Integrated Disposal Facility Operational Monitoring Plan to Meet DOE Order 435.1

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EDT/ECN: N/A (DRF) UC:
Cost Center: 7S570 Charge Code: 115827
B&R Code: N/A Total Pages: 3

Key Words: Integrated Disposal Facility, IDF, Monitoring, Plan, DOE Order 435.1, Operations

Abstract: This monitoring plan has been developed for the Integrated Disposal Facility to meet the requirements for monitoring of a low level waste disposal facility according to DOE O 435.1, Radioactive Waste Management, its associated manual DOE M 435.1 1, Radioactive Waste Management Manual, and implementation guidance DOE G 435.1 1, Implementation Guide for Use with DOE M 435.1. Refer to RPP-6877, rev 1 for the plan to establish the monitoring baseline for IDF.

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Date

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A-6002-767 (03/01)
EXECUTIVE SUMMARY


The elements of this monitoring plan consist of actions already being conducted as part of either existing radiological environmental monitoring programs or proposed Integrated Disposal Facility operations. Key elements that will be monitored to comply with DOE O 435.1 include monitoring of Secondary Leak Detection System (engineered vadose zone), Leak Detection Chamber, groundwater, and near-facility air. The activities described here, in conjunction with measures taken for radiological worker protection, provide assurance that the disposal systems of the Integrated Disposal Facility are in compliance with the performance objectives of DOE O 435.1. This plan will be reviewed periodically and elements will be added, deleted, or modified as appropriate.

The *Resource Conservation and Recovery Act of 1976* (RCRA) Part B Permit is being prepared in parallel with preparation of this plan, and although for completeness the Permit is mentioned in this plan, it is not intended that this plan fulfill monitoring that may be required by the Permit.

Chapter 1.0 of this document provides general facility information, a discussion of the reason for monitoring, information on related documents, and the monitoring approach. The monitoring plan is discussed in Chapter 2.0 and is summarized in Table 2-1. Chapters 3.0 and 4.0 provide information on data evaluation and recommendations based on data evaluation, respectively. Chapter 5.0 discusses reporting, Chapter 6.0 describes implementation of the monitoring plan, and Chapter 7.0 identifies references.
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<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>DAS</td>
<td>Disposal Authorization Statement</td>
</tr>
<tr>
<td>DCG</td>
<td>Derived Concentration Guide</td>
</tr>
<tr>
<td>DOE/EM</td>
<td>U.S. Department of Energy, Office of Environmental Management</td>
</tr>
<tr>
<td>Ecology</td>
<td>State of Washington Department of Ecology</td>
</tr>
<tr>
<td>GCL</td>
<td>geosynthetic clay liner</td>
</tr>
<tr>
<td>IDF</td>
<td>Integrated Disposal Facility</td>
</tr>
<tr>
<td>ILAW</td>
<td>immobilized low-activity waste</td>
</tr>
<tr>
<td>LCRS</td>
<td>Leachate Collection and Removal System</td>
</tr>
<tr>
<td>LDS</td>
<td>Leak Detection System</td>
</tr>
<tr>
<td>NOC</td>
<td>Notice of Construction</td>
</tr>
<tr>
<td>PNNL</td>
<td>Pacific Northwest National Laboratory</td>
</tr>
<tr>
<td>RCRA</td>
<td>Resource Conservation and Recovery Act of 1976</td>
</tr>
<tr>
<td>SLDS</td>
<td>Secondary Leak Detection System</td>
</tr>
<tr>
<td>TLD</td>
<td>thermoluminescent dosimeters</td>
</tr>
<tr>
<td>WDOH</td>
<td>Washington State Department of Health</td>
</tr>
</tbody>
</table>
1.0 INTRODUCTION

1.1 DESCRIPTION OF FACILITY AND WASTE STREAMS

The Integrated Disposal Facility (IDF) will consist of an expandable lined landfill located in the 200 East Area on the Hanford Site. The landfill will be divided lengthwise into distinct east and west cells, one for disposal of low-level radioactive waste and the other for disposal of mixed waste. The waste streams for IDF include:

- Immobilized (vitrified) low-activity waste (ILAW) from the River Protection Project Waste Treatment Plant and bulk vitrification process
- Mixed low-level waste
- Low-level waste.

The IDF is located on 67 hectares southwest of the Plutonium-Uranium Extraction (PUREX) Plant in the 200 East Area (Figure 1), of which approximately 25 hectares are allocated to the full build out of the disposal trench. The IDF will consist of a lined landfill, approximately 442 m wide by 555 m long by up to 15 m deep (Figure 2). The Resource Conservation and Recovery Act of 1976 (RCRA)-regulated portion of the landfill will be approximately 221 m wide by 555 m long by up to 15 m deep. The landfill is designed to accommodate four layers of ILAW containers separated vertically by 0.9 m of soil. The approximate total volume of waste to be disposed will be 900,000 m$^3$. 
Figure 1. Integrated Disposal Facility Location.
The landfill will be segregated into a RCRA-permitted cell and a non-RCRA, non-permitted cell. The leachate collection system will be designed to segregate leachate collected from the individual cells. A high point down the center of the liner system will ensure the leachate from the RCRA-permitted cell does not mix with leachate from the non-RCRA cell.

