Summary

L. F. Morasch

Each year, the U.S. Department of Energy (DOE) publishes this integrated environmental report about the Hanford Site. Individual sections of the report are designed to:

- Describe the Hanford Site and its mission.
- Summarize the status of compliance with environmental regulations.
- Discuss the status and results of Hanford Site cleanup and remediation activities.
- Describe the environmental and groundwater surveillance and protection programs at the Hanford Site.
- Summarize and discuss effluent monitoring, environmental monitoring and surveillance, and groundwater protection and monitoring information.
- Discuss the estimated radiation exposure to the public from 2003 Hanford Site activities.
- Discuss activities conducted to assure data quality.

The current mission of DOE at the Hanford Site includes cleaning up and shrinking the size of the site. It is the policy of the DOE that all activities be carried out to comply with applicable federal, state, and local laws and regulations, DOE Orders, Secretary of Energy Notices, and directives, policies, and guidelines from DOE Headquarters and site operations.

Compliance with Environmental Regulations in 2003

The site's compliance with federal acts in 2003 is summarized in Table S.1 and discussed in detail in Chapter 2 of this report.

A key element in Hanford's compliance program is the Tri-Party Agreement. The Tri-Party Agreement is an agreement among the Washington State Department of Ecology, U.S. Environmental Protection Agency (EPA), and the DOE to achieve compliance with the remedial action provisions of the *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA) and with treatment, storage, and disposal unit regulation and corrective action provisions of the *Resource Conservation and Recovery Act* (RCRA). During 2003, there were 36 specific Tri-Party Agreement cleanup milestones scheduled for completion: 35 were completed on or before their required due dates, and 1 was completed beyond its established due date.

Cleanup activities on the Hanford Site generate radioactive, mixed, and hazardous waste (Section 2.5). Mixed waste has both radioactive and hazardous non-radioactive substances. Hazardous waste contains either dangerous waste or extremely hazardous waste or both. This waste is handled and prepared for safe storage on the site or shipped to offsite facilities for treatment and disposal. A summary of waste generated on the site or received from off the site in 2003 is provided in Table S.2. Major contributors to the solid waste generated on the Hanford Site (by weight) included the 300 Area projects (18%), Tank Farms (18%), and the N Springs remediation project (10%). Similarly, Pacific EcoSolutions (formerly Allied Technology Group Corporation) (35%), DOE Fermi National Accelerator Laboratory (31%), and DOE Argonne National Laboratory (12%) were the primary contributors of solid waste received from offsite sources (by weight).

In addition to newly generated waste, significant quantities of legacy waste remain from years of nuclear material production and waste management activities. Most legacy waste from past operations at the Hanford Site resides in RCRA-compliant waste sites or is stored in places awaiting cleanup and ultimate safe storage or disposal. Examples include high-level radioactive waste stored in single- and double-shell tanks and transuranic waste stored in vaults and on storage pads (see Section 2.5 for details).

Table S.1. Compliance with Federal Acts at the Hanford Site in 2003 (details in Section 2.2)

