

8.0 Environmental and Resource Protection Programs



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U.S. Department of Energy (DOE) Orders 450.1, *Environmental Protection Program*, and 5400.5, *Radiation Protection of the Public and the Environment*, require that DOE conduct monitoring at Hanford to protect the site's environmental and cultural resources, the public, and workers on the site. The monitoring activities support the site's *Integrated Safety Management System Policy* (DOE P 450.4) and its component Environmental Management System (see Section 4.0.1). These component systems are tools for achieving site and contractor compliance with environmental, public health, and resource protection laws, regulations, and DOE Orders.

The *Environmental Monitoring Plan, United States Department of Energy, Richland Operations Office* (DOE/RL-91-50) is the mechanism through which monitoring programs and projects are implemented at Hanford. The plan contains the rationale for the required programs and projects including design criteria, sampling locations and schedules, quality assurance requirements, program and project implementation procedures, analytical procedures, and reporting requirements. The early identification of, and appropriate response to, potentially adverse environmental and resource effects associated with DOE operations are assured by routinely conducting pre-operational environmental characterization and assessment activities, monitoring effluent and emissions, performing environmental monitoring and surveillance (as defined in DOE Order 5400.5 and in Appendix B, Glossary), monitoring cultural resources, performing periodic sampling of Hanford Site drinking water, and monitoring and controlling contaminated and undesirable biota.

The objectives of the monitoring programs include:

- Detecting, characterizing, and responding to contaminant releases from Hanford Site DOE facilities and operations.

- Providing data for assessing the human health and ecological impacts of Hanford-produced contaminants.
- Estimating contaminant dispersal patterns in the environment.
- Characterizing the pathways of exposure to members of the public and biota.
- Characterizing the exposures and doses to individuals, the nearby population, and biota.
- Evaluating potential impacts to biota (and the Columbia River) in the vicinity of DOE Hanford Site activities.
- Assuring that environmental monitoring programs are conducted in an integrated fashion to preclude collection of duplicative environmental data.
- Ensuring early identification of, and appropriate response to, the potentially adverse environmental impact associated with DOE operations.
- Promoting long-term stewardship of the Hanford Site's natural and cultural resources.
- Protecting natural and cultural resources.

There are other important reasons for conducting these monitoring activities:

- Complying with local, state, and federal laws and regulations and DOE Orders.
- Confirming site compliance with local, state, and federal laws and regulations and DOE Orders.
- Verifying the efficacy of waste management practices on the Hanford Site.
- Providing information to assure the public that facilities and operations are not adversely affecting people or the environment.
- Answering questions or providing information to stakeholders, activist organizations, and the public.



- Supporting DOE decisions.
- Providing information to support DOE in environmental litigations.

The primary environmental and resource monitoring program and projects at Hanford include the Effluent Monitoring Program, conducted by Fluor Hanford, Inc.; the Public Safety and Resource Protection Project, managed by the Pacific Northwest National Laboratory; and the Groundwater Performance Assessment Project, also managed by the Pacific Northwest National Laboratory. These efforts are managed through the DOE Richland Operations Office. Detailed program and project information, including the specific objectives of each program and project element, is included in the Hanford Site Environmental Monitoring Plan (DOE/RL-91-50).

Pacific Northwest National Laboratory personnel through a contract with Fluor Hanford, Inc. monitor radiological contaminants in Hanford Site drinking water. Sample collection for the Drinking Water Monitoring Project is done in conjunction with sampling activities of the Surface Environmental Surveillance Project (an element of the Public Safety and Resource Protection Project), and sample analyses are accomplished through the Surface Environmental Surveillance Project's analytical contract. Data management and quality assurance are also tied to surveillance project requirements and staff.

The Biological Control Program manages activities on the Hanford Site to prevent, limit, and clean up contaminated or undesirable plants or animals and to remediate their impact to the environment and human health and safety. This program, managed for DOE by Fluor Hanford, Inc., was established in 1998 in response to increasing incidents of radiological contamination spread by biological vectors (DOE/RL-98-77). The radiological component of the project includes activities to control plants and animals that have spread or have the potential to spread radioactive contamination. The non-radiological component of the program deals with control of pests, such as noxious weeds, that may adversely affect the workplace or the environment.