The landfill liner system will comply with requirements for dangerous waste landfills and includes the following components (from top to bottom) as shown in Figure 3.

1. The Operations Layer will provide a working surface for equipment, protect the liner from mechanical damage, and prevent freezing of lower liner components.

The Operations Layer will consist of a minimum 0.9-m thick layer of native soil.
2. The Leachate Collection and Removal System (LCRS) liners will collect and convey leachate to the LCRS sump for removal and will include the following components.

- The LCRS will contain a minimum 0.3-m thick drainage gravel layer with a hydraulic conductivity of at least $1 \times 10^2 \text{ cm/s}$ (sometimes including perforated drainage pipes). A nonwoven separation geotextile is located between the operations layer and the drainage gravel layer to minimize sediment (fine-soil) migration into the LCRS. A nonwoven cushion geotextile is located between the drainage gravel and the primary geomembrane to protect the primary geomembrane.

- The primary geomembrane liner will consist of high density polyethylene because of its excellent resistance to expected chemicals (based on known waste composition, process information, leachate from other operating lined landfills, and similar sources of data); nominal 60 mil thickness (54 mil minimum), which is textured (to improve stability against sliding). The geomembrane will act as a moisture barrier. Located immediately above the primary geomembrane the LCRS will include a perforated pipe that helps collect and guide water into the leachate collection sump. The perforated pipe is located along the centerline of the cell and provides high-flow path water to the primary collection sump.

- The primary geosynthetic clay liner (GCL) consists of a high-swelling sodium synthetic mat containing bentonite with a hydraulic conductivity of $1 \times 10^{-8} \text{ cm/s}$ or less. This layer will act as an additional primary moisture barrier directly under the primary geomembrane.

3. The Leak Detection System (LDS) will collect any leachate that leaks through the primary liner system and convey the leachate to the LDS sump for removal. The LDS also will serve as a secondary LCRS. The LDS is similar to the LCRS except the composite drainage net replaces the primary gravel layer. The GCL will be placed directly under the secondary geomembrane liner only under the LDS sump and the perforated pipes will not be needed because very high flow capacities will not be required. The LDS will include the following components:

- The secondary geomembrane liner is the same as the primary geomembrane liner.

- The secondary GCL is the same as the primary GCL.

- The admix liner consists of a minimum 0.9-m thick layer of compacted soil/bentonite admixture with a hydraulic conductivity of $1 \times 10^{-7} \text{ cm/s}$ or less. The bentonite will be high-swelling sodium bentonite. This layer will act as an additional moisture barrier directly under the secondary GCL in the LDS sump area and the secondary geomembrane outside the LDS sump area.

4. The Secondary Leak Detection System (SLDS) will provide access to the area below the LDS sump area. The SLDS will collect liquids resulting from construction water and potentially, liquid from other sources. The SLDS will provide information on the performance of the IDF double liner systems (LCRS and LDS). The SLDS liners will
convey collected liquids to the SLDS piping for monitoring and/or removal. The SLDS consists of the following components:

- An operations layer type fill for a foundation of the LDS admix layer, drainage gravel with a hydraulic conductivity of at least $1 \times 10^2$ cm/s adjacent to a perforated pipe, and a composite drainage net.

- The tertiary geomembrane liner is the same as the primary geomembrane liner.

- A nonwoven separation geotextile is located between the operations layer type material and the drainage gravel to minimize sediment (fine-soil) migration into the SLDS piping.

The IDF will include two (one for each cell) large abovegrade leachate storage tanks for the LCRS and the LDS, and smaller portable containers will be used for each SLDS. The leachate collection tanks will be located at the north end, in close proximity to the lined landfill. The tanks will be protected by secondary containment. Leak detection of the tanks and transfer piping will be provided by monitoring of the secondary containment at the Leak Detection Chamber.

The landfill will be constructed in several phases. Starting at the northern edge, approximately one third of the total length of the landfill will be constructed. This will include the leachate collection system and tanks. The subsequent phases will be constructed after waste has been placed in the landfill and additional disposal capacity is needed. This approach minimizes the open area susceptible to collection of rainwater and subsequent leachate.
Figure 3. Leachate Flow Diagram for the Integrated Disposal Facility. (sheet 1 of 2)
Figure 3. Leachate Flow Diagram for the Integrated Disposal Facility. (sheet 2 of 2)
1.2 BASIS FOR RADIOLOGICAL MONITORING

A monitoring plan for IDF shall be written, approved, and implemented, and updated at least every 5 years as per the requirements of DOE O 435.1, Radioactive Waste Management, and the Disposal Authorization Statement (DAS) (Memorandum 081365, "Disposal Authorization for the Hanford Site Low-Level Waste Disposal Facilities" [Scott 2001]). A pre-operational monitoring plan was prepared to establish the plan for activities to support development of the environmental baseline for the disposal facility location (see RPP-6877, Integrated Disposal Facility Preoperational Monitoring Plan, Rev. 1, Section 1.3).