Regulation	What it Covers	2003 Status
Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)	Sites already contaminated by hazardous materials.	Work on these sites followed CERCLA requirements and met the schedules established by the Tri-Party Agreement.
Emergency Planning and Community Right-to-Know Act	The public's right to information about hazardous materials in the community and establishes emergency planning procedures.	The Hanford Site met the reporting requirements contained in this act.
Resource Conservation and Recovery Act (RCRA)	Tracking hazardous waste from generator to treatment, storage, or disposal.	The Washington State Department of Ecology identified four non-compliance issues during 2003: (1) Concerns regarding inspection and repair of leak detection systems used at AY, AZ, and SY Tank Farms; (2) Concern about storing chemicals; (3) and (4) Concerns about DOE complying with Washington Administrative Code and Revised Code of Washington regulations. All corrective actions were completed and accepted.
Clean Air Act	Air quality, including emissions from facilities and diffuse and unmonitored sources.	According to the Washington State Department of Health, air emissions from Hanford Site facilities were well below state and federal standards. There were no non-compliance issues.
Clean Water Act	Discharges to U.S. waters.	The Hanford Site had one National Pollutant Discharge Elimination System Permit, one storm water permit, and ten State Wastewater Discharge Permits in 2003.
Safe Drinking Water Act	Drinking water systems operated by DOE at Hanford.	There were nine public water systems on the Hanford Site in 2003. The systems were monitored and all analytical results for 2003 met the requirements of the Washington State Department of Health.
Toxic Substances Control Act	Primarily regulation of chemicals called polychlorinated biphenyls.	Non-radioactive and certain categories of radioactive polychlorinated biphenyl waste were disposed in accordance with 40 CFR 761 or remained in storage onsite pending the development of adequate treatment and disposal technologies.
Federal Insecticide, Fungicide, and Rodenticide Act	Storage and use of pesticides.	At the Hanford Site, pesticides are applied by commercial pesticide operators licensed by the state.
Endangered Species Act of 1973	Rare species of plants and animals.	Hanford activities followed the requirements of this act. The Hanford Site has eleven plant species, two fish species, and five bird species on the federal or state lists of threatened or endangered species.
American Indian Religious Freedom Act, Antiquities Act, Archaeological and Historic Preservation Act, Archaeological Resources Protection Act of 1979, Historic Sites, Buildings, and Antiquities Act, National Historic Preservation Act, and Native American Graves Protection and Repatriation Act	Cultural resources.	One hundred forty-two cultural resource reviews were conducted on the Hanford Site.
National Environmental Policy Act	Environmental impact statements for federal projects.	Environmental impact statements and environmental assessments were prepared or conducted as needed. In 2003, there were 20 site-wide categorical exclusions – actions that have already been analyzed by DOE and have been determined not to result in a significant environmental impact.
Migratory Bird Treaty Act	Migratory birds or their feathers, eggs, or nests.	Hanford activities used the ecological review process as needed to minimize any adverse effects to migratory birds. There are over 100 species of birds that occur on the Hanford Site that are protected by this act.

Table S.2. Hanford Waste Summary, 2003

Activity	Waste Type	Amount
Waste generated during onsite cleanup activities	Solid mixed waste Radioactive waste	929,000 pounds 1.6 million pounds
Waste received at Hanford from off the site	Solid mixed waste Radioactive waste	1.4 million pounds 898,200 pounds
Waste shipped off of Hanford Site	Hazardous waste	494,200 pounds
Waste generated at Hanford and added to double-shell tanks	Liquid waste	2.5 million gallons
Waste volume in double-shell tanks at the end of 2003	Liquid waste	24.5 million gallons

Environmental Occurrences

Environmental releases of radioactive and regulated materials from the Hanford Site are reported to the DOE and other federal and state agencies as required by law. The specific agencies notified depend on the type, amount, and location of the individual occurrence. The Hanford Site Occurrence Notification Center maintains both a computer database and a hardcopy file of event descriptions and corrective actions.

During 2003, there were no environmentally significant emergency occurrence reports or environmentally significant unusual occurrence reports filed at the Occurrence Notification Center. Two off-normal occurrences with environmental impacts are discussed in Section 2.4.3. One was contaminated wasp nests found outside of a contaminated area in the 100-H Area. The second event was a contaminated wasp nest discovered on a generator in the 100-N Area; investigation determined that the generator had been used in the 100-H Area before it was brought to 100-N Area and probably had contaminated mud on it. Throughout the summer of 2003, contaminated wasp nests were found around the H Reactor building. Investigation determined the mud from the floor of 100-H Basin had been used by the wasps to make their nests. Mitigation activities included using Borax as a deterrent, applying pesticides to eliminate the wasps, creating clean mud sources, and reducing the amount of exposed mud in the basin.

Environmental Monitoring

Environmental monitoring at the Hanford Site includes near-facility environmental monitoring (Section 3.2), surface environmental surveillance (Chapter 4), groundwater monitoring (Chapter 6), and vadose zone monitoring (Chapter 6). Near-facility monitoring includes the analysis of environmental samples collected near major nuclear-related installations, waste storage and disposal units, and remediation sites. Surface environmental surveillance consists of sampling and analyzing various media on and around the site (including the Columbia River) to detect potential contaminants and to assess their significance to environmental and human health. Groundwater sampling is conducted on the site to determine the distribution of radiological and chemical constituents in groundwater. The strategy for managing and protecting groundwater resources at the Hanford Site focuses on protecting the Columbia River, human health and the environment; treating groundwater contamination; and limiting the movement of groundwater contamination. Vadose monitoring was conducted to better understand the properties of the vadose zone and its contaminants and the extent of subsurface contamination. The overall objectives of these monitoring and surveillance programs are to demonstrate compliance with applicable federal, state, and local regulations; confirm adherence to DOE environmental, public health, and worker protection policies; and support environmental and waste management decisions.