Brief overviews of environmental monitoring program and project elements, the Drinking Water Monitoring Project, and the Biological Control Program are provided in the following sections.

8.0.1 Effluent Monitoring Program

Effluent monitoring at Hanford has two elements: (1) liquid effluent and airborne emissions monitoring at site facilities and operations and (2) environmental monitoring near facilities and operations that have the potential to discharge, or have discharged, stored, or disposed of radioactive and hazardous materials. Categories of effluent that normally or potentially contain radionuclides or hazardous materials include cooling water, steam condensates, process condensates, and wastewater from laboratories and chemical sewers. Airborne emissions can include both radioactive and non-radioactive particulate, gaseous, and volatilized materials from facility stacks.

8.0.1.1 Liquid Effluent and Airborne Emissions Monitoring

The Hanford Site's contractors perform real-time monitoring of liquid effluent and airborne emissions at each facility to assess the effectiveness of effluent and emissions treatment and control systems, pollution management practices, and to determine facility and site compliance with state and federal regulatory requirements. Information on effluent discharged from site facilities in 2004 is summarized in Section 8.3 and in an annual environmental releases report (e.g., HNF-EP-0527-14). Emissions data for 2004 are summarized in Section 8.1 and in several other reports (e.g., DOE/RL-2005-06).

8.0.1.2 Near-Facility Environmental Monitoring

Near-facility environmental monitoring is conducted near DOE facilities and operations on the Hanford Site that have the potential to discharge, or have discharged, stored, or disposed of radioactive or hazardous contaminants. Monitoring locations are associated with nuclear facilities such as the Canister Storage Building and the 100-K Basins; inactive nuclear facilities such as N Reactor and the Plutonium-Uranium Extraction (PUREX) Plant; and active and inactive waste storage or disposal facilities such as burial grounds, cribs, ditches, ponds, underground waste storage tanks, and trenches.

Much of the monitoring program consists of collecting and analyzing environmental samples and conducting radiological surveys in areas near facilities. The program also is designed to evaluate and report analytical data, determine the effectiveness of facility effluent monitoring and controls, measure the adequacy of containment at waste disposal sites, and detect and monitor unusual conditions. The program implements applicable portions of DOE Orders 435.1, *Radioactive Waste Management*, 450.1 (replaced DOE Order 5400.1, *General Environmental Protection Program*, in January 2003), and 5400.5; DOE Manual 231.1-1A, *Environment, Safety, and Health Reporting Manual*; Title 10, *Code of Federal Regulations*, Part 835 (10 CFR 835, *Occupational Radiation Protection*) and 40 CFR 61, *National Emission Standards for Hazardous Air Pollutants*; and *Washington Administrative Code* (WAC) 246-247, *Radiation Protection—Air Emissions*.

Several types of environmental media are routinely sampled near Hanford Site facilities and various radiological and non-radiological measurements are taken. The media sampled include air, Columbia River shoreline-spring water (seep wells in the 100-N Area), soil, and vegetation. In addition, surface contamination and external radiation levels are monitored. Media samples are collected from known or expected emissions and effluent pathways, which are generally downwind of potential or actual airborne releases and downgradient of liquid discharges.

Active and inactive waste disposal sites and the terrain surrounding them are surveyed to detect and characterize radioactive surface contamination. Routine radiological survey locations include former waste disposal cribs and trenches, retention basin perimeters, ditch banks, solid waste disposal sites (e.g., burial grounds), unplanned release sites, tank farm perimeters, stabilized waste disposal sites, roads, and firebreaks in and around the site operational areas.

Investigations of contaminated biota, soil, and other materials are conducted in the operational areas to monitor the presence or movement of radioactive and/or hazardous materials around areas of known or suspected contamination or to verify radiological conditions at specific project (e.g., cleanup or construction) sites. Investigations for contaminants are conducted for at least one of the following reasons:

- To follow up surface radiological surveys that had indicated radioactive contamination was present

- To conduct pre-operational surveys to characterize the radiological and chemical conditions at a site before facility construction, operation, or ultimate remediation
- To determine if biotic intrusion (e.g., animal burrows or deep-rooted vegetation) had created a potential for contaminants to spread
- To determine the integrity of waste containment systems.