This plan has been prepared to document monitoring planned during the operations phase of the landfill and includes annual data review and evaluation. Following annual data review and evaluation, any modifications to this monitoring plan that may be applicable will be noted and the plan updated as necessary.

Monitoring to be performed as part of this plan is intended to meet the requirements of DOE O 435.1 and its associated implementation manual and guidance documents (DOE M 435.1-1, Radioactive Waste Management Manual, and DOE G 435.1-1, Implementation Guide for Use with DOE M 435.1-1). These documents require disposal facilities to monitor for compliance with the conditions of the DAS. In particular, the following must be addressed:

- The site-specific performance assessment and composite analysis shall be used to determine the media, locations, radionuclides, and other substances to be monitored.

- The environmental monitoring program shall be designed to include measuring and evaluating releases, migration of radionuclides, disposal unit subsidence, and changes in disposal facility and disposal site parameters which may affect long-term performance.

- The environmental monitoring programs shall be capable of detecting changing trends in performance to allow application of any necessary corrective action prior to exceeding the performance assessment performance objectives (DOE M 435.1-1).

1.3 RELATED DOCUMENTS

The "Disposal Authorization Statement for the Hanford Site Low-Level Waste Disposal Facilities" memorandum (Scott 2001) was issued in November 2001. This document specifies the provisions and conditions for waste disposal at Hanford disposal facilities including the Immobilized Low-Activity Waste Disposal Facility.

The performance assessment for the IDF is being updated in parallel with preparation of this plan and will be documented in ORP-25439, Hanford Integrated Disposal Facility Performance Assessment. ORP-25439 is scheduled to be sent to the U.S. Department of Energy, Office of Environmental Management (DOE/EM) in the summer of 2005 for review and approval. Previously, DOE/EM reviewed and approved DOE/ORP-2000-24, Hanford Immobilized Low-Activity Waste Performance Assessment: 2001 Version. This approved performance assessment has been maintained through a series of annual summaries (DOE/ORP-2000-19, Rev. 2, Annual Summary of ILAW Performance Assessment for 2002; DOE/ORP-2000-19,

Because the IDF requires a RCRA Part B Permit and concurrence from the U.S. Nuclear Regulatory Commission (“Classification of Hanford Low Activity Tank Waste Fraction” (letter from C. J. Papanicolaou, Nuclear Regulatory Commission, to J. Kinzer, U.S. Department of Energy, Richland Operations Office [NRC 1997]), the performance requirements from RCRA were merged with the requirements from DOE O 435.1 into a unified set of performance objectives for the disposal site in RPP-13263, *Performance Objectives for the Hanford Immobilized Low-Activity Waste (ILAW) Performance Assessment*.

The composite analysis complements the performance assessment by addressing impacts associated with sources of radioactive material that may interact with the IDF. PNNL-11800, *Composite Analysis for Low-Level Waste Disposal in the 200 Area Plateau of the Hanford Site*, was prepared in response to Recommendation 94-2 of the Defense Nuclear Safety Board to the Secretary of Energy (59 FR 47309, “DOE: Response to Recommendation 94-2, Conformance With Safety Standards at DOE Low-Level Nuclear Waste and Disposal Sites of the Defense Nuclear Facilities Safety Board”). The recommendation noted the need for a risk assessment that addresses the environmental impacts of all radioactive waste disposal actions or leaks at a DOE site. The authors of the revised composite analysis (which is due to be published in calendar year 2006) are working in conjunction with the authors of the IDF performance assessment to ensure consistency of data and methods. The current analysis considered a time period of 1,500 years beginning in 1944 and including the 1,000 years following site closure, which is assumed to be 2050. The IDF performance assessment, however, considered a time period of at least 10,000 years and the revised composite analysis will consider a time period of 10,000 years after site closure. Consistent with the IDF performance assessment, the composite analysis shows that groundwater impact from IDF disposal would occur after 1,500 years. The IDF performance assessment, therefore, provides a more conservative approach to assessing the impact of waste disposal at the site on the environment and the performance objectives.

The maintenance plan for the composite analysis (DOE/RL-2000-29, *Maintenance Plan for the Composite Analysis of the Hanford Site, Southeast Washington*) describes the plan for maintaining a composite analysis that will support waste disposal and remedial actions for the Hanford Site. It provides the current plans for revisions to the composite analysis and describes the work expected to be completed for ongoing reviews so new information (data related to residual sources of radioactive material, land use, and monitoring; and research and
development-related activities being conducted at the Hanford Site and within other DOE programs) can be incorporated into the Composite Analysis. The emphasis of this maintenance plan is to identify additional data and information that will better support the current and next composite analysis. Improvements are expected in the knowledge of waste characterization and inventory, site-specific geotechnical data and final disposition of major disposal facilities and waste sites.