Environmental monitoring and surveillance results for 2003 are summarized in Table S.3. For detailed discussions of results, refer to the appropriate sections of this report.

Effluent Monitoring

Liquid effluent and airborne emissions that may contain radioactive or hazardous constituents are continually

Table S.3. Hanford Site Monitoring Results for 2003

	What was Monitored?	The Bottom Line
Air	Air particles and gases were analyzed for radioactive materials. Air was sampled at 23 locations on Hanford, 11 perimeter locations, 8 community locations, and in 2 distant communities. In addition, near-facility monitoring collected air samples at 82 locations near Hanford facilities.	All measurements of radioactive materials in air were below recommended guidelines.
Columbia River Water	Columbia River water was collected from multiple Hanford Reach sampling points throughout the year. Water samples were analyzed for radioactive and chemical materials. Water in the Columbia River continues to be designated Class A (Excellent) by the state of Washington. This designation means that the water is usable for substantially all needs.	As in past years, small amounts of radioactive materials were detected downriver from Hanford. However, the amounts were far below federal and state limits. During 2003, there was no indication of any deterioration of Columbia River water quality resulting from operations at Hanford.
Columbia River Shoreline Springs	Groundwater discharges to the Columbia River via surface and subsurface springs. Discharges above the water level of the river are identified as riverbank springs. Samples of spring water were collected at locations along the Columbia River shoreline.	Samples collected at the springs contained some contaminants at levels above those observed in near-shore river but similar to. local groundwater. However, concentrations in river water downtream of the shoreline springs remained far below federal and state limits.
Groundwater	Groundwater samples were collected from 652 wells and 48 shoreline aquifer tubes to monitor contaminant concentrations. Water levels were measured in several hundred wells on the site to map groundwater movement.	Samples showed that groundwater contaminant plumes are continuing to move from beneath former waste sites toward the Columbia River. Contaminant concentrations are declining in the largest plumes because of spreading and radioactive decay.
Vadose Zone	The vadose zone is the region between the ground surface and the top of the water table. Vadose zone characterization and monitoring were conducted to better understand the properties of contaminants and the extent of the contamination.	Vadose zone monitoring was conducted at the single-shell tank farms to detect changes or trends in contaminants. Characterization of vadose zone contaminants occurred at past-practice disposal sites.
Drinking Water	The quality of the drinking water supplied by nine DOE-owned systems on the Hanford Site was monitored.	All DOE-owned drinking water systems on the Hanford Site met Washington State and EPA standards.
Food and Farm Products	Samples of alfalfa, apples, asparagus, honey, leafy vegetables, milk, potatoes, tomatoes, and wine were collected from 20 locations upwind and downwind of the Hanford Site.	Radionuclide levels in samples of food and farm products were at normal environmental levels.
Fish and Wildlife	Game animals on the site and along the Hanford Reach and fish from the Columbia River were monitored at 13 locations. Carcass, bone, and muscle samples were analyzed to evaluate radionuclide levels.	Samples of fish, geese, rabbits, crayfish, and clams were collected and analyzed. Radionuclide levels in wildlife samples were well below levels that are estimated to cause adverse health effects to animals or to the people who may consume them.
Effluent Monitoring	Liquid effluent and airborne emissions that may contain radioactive or hazardous constituents are continually monitored on the Hanford Site.	Compliance with all applicable effluent monitoring requirements was achieved in 2003.

monitored when released to the environment at the Hanford Site. Facility operators perform the monitoring mainly through analyzing samples collected at points of release into the environment. Monitoring data are evaluated to determine the degree of regulatory compliance for each facility and/or the entire site. The evaluations are also useful to assess the effectiveness of effluent treatment and pollution-management practices.

In 2003, only facilities in the 200 Areas discharged radioactive liquid effluent to the ground, which went to the State-Approved Land Disposal Site (Section 3.1.3). Non-radioactive hazardous materials in liquid effluent were discharged to both the State-Approved Land Disposal Site and to the Columbia River at designated (permitted) discharge points. Monitoring indicated that no known releases of hazardous substances exceeding reportable quantities occurred at these discharge points in 2003 (Section 3.1.5).