Contamination incidents investigated in 2004 focused on soil, vegetation, wildlife, and wildlife-related materials. Most materials were surveyed in the field to detect radioactive contamination. Some materials were sampled and the samples were submitted to an analytical laboratory for analysis. Methods for surveying and sampling these contaminated materials are described in DTS-OEM-001, *Operational Environmental Monitoring*. Laboratory analyses results and field survey readings for contamination incidents investigated in 2004 are provided in PNNL-15222, APP. 2, *Hanford Site Near-Facility Environmental Monitoring Data Report for Calendar Year 2004*.

Information on contaminant concentrations or radiation levels measured onsite near facilities and operations during 2004 is summarized in Sections 8.2, 8.5, 8.9, 8.10, 8.13, and 8.18. Additional data may be found in PNNL-15222, APP. 2). The type and general locations of samples collected for near-facility monitoring during 2004 are summarized in Table 8.0.1. Information on contamination incidents investigated during 2004 is summarized in Sections 8.9, 8.10, and 8.11.

8.0.2 Public Safety and Resource Protection Project

The Public Safety and Resource Protection Project is managed for the DOE Richland Operations Office by Pacific Northwest National Laboratory. Its purpose is to monitor the Hanford environment, provide assurance that the site operates in compliance with applicable environmental regulations, and conduct impact assessments to protect public and worker safety as well as Hanford's significant ecological and cultural resources. The project obtains environmental information related to public health and environmental effects that is necessary for DOE to manage environmental risk at Hanford. Whereas effluent and near-facility environmental monitoring are



Table 8.0.1. Routine Environmental Monitoring Samples and Locations Near Hanford Site Facilities and Operations, 2004

Sample Type	Number of Sample Locations	Operational Area							ERDF ^(a)	200/600	300/400
		100-B/C	100-D/DR	100-K	100-F	100-H	100-N				
Air	85	5	3	11	2	2	4	3	47 ^(b)	8	
Soil	83	2	0	1	2	0	7	1	56	14	
Vegetation	69	0	0	0	0	0	6	0	49	14	
External radiation	135	4	0	20	0	0	14	3	67	27	
Water	8	0	0	0	0	0	8	0	0	0	

(a) Environmental Restoration Disposal Facility in the 200-West Area.

(b) Includes 1 station at the Wye Barricade, 23 in the 200-East Area, and 23 in the 200-West Area.

conducted by the facility operating contractor or designated subcontractor, environmental surveillance is conducted under an independent program that reports directly to the DOE Richland Operations Office.

The project is managed as an integrated unit that consists of the following five elements:

- Hanford Environmental Oversight
- Meteorological and Climatological Services Project
- Surface Environmental Surveillance Project
- Ecological Monitoring and Compliance Project
- Cultural Resources Project.

Brief overviews of these elements are provided in the following sections.

8.0.2.1 Hanford Environmental Oversight

Hanford Environmental Oversight manages the Public Safety and Resource Protection Project. This element is responsible for the integration of activities performed within the Public Safety and Resource Protection Project and the coordination of related environmental assessment and resource protection activities across the site. In addition, it is responsible for the optimization of other Public Safety and Resource Protection Project elements and operations, including self-assessments, performance assessments, and design reviews. This element also provides for the:

- Stewardship of long-term historical environmental, ecological, climatological, and cultural resource databases

- Coordination and control of the Hanford Site Environmental Monitoring Plan (DOE/RL-91-50) consistent with 65 FR 24595, *Greening the Government Through Leadership in Environmental Management*, and DOE Order 450.1.
- Annual updates of the *Hanford Site National Environmental Policy Act (NEPA) Characterization Report* (PNNL-6415).