RPP-6877, Rev. 0, Remote-Handled Low-Activity Waste Disposal Facility Preoperational Monitoring Plan, and RPP-6877, Rev. 1, Integrated Disposal Facility Preoperational Monitoring Plan, were prepared to establish the plan for activities to support development of the environmental baseline for the disposal facility location. RPP-6877, Rev. 0, was prepared and approved in September 2000 when the facility was proposed for disposal of ILAW only. The facility was known as the “Remote-Handled Immobilized Low-Activity Disposal Facility.” RPP-6877, Rev. 1, was approved in January 2005 to reflect the change in disposal mission of the IDF to include disposal of low-level waste and mixed low-level waste.

1.4 MONITORING PLAN APPROACH

This monitoring plan uses existing monitoring from other required radiological monitoring programs whenever possible. It is not the intent of this plan to duplicate efforts undertaken elsewhere and/or to fulfill other requirements. Existing programs applicable to the IDF include groundwater monitoring and near-facility environmental monitoring, and surface environmental surveillance (far-field environmental monitoring) that are included in DOE/RL-91-50, Environmental Monitoring Plan United States Department of Energy Richland Operations Office. Groundwater and air monitoring will also be conducted in accordance with any additional permitting requirements that may be specified by the State of Washington Department of Ecology (Ecology) and Washington State Department of Health (WDOH), if any, as a result of a Part B Permit and the Notice of Construction (NOC). Monitoring of the IDF SLDS and the Leak Detection Chamber is currently being developed in operations procedures and with Ecology in the Part B permitting process. Preoperational monitoring that has been initiated to establish the IDF environmental baseline is documented in RPP-6877, Rev. 1.

2.0 MONITORING PLAN

Table 2-1 summarizes the monitoring that will be implemented to assess the IDF compliance with the performance objectives identified in the facility's performance assessment and included in the DAS. A more detailed discussion of each of the items in this table is presented in the subsections following the table.
Table 2-1. Integrated Disposal Facility Radioactive Waste Management Summary Monitoring Table.

<table>
<thead>
<tr>
<th>Pathway/Relevant Feature</th>
<th>Media/Inspection</th>
<th>Monitoring Location</th>
<th>Radionuclide/Other Substance</th>
<th>Sampling Frequency</th>
<th>Sampling Method</th>
<th>Analytical Method</th>
<th>Method Minimum Detection Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Groundwater pathway</td>
<td>Groundwater</td>
<td>Upgradient and downgradient locations, see Figure 4</td>
<td>Total alpha and total beta $^{99m}$Tc, $^{I29}$I</td>
<td>Semiannual basis</td>
<td>Pump</td>
<td>Gross count and isotopic specific</td>
<td>As designated in PNNL-13080</td>
</tr>
<tr>
<td>Liquid collected in the SLDS</td>
<td>SLDS sump, see</td>
<td>To be defined in operations procedure</td>
<td>To be defined in operations procedure</td>
<td>Pump</td>
<td>To be defined in operations procedure</td>
<td>To be defined in operations procedure</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Figure 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liquid in leachate storage tanks and</td>
<td>Leak Detection</td>
<td>Liquid indicates leak in primary containment. Source will be visually determined in</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>transfer piping secondary</td>
<td>Chamber in the</td>
<td>accordance with operating procedures</td>
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<td></td>
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<td>containment</td>
<td>Combined Sump,</td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td>see Figure 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Air</td>
<td>Near-facility</td>
<td>Upwind and downwind locations, see Figure 5</td>
<td>Total alpha and total beta</td>
<td>Biweekly</td>
<td>Forced air through an open faced filter</td>
<td>Gross count</td>
<td>As designated in INF-EP-0835</td>
</tr>
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<td>sampling of air pathway</td>
<td>Air</td>
<td></td>
<td>Gamma energy analysis, $^{85m}$Sr, isotopic Pu (238, 239/240), isotopic U (234, 235, 238)</td>
<td>Composite of 6 months of biweeklies</td>
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<tr>
<td>External radiation</td>
<td>Dose Rate</td>
<td>Collocated with air samplers, see Figure 5</td>
<td>Dose rate/unit time (hr/day/quarter/year)</td>
<td>Quarterly (continuous)</td>
<td>TLD</td>
<td>Harshaw 8800 Reader (site standard)</td>
<td>As designated in PNNL-842</td>
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<td></td>
<td>Monitoring using</td>
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<td></td>
<td>TLDs</td>
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<td></td>
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</tbody>
</table>

Notes:

N/A = not applicable.
SLDS = Secondary Leak Detection System.
TLD = thermoluminescent dosimeters.
2.1 PATHWAYS, RELEVANT FEATURES, AND MEDIA TO BE MONITORED

This section provides a brief discussion and justification of the exposure pathways and relevant features to be monitored at the IDF and the appropriate media to be sampled or inspections to be performed to evaluate compliance with the performance assessment objectives and/or to identify early indications of possible releases.

The performance assessment for the IDF evaluates pathways for human exposure to disposal facility constituents in the following categories with the DAS performance objective listed in parenthesis:

- All pathways (<25 mrem/yr)
- Inadvertent intruder (100 mrem/yr chronic exposure, 500 mrem/yr single exposure)
- Air pathway (<10 mrem/yr)
- Radon flux (average <20 pCi/m²/s or concentration <0.5 pCi/L)
- Water resource protection (Beta/photon emitters: 4 mrem/yr, alpha emitters: 15 pCi/L, radon: 3 pCi/L).

