the line and picked up sediments.
(g) Analyst indicated that none of the beta energy spectra for the tritium samples indicated the presence of tritium.
(h) Uncertainty reported as 1-sigma.

Appendix C

Treated Effluent Disposal Facility Waste Acceptance Criteria

Appendix C

Treated Effluent Disposal Facility Waste Acceptance Criteria

The Treated Effluent Disposal Facility Waste Acceptance Criteria are listed below. These criteria are the same as those provided in RCP-310, *300 LEF Project Administration Procedures*, Section 3.03 "Waste Acceptance Criteria for the 300 Area Process Sewer & TEDF." In addition, toxic pollutants not specifically listed in the waste acceptance criteria are limited to 100 micrograms per liter. The list of toxic pollutants is provided in Table C.2.

Table C.1. 300 Area Treated Effluent Disposal Facility Acceptance Criteria

Constituent	Units	Limit
Bis(ethylhexyl) phthalate	μg/L	200
Chloroform	μg/L	34
1,1 - Dichloroethane	μg/L	7
Methylene chloride	μg/L	5
Tetrachloroethylene	μg/L	9
Toluene	μg/L	9
1,1,1 - Trichloroethane	μg/L	9
Trichloroethylene	μg/L	3
Aluminum	μg/L	600
Ammonia (total)	μg/L	1,800
Arsenic	μg/L	10
Beryllium	μg/L	30
Cadmium	μg/L	10
Copper	μg/L	200
Chromium	μg/L	50
Cyanide	μg/L	50
Iron	μg/L	7000
Lead	μg/L	60
Manganese	μg/L	150
Mercury	μg/L	3
Nickel	μg/L	60
Nitrite	μg/L	400
Selenium	μg/L	45

Table C.1. (contd)

Constituent	Units	Limit
Silver	μg/L	20
Zinc	μg/L	650
Total Organic Carbon	mg/L	20
pH	-	6 - 11
Suspended solids	μg/L	9,000
Toxic pollutants (not otherwise limited in waste acceptance criteria)	μg/L	100
Alpha activity	pCi/L	15
Beta activity	pCi/L	50
Gamma energy analysis	pCi/L	9,000
Tritium	pCi/L	20,000
Radium (total)	pCi/L	0.4
pCi/L = picocuries per liter. μg/L = micrograms per liter. mg/L = milligrams per liter.		

Table C.2. Toxic Pollutants

Chemical Compound	CAS #	Chemical Compound	CAS #	Chemical Compound	CAS #
Antimony	7440360	Arsenic	7440382	Beryllium	7440417
Cadmium	7440439	Chromium (III)	16065831	Chromium (VI)	18540299
Copper	7440508	Lead	7439921	Mercury	7439976
Nickel	7440020	Selenium	7782492	Silver	7440224
Thallium	7440280	Zinc	7440666	Cyanide	57125
Asbestos	1332214	2,3,7,8 - TCDD (dioxin)	1746016	Acrolein	107028
Acrylonitrile	107131	Benzene	71432	Bromoform	75252
Carbon tetrachloride	56235	Chlorobenzene	108907	Chlorodibromethane	124481
Chloroethane	75003	2-Chloroethylvinyl ether	110758	Chloroform	67663
Dichlorobromethane	75274	1,1-Dichloroethane	75343	1,2-Dichloroethane	107062
1,1-Dichloroethylene	75354	1,2-Dichloropropane	78875	1,3-Dichloropropylene	542756
Ethylbenzene	100414	Methyl bromide	74839	Methyl chloride	74873
Methylene chloride	75092	1,1,2,2-Tetrachloroethane	79345	Tetrachloroethylene	127184
Toluene	108883	1,2-Trans-Dichloroethylene	156605	1,1,1-Trichloroethane	71556
1,1,2-Trichloroethane	79005	Trichloroethylene	79016	Vinyl chloride	75014
2-Chlorophenol	95578	2,4-Dichlorophenol	120832	2,4-Dimethylphenol	105679

Chemical Compound	CAS #	Chemical Compound	CAS #	Chemical Compound	CAS #
2-Methyl-4,6-dinitrophenol	534521	2,4-Dinitrophenol	51285	2-Nitrophenol	88755
4-Nitrophenol	100027	3-Methyl-4-chlorophenol	59507	Pentachlorophenol	87865
Phenol	108952	2,4,6-Trichlorophenol	88062	Acenaphthene	83329
Acenaphthylene	208968	Anthracene	120127	Benzidine	92875
Benzo(a)anthracene	56553	Benzo(a)pyrene	50328	Benzo(b)fluorathene	205992
Benzo(g,h,i)perylene	191242	Benzo(k)fluoranthene	207089	Bis(2-Chloroethoxy)methane	111911
Bis(2-chlorethyl)ether	111444	Bis(2-chloroisopropyl)ether	108601	Bis(2-ethylhexyl)phthalate	117817
4-Bromophenyl phenyl ether	101553	Butylbenzyl phthalate	85687	2-Chloronaphthalene	91587
4-Chlorophenyl phenyl ether	7005723	Chrysene	218019	Dibenzo(a,h)anthracene	53703
1,2-Dichlorobenzene	95501	1,3-Dichlorobenzene	541731	1,4-Dichlorobenzene	106467
3,3’-Dichlorobenzidine	91941	Diethyl phthalate	84662	Diemthyl phthalate	131113
Di-n-butyl phthalate	84742	2,4-Dinitrotoluene	121142	2,6-Dinitrotoluene	606202
Di-n-Octyl phthalate	117840	1,2-Dipenylhydrazine	122667	Fluoranthene	206440
Fluorene	867373	Hexachlorobenzene	118741	Hexachlorobutadiene	87683
Hexachlorocyclopentadiene	77474	Hexachloroehtane	67721	Indeno(1,2,3-cd)pyrene	193395
Isophorone	78591	Napthalene	91203	Nitrobenzene	98953
N-Nitrosodimethylamine	62759	N-Nitrosodi-n-propylamine	621647	N-Nitrosodiphenylamine	86306
Phenanthrene	85018	Pyrene	129000	1,2,4-Trichlorobenzene	120821
Aldrin	309002	alpha-BHC	319846	beta-BHC	319857
Gamma-BHC	58899	delta-BHC	319868	Chlordane	57749
4-4’-DDT	50293	4,4’-DOE	72559	4,4’-DDD	72548
Dieldrin	60571	alpha-Endosulfan	959988	beta-Endosulfan	33213659
Endosulfan	1031078	Endrin	72208	Endrin aldehyde	7421934
Heptachlor	76448	Heptachlor epoxide	1024573	PCB-1242	53469219
PCB-1254	11097691	PCB-1221	11104282	PCB-1232	11141165
PCB-1248	12672296	PCB-1260	11096825	PCB-1016	12674112
Toxaphene	8001352				
CAS # = Chemicals Abstract Service number.					