8.0.2.2 Meteorological and Climatological Services Project

The Meteorological and Climatological Services Project provides information to help ensure that DOE activities on the Hanford Site, which could be affected by adverse meteorological conditions (thunderstorms, strong winds, blowing dust, dense fog, and snowstorms), operate in as safe and efficient a manner as possible. Meteorological data are essential for planning day-to-day work activities. The project also provides meteorological response in the event of a suspected or actual release of radioactive or hazardous material to the atmosphere so that personnel involved in responding to the event can make appropriate and timely decisions. Meteorological data are also integral to the annual estimation of potential public radiation exposure. Comprehensive climatological data records are maintained for use in a variety of other applications, such as post-accident analysis, dose reconstruction, building designs, and environmental impact assessments. Summary meteorological monitoring data for 2004 and some historical climatological information are provided in Section 8.16. Detailed monitoring data are reported in the *Hanford Site Climatological Data Summary 2004 with Historical Data* (PNNL-15160).



8.0.2.3 Surface Environmental Surveillance Project

The Surface Environmental Surveillance Project is an element responsible for measuring the concentrations of radionuclides and chemicals in environmental media onsite at locations away from facilities (site-wide) and offsite at perimeter, community, and distant locations, and assessing the potential effects of these materials on the environment and the public. Samples of agricultural products, air, fish and wildlife, soil, surface water and sediment, Columbia River shoreline seep water and sediment, and vegetation are collected routinely. The samples are analyzed for radionuclides and chemicals, including metals and anions. In addition, ambient external radiation is measured at selected locations on and off the site and ambient gamma radiation levels are monitored at four offsite air sampling locations.

Project monitoring activities focus on routine releases from DOE facilities on the Hanford Site; however, the project also conducts sampling and analysis in response to known unplanned releases and releases from non-DOE operations on and near the site. Monitoring results are provided to the DOE and the public annually through this report series. Unusually high contaminant concentrations, should they occur, are reported to the DOE Richland Operations Office and the appropriate facility managers.

The general requirements and objectives for this Surface Environmental Surveillance Project are to monitor routine and non-routine contaminant releases to the environment from DOE facilities and operations, to assess doses to members of the public, to monitor potential impacts of contaminants on other biota, and to alert DOE to the possible need for corrective action (DOE Orders 450.1 and 5400.5; DOE/EH-0173T, *Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance*). The specific objectives of the monitoring activities include:

- Collecting and analyzing samples, reviewing and interpreting analytical data, and maintaining a long-term computer database for trend analysis
- Determining compliance with applicable environmental quality standards, public exposure limits, and applicable laws and regulations; the requirements of DOE Orders; and the environmental commitments

made in environmental impact statements, environmental assessments, safety analysis reports, or other official DOE documents

- Conducting pre-operational assessments
- Assessing radiological doses to the public and environment
- Assessing doses from other local sources
- Reporting alarm levels and potential doses exceeding reporting limits
- Determining background levels and site contributions of contaminants in the environment
- Determining long-term accumulations of site-related contaminants in the environment and predicting trends
- Characterizing and defining trends in the physical, chemical, and biological conditions of environmental media
- Determining the effectiveness of treatments and controls in reducing effluents and emissions
- Determining the validity and effectiveness of models to predict concentrations of pollutants in the environment
- Detecting and quantifying unplanned releases
- Identifying and quantifying new environmental quality problems
- Maintaining the capability to assess the consequence of accidental contaminant releases.
- Providing public assurance and addressing issues of concern to the public, stakeholders, regulatory agencies, and business community
- Enhancing public understanding of site environmental issues, primarily through public involvement and by providing environmental information to the public
- Providing environmental data and assessments to assist DOE and its contractors in environmental management of the site.

Annual design reviews are performed to assure the project is aligned with current operations and missions, focused on those contaminants having the greatest contribution to the potential offsite dose, and providing the greatest amount of useful information for the waste management, cleanup, and environmental assessment activities planned or ongoing at Hanford. Site-wide and offsite surveillance



is closely related to and coordinated with the Near-Facility Environmental Monitoring Program described in Section 8.0.1.2 and the Groundwater Performance Assessment Project (Section 8.0.3).