The relevance of each of these categories to the IDF performance assessment monitoring plan is discussed below.

All-Pathways and Water Resource Protection

Section 7.2 of the IDF performance assessment compares the estimated impacts to the performance objectives for members of the general public. Each of these pathways derives from contaminated groundwater. Accordingly, it is imperative that monitoring of groundwater and its precursors, the SLDS and Leak Detection Chamber, occur. Groundwater monitoring is being performed in accordance with the Hanford Groundwater Performance Assessment Project and as further reinforced by the Part B Permit, Chapter 5, upon issuance. Monitoring of the SLDS and the Leak Detection Chamber will be performed in accordance with IDF operating procedures and within any parameters that may be defined in the Part B Permit.

Air Pathway and Radon Flux

Doses via the air pathway were estimated for $^3$H (tritium), $^{14}$C, and $^{222}$Rn (radon) in Section 4.12 of the performance assessment. The time of compliance is 1,000 years and the point of compliance is just above the IDF. The predicted releases are far below the performance objectives. Current radiological protection activities for the worker provide adequate assurance that any releases to the air pathway at levels of concern will be prevented. The Effluent and Environmental Monitoring Program collects near-facility air samples near the IDF facility boundary that provide indication of IDF impact to the Hanford Site. Additionally, the Surface Environmental Surveillance Project collects air samples at the Hanford Site boundary that
provide the basis for calculating the dose to general population via the air pathway from all sources. Should additional requirements be required by air permitting activities, these will be implemented by IDF operating procedures and/or revisions of the near-facility environmental monitoring or surface environmental surveillance scope/schedules if necessary.

**Inadvertent Intruder**

The exposure scenarios for the inadvertent intruder analysis are discussed in Section 5.5 of the performance assessment. Because of the performance objective limits for groundwater contamination, the only significant pathways for the inadvertent intruder involve direct contact with the waste. Because these pathways are not appropriate for monitoring until after control of the site is relinquished, the inadvertent intruder pathway will not be monitored.

In addition to exposure pathways, certain facility features are relevant to minimizing the potential for release of constituents to the surrounding environment. These features include liners, sumps, leachate storage tanks, piping and support facilities, and activities to minimize subsidence (waste placement and backfill). The maintenance and operations inspections of these relevant features will be incorporated into facility operating procedures. Upon closure and installation of the barrier cover, subsidence monitoring of the cover can be implemented. Details of subsidence monitoring will be included in a later revision to this plan and will be based upon the subsidence tolerance of the selected barrier cover system.

### 2.2 RADIONUCLIDES AND OTHER SUBSTANCES TO BE MONITORED

The results of the groundwater protection analysis are provided in Section 7.2.4 of the performance assessment. In addition to the analytes to be monitored for in the Part B Permit, gross alpha, gross beta, $^{99}$Tc, and $^{129}$I analyses of groundwater will be performed to provide early detection of any unforeseen releases of radionuclides. This list may be modified in the future to include contaminants identified in the SLDS sumps.

Like other facilities on the 200 Area Central Plateau at Hanford, the radionuclides in wastes received and disposed of at the IDF consist mainly of fission products but also include activation products, decay products, and naturally-occurring radionuclides. During the operational period of the facility (i.e., prior to placement of final cover), biweekly near-facility air samples will be analyzed for total alpha and beta, and semiannual composites will be submitted to the Waste Sampling and Characterization Facility for gamma energy analysis, $^{90}$Sr, isotopic plutonium, and isotopic uranium analyses.

The performance assessment evaluates bounding diffusion flux releases of $^{3}$H, $^{14}$C, and $^{222}$Rn. No specific analyses for these isotopes for near-facility environmental monitoring air samples are planned at the present time, but could be reconsidered following placement of the IDF's final cover as part of closure if warranted based upon operational experience and any other relevant factors. Pacific Northwest National Laboratory (PNNL) performs monthly $^{3}$H sampling and analyses for a number of more distant air sampling stations as part of the surface environmental surveillance program, including one station downwind and outside of the 200 East Area.
2.3 MONITORING LOCATIONS

For the constituents discussed in Section 2.2, groundwater monitoring will be performed based on the facility groundwater monitoring network to provide data for evaluation to determine whether waste constituents are migrating from the facility. Figure 4 shows the IDF groundwater monitoring network as it relates to the expandable size of IDF.

Monitoring and management of the SLDS sumps provide the means to monitor performance on the LCRS and LDS liner systems. Early warning of release of constituents of concern will be provided by the SLDS which is an engineered vadose zone for monitoring below the primary (LCRS) and secondary (LDS) liner systems of IDF. Monitoring frequency, pressure transducer configuration, liquid collection and storage processes, sampling and analysis, action leak rates, and response actions will be included in the IDF operations procedures.

Monitoring of primary piping and tank liners will be performed in the Leak Detection Chamber of the Combined Sump. Upon alarming notifying operations of liquid in the Leak Detection Chamber, source of the leak will be performed visually in the chamber. Sampling and analysis will be performed only as necessary to further evaluate the source of the liquid.