Radioactive air emissions usually come from a building stack or vent. Radioactive emission discharge points are located in the 100, 200, 300, 400, and 600 Areas. Table 3.1.1 of this document provides a summary of radionuclides discharged to the atmosphere at the Hanford Site in 2003. Non-radioactive air pollutants from such things as diesel-powered electrical generating plants were also monitored. Table 3.1.2 summarizes the non-radioactive discharges to the air on the Hanford Site during 2003.

Waste Site Remediation

Full-scale remediation of waste sites began in the 100 Areas in 1996 and continued in 2003 at the 100-B/C, 100-K, 100-N, and 100-F Areas (Section 2.3.12.2). Also, remediation of the treatment, storage, and disposal units at the 100-N Area continued and backfill activities were completed in the 100-F Area and began in the 100-B/C Area. A total of 506,275 tonnes (558,073 tons) of contaminated soil from 100 Areas remediation activities were disposed at the Environmental Restoration Disposal Facility (near the 200-West Area) during 2003.

Since cleanup activities began in 1996, the primary focus has been on liquid effluent waste sites. After nearly 7 years of work the number of liquid effluent waste sites requiring remediation has been reduced and cleanup activities now are turning to remediation of waste burial grounds. The volume of contamination in waste burial grounds is less than in liquid effluent waste sites; however, the burial grounds may contain unknown materials and additional time may be required to characterize the waste and dispose of it properly.

Remediation work at the 300-FF-1 Operable Units began in 1997 and was completed in 2003. Remediation continued at the 300-FF-2 Operable Unit. In 2003, more than 52,590 tonnes (57,970 tons) of contaminated soil from 300 Area remediation were removed and disposed of at the Environmental Restoration Disposal Facility.

Pollution Prevention Program. This program (Section 2.3.1) is an organized and continuing effort to reduce the quantity and toxicity of hazardous, radioactive, mixed, and sanitary waste produced at Hanford. The program fosters the conservation of resources and energy, reduction in the use of hazardous substances, and prevention or minimization of pollutant releases to all environmental media from all operations and site cleanup activities.

The DOE met the 2003 goals for reducing low-level waste and mixed low-level waste generation and increasing sanitary waste (including paper, plastic, cardboard, glass, etc.) recycling. The goal of purchasing more environmentally preferable products containing recycled material was also achieved.

However, the generation goal for routine hazardous waste was not met at the Hanford Site in 2003. Hanford generated 17.78 cubic meters (23.2 cubic yards) of hazardous waste, which exceeded goal of 16.39 cubic meters (21.4 cubic yards) by 1.39 cubic meters (1.82 cubic yards). This was largely due a diesel oil spill at the Waste Treatment Project, which resulted in 6.1 cubic meters (8 cubic yards) of contaminated soil.

The Hanford Site generated 20,454 cubic meters (26,754 cubic yards) of low-level waste, mixed low-level waste, and hazardous waste during 2003. This was well below the goal of 28,604 cubic meters (37,414 cubic yards).

Spent Nuclear Fuel Project. This project (Section 2.3.2) provides safe, economic, and environmentally sound management of Hanford spent nuclear fuel and prepares the fuel for long-term storage. In 2003, the project continued to make accelerated progress on removing spent fuel from underwater storage in the K Basins

and placing it in dry interim storage in the 200-East Area. Major accomplishments of the Spent Nuclear Fuel Project during 2003 included the following:

- Two hundred shipments of spent fuel were transferred from the K-East Basin to the K-West Basin, completing 215 of 380 planned shipments (56% complete).
- One hundred thirteen multi-canister overpacks of spent fuel were removed from the K-West Basin and dried, for a total of 293 multi-canister overpacks out of approximately 385 (75% complete). The 2003 progress brought the total amount of fuel removed and dried to approximately 1,600 tonnes (1,800 tons).
- One hundred twenty multi-canister overpacks were permanently closed (at the Canister Storage Building) with "N-Stamped" welds (those meeting the highest nuclear quality standards of the American Society of Mechanical Engineers). The welding subproject remained consistently ahead of schedule.
- Scrap-processing equipment was installed in the K-West Basin and the loading of fuel scraps into multi-canister overpacks was begun.
- The washing and loading of aged fuel canisters for disposal as low-level nuclear waste continued. By end of 2003, 3,700 canisters (55% of the total) had been washed and disposed.