Information on contaminant concentrations in project samples collected at site-wide and offsite locations during 2004 is summarized in Sections 8.2, 8.4, 8.5, 8.8, 8.9, 8.10, 8.11, 8.13, and 8.14. Other project information is summarized in Sections 8.12, 8.17, and 8.18. More detailed contaminant data are provided in *Hanford Site Environmental Surveillance Data Report for Calendar Year 2004* (PNNL-15222, APP. 1). The types and general locations of samples collected for site-wide and offsite environmental monitoring during 2004 are summarized in Table 8.0.2.

8.0.2.4 Ecological Monitoring and Compliance Project

The Ecological Monitoring and Compliance Project has multiple objectives that support both activity-specific ecological compliance requirements and site-wide requirements to assure the protection of Hanford's natural resources. Project personnel monitor the abundance, vigor, and distribution of plant and animal populations on the Hanford Site and evaluate the cumulative impact of site operations on these resources. In addition, project staff perform baseline ecological resource surveys to document the occurrence of protected resources, evaluate and document impacts to protected species and habitats as required

Table 8.0.2. Routine Hanford Site Environmental Surveillance Samples and Locations at Site-Wide and Offsite Locations, 2004

Type	Total Number	Sample Locations					Columbia River		
		Onsite ^(a)	Site Perimeter ^(b)	Nearby ^(c)	Distant ^(c)	Upstream ^(c)	Hanford Reach ^(b)	Downstream ^(c)	
Air	44	23	11	8 ^(d)	2 ^(d)				
Spring water	9						9		
Spring sediment	5						5		
Columbia River water	7					2	4	1	
Irrigation water	2		2						
Drinking water	4	4							
River sediment	6					1	3	2	
Ponds	2	2							
Pond sediment	1	1							
Foodstuffs	9		2	4	3				
Wildlife	11	9			2				
Aquatic biota	2					1	1		
Vegetation	17	8	4	1	4				
Soil	42	20	13	2	7				
External dose ^(e)	81	33	12	6	2	1	24	3	
External shoreline radiation ^(f)	15					1	14		
Exposure rate (PIC) ^(g)	4			3	1				

- (a) Surveillance Zone 1 (between the Near-Facility Environmental Monitoring Program sampling locations and the site perimeter).
- (b) Surveillance Zone 2 (near or just inside the site boundary).
- (c) Surveillance Zone 3 (in and between communities within an 80-kilometer [50-mile] radius of the site's industrial areas).
- (d) Includes community-operated environmental surveillance stations.
- (e) Measured by thermoluminescent dosimeters.
- (f) Measured by handheld survey instruments.
- (g) Pressurized ionization chambers.

by the *National Environmental Policy Act* and the *Endangered Species Act*, facilitate cost-effective regulatory compliance, and assure fulfillment of DOE natural resource protection responsibilities. This project also supports multiple objectives for completion of Hanford's waste management and environmental restoration mission through the following activities:

- Assuring Hanford Site operational compliance with laws and regulations including the *Endangered Species Act*, the *Bald and Golden Eagle Protection Act*, and the *Migratory Bird Treaty Act*
- Providing data for environmental impact and ecological risk assessments
- Providing maps and information useful for biological resource impact mitigation during facility expansions
- Supporting Hanford Site land-use planning and stewardship.

These activities are intended to help protect the natural resources within the DOE-operated portions of the Hanford Site, including the DOE-managed portion of the Hanford Reach National Monument, and provide information useful to the Hanford natural resource stakeholders and the public on the status of some of Hanford's most highly valued biological resources.

Ecosystem and compliance monitoring information for 2004 for plant and animal species and communities found on the Hanford Site is summarized in Sections 8.10 and 8.11.

8.0.2.5 Cultural Resources Project

The Cultural Resources Project operates the Hanford Cultural Resources Laboratory for DOE. Project staff perform baseline cultural resource surveys to document the occurrence of protected resources; evaluate and document impacts to protected resources as required by the *National Historic Preservation Act*, the *American Indian Religious Freedom Act*, and the *Archaeological Resources Protection Act*; facilitate regulatory compliance; and assure fulfillment of DOE cultural resource protection responsibilities. A summary of Hanford Site cultural resource monitoring activities conducted in 2004 is provided in Section 8.15.