The air samplers (air pumps with filters) N532, N969, N970, and N978 that provide the near-facility air monitoring network for IDF are located as shown on the included map (Figure 5).

Thermoluminescent dosimeters (TLD) are located adjacent to each air sampler. The TLD measurements are taken to determine dose rates near the operations area environment. From these data, contribution of IDF activities to dose rates in the area can be discerned.
Figure 4. Map of Integrated Disposal Facility Groundwater Monitoring Network Wells.

North ↑

Sequence for Installation of Downgradient Monitoring Wells at the IDF. Areas in black are areas from which leaks will not be detected with the array of monitoring wells shown.

A. Area used for disposal and associated monitoring wells for construction phase I;
B. Area used for disposal and associated monitoring wells for construction phase II;
C. Area used for disposal and associated monitoring wells for construction phase III.
2.4 SAMPLING FREQUENCIES AND METHODS

The IDF groundwater monitoring well network, located around the perimeter of the IDF site, will be sampled on a semiannual basis. Sampling methods that will be used will be the appropriate approved methods identified in the Hanford Groundwater Performance Assessment Project, implemented through PNNL-13080, *Hanford Site Groundwater Monitoring, Setting, Sources, and Methods*.

The air sampler filters are exchanged biweekly, held for 1 week to allow for decay of short-lived natural radioactivity and then sent for analysis of total alpha and total beta activity. The filters are stored until the end of a 6 month period and then combined into composites by station for specific radionuclide analysis as described previously in Section 3.2.

TLDs continuously monitor for dose and are positioned approximately 1 m above the ground adjacent to air samplers. The TLDs are exchanged and read quarterly.
Pumping and sampling of liquid collected in the SLDS will be required by IDF operations procedures and will encompass requirements from the Part B Permit. The liquid collected in the SLDS sump will be pumped as required to maintain the level below a depth of 30.5 cm on the liner. Currently it is envisioned that sample analysis of pumped liquid is dependent upon constituents identified in the LDS liner above the SLDS. Until a constituent of concern is identified in the LDS, liquid collected in the SLDS will be considered non-waste water. The Leak Detection Chamber will collect any leaks in the primary leachate transfer piping and storage tanks. Visual observation in the Leak Detection Chamber should provide operations with the source of the primary leak so sampling is not currently planned. IDF operations procedures are currently being prepared for these systems.

2.5 ANALYTICAL METHODS AND MINIMUM DETECTION LIMITS

The analytical methods and required minimum detectable activities or method detection limits described in the Hanford Groundwater Performance Assessment Project (as implemented through PNNL-13080), the Hanford Environmental Monitoring Plan (as implemented through HNF-EP-0835-11, Statement of Work for Services Provided by the Waste Sampling and Characterization Facility for the Environmental Compliance Program), and as required by IDF operations procedures and permits will be appropriate for use in this monitoring plan. Sampling procedures, sample collection documentation, sample preservation and transfer/shipment, and chain of custody requirements are described in subcontractor operating procedures/manuals and in a quality assurance project plan for the Hanford Groundwater Performance Assessment Project and the Hanford Environmental Monitoring Plan.

Analytical services quality assurance requirements are specified in DOE/RL-96-68, Hanford Analytical Services Quality Assurance Requirements Document (HASQARD). Quality requirements from the HASQARD for sampling activities, including requirements for procedures, containers, transport, storage, chain of custody, and records requirements, are specified in a statement of work to subcontractors providing analytical services. To ensure that samples of known quality are obtained, the subcontractor are required to use contractor controlled procedures based on standard methods for sampling whenever possible. The procedures are reviewed for technical quality and consistency. In addition, periodic assessments of sample analysis activities will be performed to further ensure that procedures are followed to maintain sample quality and integrity.

The sampling methods follow documented procedures that ensure integrity of the sample and consistency between samples collected at various times, to minimize the possibility of external contamination of the sample and to ensure sample integrity during shipping. The minimum detectable activities or method detection limits specified for use in PNNL-13080 and HNF-EP-0835 are appropriate for use in this monitoring plan. These limits are sufficiently below the performance objective results to provide early warning of very low levels of contamination migrating from the facility, allowing time for confirmation sampling and/or implementation of corrective measures, as necessary.

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The TLD’s average daily dose rate is determined by dividing the average total environmental dose by the number of days the dosimeter was exposed. Daily dose equivalent rates (millirem per day) at each location are converted to annual dose equivalent rates (millirem per year) by averaging the daily dose rates and multiplying by 365 days per year. The TLDs are read using the Harshaw 8800 Reader. The minimum detectable limits and record retention requirements are documented PNL-MA-842, Hanford External Dosimetry Technical Basis Manual.