Sludge Retrieval and Disposition Project. In late 2003, to bring more focus and dedicated resources to sludge issues, Fluor Hanford, Inc. separated the sludge work from the Spent Nuclear Fuel Project and created the new Sludge Retrieval and Disposition Project (Section 2.3.3). T Plant had always been an interim storage site, and Fluor Hanford, Inc. and the DOE desired to establish a path leading more directly toward sludge disposal.

Throughout much of 2003, Fluor Hanford, Inc. managed the effort to retrieve sludge from the K Basins as part of the larger Spent Nuclear Fuel Project. The plan called for collection of the sludge in large steel containers, which would then be transported to T Plant in Hanford's 200-West Area for interim storage as remote-handled transuranic waste. This waste would be included in a treatment and disposition path with other remote-handled transuranic waste at Hanford.

K-East Basin contains a mixture of sludge from fuel canisters and from the basin floor and pits. The K-West Basin sludge exists in four discrete types. These types include sludge in pits, sludge dispersed on the basin floor, and canister and fuel wash sludge that collects in the Integrated Water Treatment System equipment used for spent nuclear fuel processing. The K-West Basin sludge also includes metallic uranium fuel fragments and fuel corrosion products from spent fuel of slightly higher enrichment levels than the K-East Basin spent fuel. Because composition of the sludge is complex, Fluor Hanford, Inc. obtained assistance from Pacific Northwest National Laboratory and others to determine suitable methods to handle and treat the sludge.

At the end of 2003, the new Sludge Retrieval and Disposition Project had been in existence only 3 months. The project staff had begun to study potential sludge treatment methods and had initiated treatment of the approximately 6 cubic meters (7.85 cubic yards) of KE North Loadout Pit sludge from the K-East Basin in a pilot grouting program. In the pilot grouting program, North Loadout Pit sludge will be mixed in concrete to prepare it for disposal at the DOE's Waste Isolation Pilot Plant in New Mexico as contact-handled transuranic waste.

Central Plateau Remediation Project. This project's mission (Section 2.3.4) is to deactivate and close facilities on the Central Plateau in a safe and compliant manner until they can be turned over to the site contractor responsible for final disposition. The Central Plateau Remediation Project includes the Accelerated Deactivation Project, 324 and 327 Facilities Deactivation Project, Equipment Disposition Project, 224-B, 224-T, and 233-S Plutonium Concentration Facility Decommissioning Project, Central Plateau Surveillance and Maintenance Project, and Canyon Disposition Initiative.

Fast Flux Test Facility. Deactivation activities continued at the Fast Flux Test Facility (Section 2.3.5) in 2003. Repairs and upgrades to reactor-fuel handling equipment were completed and successfully tested. Following removal of a hold order imposed by a U.S. District Court, the liquid sodium coolant was drained from secondary heat transport system loops to the Sodium Storage Facility tanks, where it is stored pending future conversion to sodium hydroxide for use by the Waste Treatment Plant. Eighty-one reactor fuel components were washed, packaged, and placed in approved interim storage. This included 32 un-irradiated mixed-oxide fuel assemblies, which were placed in storage

at the Plutonium Finishing Plant. Fluor Hanford, Inc. awarded a contract to TransNuclear Inc. to fabricate the remaining interim reactor-fuel storage casks and to design a pump that will be used to drain the reactor vessel.

Advanced Reactors Transition Project. The mission of this project (Section 2.3.6) is to transition or convert the Plutonium Recycle Test Reactor facility, and other facilities used for nuclear research, into structures that are safe, stable, and suitable for reuse or low cost surveillance and maintenance. During 2003, facility surveillance activities continued.

Plutonium Finishing Plant. During 1996, the DOE issued a shutdown order for this plant, authorizing deactivation and transition of the plutonium processing portions of the facility to prepare for decommissioning. Workers at the Plutonium Finishing Plant complex embarked on a large and multifaceted effort to stabilize, immobilize, re-package, and/or properly dispose of nearly 18 tonnes (19.8 tons) of plutonium-bearing materials in the plant, and had nearly completed this mission by the end of 2003 (completion occurred in February 2004). The workers also began to deactivate and dismantle the processing facilities, while still providing for the safe and secure storage of nuclear materials in the facilities. Significant accomplishments achieved at the Plutonium Finishing Plant during 2003 included the following:

- Nearly 1,000 plutonium-bearing polycubes were stabilized using a unique thermal stabilization method devised specifically for this project.
- The original 4 tonnes (4.4 tons) of plutonium-bearing residues identified for action by the Defense Nuclear Facilities Safety Board in 2000 were re-packaged, and additional materials categorized as residues were packaged.
- Re-packaged plutonium-bearing residues were shipped off of the Hanford Site to the Waste Isolation Pilot Plant in Carlsbad, New Mexico, for disposal.
- Stabilized plutonium forms were welded into sturdy, triple-layered cans meeting strict specifications of the DOE's "3013" safety standard.
- Plutonium-bearing oxides containing large amounts of chloride salts were stabilized using a unique process developed for this project.
- Approximately 90% of the total plutonium inventory in the plant was stabilized by the end of 2003.
- Plutonium held in a glove box known as HC-7C in the main Plutonium Finishing Plant Facility was cleaned up and cleanup in a second large glove box known as HC-9B was initiated.
- Equipment removal in the 232-Z incinerator facility in the Plutonium Finishing Plant complex was started and key environmental documentation in preparation for additional deactivation work was completed.
- One million safe work hours were obtained and the Plutonium Finishing Plant became the first high-hazard nuclear facility in the DOE complex to achieve Star Status in DOE's Voluntary Protection Program.

Waste Encapsulation and Storage Facility Project. The mission of the Waste Encapsulation and Storage Facility Project (Section 2.3.8) is to provide safe interim storage of encapsulated radioactive cesium and strontium. The facility was initially constructed as a portion of the B Plant complex and began service in 1974. There are currently strontium fluoride and cesium chloride capsules stored at the facility. The capsules will be stored at the Waste Encapsulation and Storage Facility until 2018 when they will either be treated at the Waste Treatment Plant or transported to the national repository.

Tri-Party Agreement milestone M-92-05 was revised in 2003 to require an assessment of the viability of directly disposing the capsules at the national high-level waste repository as an alternative to onsite vitrification. The completed assessment is due June 30, 2007, to Washington State Department of Ecology.

Solid Waste Management. Solid waste management at the Hanford Site in 2003 included the treatment, storage, and disposal of solid waste at many Hanford locations (Section 2.3.10). Onsite solid waste facilities include the Central Waste Complex, Waste Receiving and Processing Facility, Radioactive Mixed Waste Disposal Facility, and T Plant Complex. During 2003, 3,138 cubic meters (110,820 cubic feet) of mixed low-level solid waste were treated and/or directly disposed onsite. Two defueled reactor compartments from the U.S. Navy were received and disposed of at the 200-East Area in 2003; this brings the total number of reactor compartments received to 112.

Liquid Effluent Treatment. Liquid effluent is managed in facilities that comply with RCRA and state regulations (Section 2.3.11). The 242-A evaporator in the 200-East

Area concentrates dilute liquid tank waste by evaporation. This reduces the volume of liquid waste sent to the double-shell tanks for storage and reduces the potential need for double-shell tanks. The 242-A evaporator completed four campaigns during 2003. The volume of waste treated was 14.53 million liters (3.84 million gallons) and the waste volume reduction was 4.28 million liters (1.13 million gallons) or 29%. The volume of process condensate transferred from the 242-A evaporator to the Liquid Effluent Retention Facility for subsequent treatment was 5.68 million liters (1.50 million gallons).

Approximately 46.56 million liters (12.3 million gallons) of liquid waste were stored at the Liquid Effluent Retention Facility at the end of 2003. The 200 Area Treated Effluent Disposal Facility received 1,269 million liters (335.4 million gallons) of unregulated effluent for disposal in 2003. The major source of this effluent is uncontaminated cooling water and steam condensate from the 242-A evaporator.

Industrial wastewater generated throughout the Hanford Site is collected and treated in the 300 Area Treated Effluent Disposal Facility. The wastewater consists of once-through cooling water, steam condensate, and other industrial wastewater (Section 2.3.11.5). The volume of industrial wastewater treated and disposed of during 2003 was 145.5 million liters (38.4 million gallons).

Environmental Restoration Project. The Environmental Restoration Project (Section 2.3.12) includes activities to characterize and remediate contaminated soil, decontaminate and decommission facilities, maintain inactive waste sites, and to transition facilities into the surveillance and maintenance program. In 2003, work began on two new cells at the Environmental Restoration Disposal Facility with completion expected in 2004.