8.0.3 Groundwater Performance Assessment Project

The Groundwater Performance Assessment Project is responsible for assessing the distribution and movement of existing groundwater contamination (both radiological and chemical) beneath the Hanford Site and for identifying and characterizing potential and emerging groundwater contamination problems. Monitoring activities are conducted to comply with requirements of the *Resource Conservation and Recovery Act* (RCRA), DOE Orders (e.g., 5400.5), and Washington State regulations, as well as requirements for operational monitoring around retired reactors and chemical-processing facilities, and requirements for environmental surveillance. Groundwater monitoring is also carried out during cleanup investigations under the *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA). Groundwater samples are currently collected from approximately 730 wells, both on and off the site. A summary of groundwater monitoring activities and analytical results for 2004 is provided in Section 8.7.

8.0.4 Drinking Water Monitoring Project

DOE Order 5400.5 sets the radiation dose limits for persons consuming water from a public drinking water supply operated by DOE, or by a DOE contractor, to levels equivalent to those mandated by law in 40 CFR 141, *National Primary Drinking Water Regulations; Radionuclides; Proposed Rule* (federal drinking water standards). The U.S. Environmental Protection Agency (EPA) sets legal limits on the levels of certain contaminants in drinking water. State governments, through their health departments and environmental agencies, are expected to accept the major responsibility for the administration and enforcement of the limits set by EPA. In the state of Washington, federal drinking water laws are enforced by the Washington State Department of Health through state administrative codes. At Hanford, radiological monitoring of DOE-owned, contractor-operated drinking water systems is conducted through the Drinking Water Monitoring Project. Descriptions of the Hanford Site drinking water systems and



drinking water radiological-monitoring results for 2004 are summarized in Section 8.6.

8.0.5 Biological Control Program

Biological control is any activity to prevent, limit, clean up, or remediate the impact to the environment, or human health and safety, from contaminated or undesirable plants or animals. The Biological Control Program is responsible for integration of (1) expanded radiological surveillance for contaminated biota and soil, (2) control of undesirable plants and animals, (3) cleanup of legacy and new contamination related to biota, and (4) remediation, following cleanup, of sites affected by radioactive contamination spread by plants and animals.

The control of weeds and pests is an important part of the Biological Control Program. Weeds on industrial sites at Hanford are a threat to accumulate radionuclides, become fire hazards, and reduce the efficiency of people and machines. At Hanford, the control of weeds occurs at tank farms (clusters of underground radioactive-waste storage tanks), radioactive-waste pumping installations, industrial sites, power stations and along transmission lines, buildings, storage and work areas, and along fence lines. Pest control prevents, limits, or removes undesirable animals through the application of chemical, cultural, or mechanical methods.

Noxious weeds are controlled onsite to prevent their spread and reduce or eliminate their populations. A noxious weed is a legal and administrative category designated by

federal or state regulatory agencies (e.g., U.S. Department of Agriculture or Washington State Department of Agriculture). Noxious weeds are non-native, aggressively invasive, and hard to control. Damage to natural ecosystems and loss of productive agricultural lands can occur unless control measures are taken. Control measures can be mechanical, chemical, or biological.

Biological control may include preventive measures or measures in response to existing contamination spread. Activities to prevent the spread of contamination include radiological surveys, preventive controls (e.g., herbicide spraying), and the placement of engineered barriers. If contamination has already spread, typical response measures may include posting the area with radiation signs, stabilizing the contamination to keep it from spreading, and cleaning up and removing the contamination to an approved disposal location.

In some cases, restoration is necessary following cleanup and removal of contamination. Restoration is a common activity on the Hanford Site but has specific meanings and limitations when applied to biological control. Restoration may include soil removal and replacement, revegetation of the soil surface, or placement of engineered barriers to stop biological intrusion (biological barriers). Such restoration on radioactive waste sites is typically performed to prevent reoccurrence of surface radioactive contamination or unwanted biota.

Activities conducted for the Biological Control Program in 2004 are discussed in Sections 8.10 and 8.11.