### 2.6 EXCEEDANCE OF ACTION LEVELS

For RCRA substances (*Washington Administrative Code* [WAC] 173-303, “Dangerous Waste Regulations” Subpart 645(9)(g)), if a statistical exceedance occurs in a downgradient well, the appropriate response will be that specified in Chapter 5 of the Part B Permit. This monitoring plan does not include RCRA but should a radionuclide exceedance be detected, the RCRA analyses collected under the Part B Permit will be immediately examined to see if a similar exceedance occurred. If there is a RCRA analyte exceedance, then the network will be treated under RCRA regulations. If there is no RCRA exceedance, then the well where the radionuclide exceedance occurred will be resampled to ensure the original analysis was correct.

Statistical deviations in ambient air concentrations at the 2-sigma or 3-sigma levels are evaluated for possible facility contributions. The facility Environmental Compliance Officer notifies the WDOH in accordance with NOC permit conditions along with a determination whether there is any reason to believe the trend is attributable to facility operations/conditions. Tracking of ambient air concentrations using this methodology is performed at levels well below DOE concentration guides and those that would approach the bounding performance assessment dose criteria.

The initial action level for the SLDS is to maintain the liquid level below the 30.5 cm limit. Exceedance of the level should not occur under normal operating conditions. Should this level be exceeded, operational steps to recover and report will be identified in the IDF operating procedures currently being developed. Additionally, should a sampling be initiated and results of analysis indicate a constituent of concern has been collected in the SLDS, operational procedures will dictate responses and reporting requirements.

### 3.0 DATA EVALUATION

#### 3.1 DATA EVALUATION VERSUS PERFORMANCE ASSESSMENT PROJECTIONS

The DAS and DOE O 435.1, Sections IV.R.(3)(b) and IV.R.(3)(c), require that monitoring data be evaluated against projections in the performance assessment. The data collected as described in this monitoring plan shall be evaluated against the simulation results of the latest approved performance assessment (currently contained in Chapter 4 of the performance assessment). The 2005 IDF performance assessment (ORP-25439) predicts that contamination from IDF is not
expected to reach the groundwater before facility closure and that air emissions are estimated to be very minor.

3.2 COMPLIANCE WITH PERFORMANCE OBJECTIVES

The IDF is governed by Waste Acceptance Criteria derived from the performance assessment and other requirements. Limiting waste receipts to the Waste Acceptance Criteria and operating the IDF to provide worker protection provides a great deal of assurance that air and groundwater concentrations should not exceed performance objectives of the performance assessment that are restated in Section 2.1 of this plan.

Monitoring data from the IDF monitoring wells and air samplers will be compared to the performance standards of the performance assessment. If an exceedance is noted, verification sampling will be performed to determine whether the exceedance is a result of errors in sampling, laboratory analysis, or transcription. If the exceedance cannot be ruled out through verification sampling, assessment monitoring will be performed to determine whether the observed exceedance is likely caused by the IDF. A comparison with background values established through the pre-operational monitoring will be performed to evaluate whether the exceedance is caused by other source(s) upgradient of IDF. If it is determined that IDF is the source of the exceedance, corrective actions might need to be developed to mitigate the release or potential release. In addition, a re-evaluation of the performance assessment and/or the composite analysis will be performed.

Additionally, groundwater monitoring and near-facility air monitoring data are collected and evaluated to determine trends and state of compliance with applicable federal and state regulations and permits. The analysis results from the IDF near-facility air monitoring program monitor the facility's effectiveness in controlling diffuse and fugitive emissions and environmental surveillance air samples taken at the Hanford Site boundary are included in the calculation within the annual environmental report of offsite dose to the maximum exposed individual from all Hanford activities. This approach provides a health risk calculation to the general public that includes IDF operations.

3.3 TREND EVALUATION

The environmental program for IDF is required to be capable of detecting changing trends in performance to allow any necessary corrective action prior to exceeding the performance objectives.

Indicator parameters provide a reliable indication of the presence of dangerous constituents in groundwater in the uppermost aquifer beneath the site. Testing for statistically significant changes in concentrations of indicators in downgradient wells relative to baseline values will be done following the methodology described in Chapter 5 of the Part B Permit. The default statistical method ANOVA will be used for the detection monitoring program of the IDF. The proposed statistical method is consistent with EPA/530-SW-89-026, Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities – Interim Final Guidance;
As described in DOE/RL-91-50, near-facility air monitoring and TLD data are reviewed to determine compliance with applicable federal and company guides. The data are analyzed both graphically and by standard statistical tests to determine trends and impacts on the environment. Newly acquired data are compared with historical data and natural background levels. Routine environmental data are stored on both magnetic media (i.e., in a computer environment) and hard-copy printouts.

Data analysis, trending and reporting of air monitoring data for the IDF will be conducted in accordance with established routine protocols and any requirements specified by the WDOI as a result of a NOC submitted to WDOI in March 2005. Statistical analysis of air sampling data is performed and deviations at the 2-sigma or 3-sigma levels are evaluated for possible facility contributions. These outliers are reported to the designated facility contact. When applicable, the most currently available supporting air sampling data from other near-facility monitoring stations and/or PNNL far-field air monitoring locations may be included.

Data results are also compared to the applicable DOE Derived Concentration Guides (DCG) in DOE Order 5400.5, Radiation Protection of the Public and the Environment. DCGs reflect the concentrations of individual nuclides in water or air that would result in an effective dose equivalent of 100 mrem/year caused by inhalation of air at average annual intake rates. DCGs are not exposure limits, but are simply reference values provided to allow for comparison of radionuclide concentrations measured in environmental media. Tracking of ambient air concentrations is performed at levels well below DOE concentration guides (several orders of magnitude) and those that would approach the bounding performance assessment dose criteria.

Near-facility TLD results are compared to results from previous years and are also compared to surface environmental surveillance measurements obtained at perimeter and distant locations.

Any trend evaluation for the SLDS will be performed in accordance with the IDF operating procedures. Areas to trend would include volume of liquids pumped and, potentially, any constituents of concern identified through evaluation of results of analysis of the leachate collected in the primary LDS.

### 4.0 RECOMMENDATIONS BASED ON DATA EVALUATION

Following data evaluation, the related documents discussed in Section 2.3 will be reviewed to determine if the documents and/or programs/procedures discussed in those documents need to be modified. The test and research component of the performance assessment maintenance program will be an integral part of this review. This program provides a mechanism to implement additional tests and/or research that may be needed to enhance or modify IDF or its supporting monitoring and inspection regimes.
4.1 ADDITIONAL/VERIFICATION SAMPLING NEEDED

Any sampling and analysis program may produce anomalous results from time to time. These will be verified by additional sampling and analyses to determine if the results were erroneous or if they were indicative of unexpected disposal system performance. The initial results and the findings of the verification sampling and analyses will be included in the annual report.

4.2 MODIFICATIONS TO MONITORING PROGRAM

If data evaluation identifies the need for additional monitoring, the relevant programs under which that monitoring is performed will be modified to include the required additions (e.g., the Groundwater Performance Assessment Project). Confirmatory sampling may be either performed under other programs or implemented directly under this monitoring plan as necessary, based on the timeframe in which the additional data are required. Any modifications to these supporting programs that are needed based on data evaluated under this monitoring plan will be documented through revisions to this plan and in the performance assessment maintenance program.

4.3 MODIFICATIONS TO THE PERFORMANCE ASSESSMENT

If data evaluation indicates that projected results from the performance assessment are not consistent with actual results, modification of the performance assessment may be warranted. However, additional confirmatory sampling, special analyses, and tests and/or research may first be implemented through the performance assessment maintenance program to specifically identify modifications needed for the performance assessment.

4.4 MODIFICATIONS TO THE DISPOSAL FACILITY

Following any additional confirmatory sampling and tests and/or research based on data evaluation, any modifications to the facility will be implemented through the relevant functional group.

5.0 REPORTING

Groundwater monitoring and air sampling data used under this monitoring plan will be collected and reported under other existing environmental reporting systems except for possible additional requirements, if any, imposed by WDOH as a result of the IDF NOC submittal. Groundwater monitoring and surface environmental surveillance data are included in the Hanford Environmental Information System database. Near facility monitoring data are included in the
Automated Bar Coding of All Samples at Hanford 2 and Environmental Release Summary computer programs.

A comprehensive report of groundwater conditions on the Hanford Site is issued annually to fulfill the reporting requirements of DOE Orders and the Washington Administrative code. Future groundwater annual reports will include results of groundwater sampling at the IDF. The annual report for 2004 was issued in March 2005 as PNNL-15070, Summary of Hanford Site Groundwater Monitoring for Fiscal Year 2004.

Information from the IDF near-facility air monitoring program is included in the annual Radionuclide Air Emissions Report for the Hanford Site required by Title 40, Code of Federal Regulations, Part 61, “National Emission Standards for Hazardous Air Pollutants” (40 CFR 61), Subpart H, and WAC 246-247, “Radiation Protection Standards.” DOE/RL-2004-09, Radionuclide Air Emissions Report for the Hanford Site, Calendar Year 2003, is an example report available as of the writing of this monitoring plan. Results of IDF sampling will be included in future reports.

The environmental monitoring data are included in the annual Hanford Site Environmental Report that is required by DOE O 231.1A, Environmental, Safety, and Health Reporting. An example of this report is PNNL-14687, Hanford Site Environmental Report for Calendar Year 2003.

These internal and external reports and electronic databases will be reviewed at least annually by IDF personnel and the relevant data extracted for evaluation as described in Section 4.0. Results and recommendations from data evaluation will be reported and distributed in the annual review conducted through the performance assessment maintenance program.

SLDS monitoring, Leak Detection Chamber monitoring, and visual monitoring of IDF results will be documented in the IDF operating record.

6.0 IMPLEMENTATION

The manager of operations for IDF has the ultimate responsibility for compliance with this plan. Most of the required monitoring infrastructure and expertise is in place to implement this plan and evaluate the results because of the ongoing monitoring of the Hanford Site, including the Hanford Site Effluent and Environmental Monitoring Program, Surface Environmental Surveillance Project, and the Hanford Site Groundwater Performance Assessment Project. This multi-disciplinary team will implement the plan and interpret the results. IDF operations procedures are currently being drafted. Specific references to procedures will be added in the next revision of this plan.
7.0 REFERENCES


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