During 2003, interim safe storage of the F Reactor was completed. Demolition of the 117-DR Exhaust Filter Building and associated tunnels was also completed. The D Reactor Safe Storage Enclosure design was completed, and the subcontractor initiated construction activities. The demolition and closure of the 1720-HA Arsenal in 100-H Area was completed, and demolition of the H Reactor basin was initiated and is nearing completion. Demolition and closure of the 118-C-4 Horizontal Control Rod Storage Cave in the 100-B/C Area was also completed in 2003. Decontamination and decommissioning activities were also initiated in 100-N Area with demolition of the 1304-N Emergency Dump Tank, which was in progress.

The DOE Richland Operations Office and U.S. Fish and Wildlife Service cooperatively worked on a plan to re-vegetate land on the Fitzner/Eberhardt Arid Lands Ecology Reserve to compensate for damage to the environment caused by construction of cells 1 and 2 at the Environmental Restoration Disposal Facility. The Environmental Restoration Disposal Facility mitigation project includes three separate planting elements: native grass seed, shrub seedlings, and native grass-plugs. The final Environmental Restoration Disposal Facility mitigation planting was completed in November 2003.

Groundwater Remediation Project. The Groundwater Remediation Project (Section 2.3.13) coordinates all projects at Hanford involved in characterizing, monitoring, and remediating groundwater and the vadose zone. The goal of groundwater remediation is to prevent contaminants from entering the Columbia River, reduce the contamination in areas of high concentration, prevent the movement of contamination, and protect human health and the environment. Table S.4 is a summary of groundwater and vadose zone protection activities conducted in 2003. Figure S.1 shows the location of groundwater remediation systems.

Office of River Protection. The Office of River Protection manages the DOE's River Protection Project, which is responsible for storage, retrieval, treatment, and disposal of high-level tank waste and closure of tank farms on the Hanford Site (Section 2.3.9). The status of 177 waste tanks on the Hanford Site was reported in *Waste Tank Summary Report for Month Ending December 31, 2003*.

During the year, more than 1 million liters (300,000 gallons) of waste was pumped from single-shell tanks into the double-shell tank system. At the end of 2003, tank 241-U-108 was the only remaining single-shell tank that still needs to be stabilized.

To assure safe storage and retrieval, the contents of 154 of 177 (87%) waste tanks have been at least partially characterized. All of the double-shell tanks and most of the single-shell tanks have been sampled; however, a number of these samples were analyzed for a limited number of analytes.

Table S.4. Summary of Groundwater Pump-and-Treat Systems and a Vadose Zone Soil-Vapor Extraction System

Location	Startup Date	Contaminant	Mass Removed 2003	Mass Removed – Since Startup
Groundwater Pump-and-Treat Systems				
100-D and 100-H Areas	1997	Hexavalent chromium	43 kilograms (94.7 pounds)	204 kilograms (450.4 pounds)
100-K Area	1997	Hexavalent chromium	36.7 kilograms (80.9 pounds)	221.9 kilograms (489.2 pounds)
100-N Area	1995	Strontium-90	0.20 curies	1.45 curies removed; ~12 curies decayed naturally
200-West Area (200-ZP-1) Operable Unit	1994	Carbon tetrachloride	799 kilograms (1,761 pounds)	7,848 kilograms (17,302 pounds)
200-West Area (200-UP-1) Operable Unit	1994	Carbon tetrachloride	2.7 kilograms (6 pounds)	26.04 kilograms (57.4 pounds)
	1994	Nitrate	3.191 kilograms (7,035 pounds)	27,343 kilograms (60,290 pounds)
	1994	Technetium-99	10.1 grams (0.0222 pound)	103.3 grams (0.2316 pound)
	1994	Uranium	18.2 kilograms (40.1 pounds)	181 kilograms (399 pounds)
Soil-Vapor Extraction				
200-West Area	1992	Carbon tetrachloride	294 kilograms (658 pounds)	78,092 kilograms (172,163 pounds)

During 2003, CH2M HILL Hanford Group, Inc. retrieved waste from tank 241-C-106, dissolving and mobilizing the waste with an acid solution. Retrieval also began at tank 241-S-112, where water was used to dissolve and mobilize the waste. Evaluation of a third waste retrieval technology, the mobile retrieval system, continued. This third technology is intended for use on solid waste. It consists of a remote controlled in-tank vehicle (used to push tank waste to a central location) and an articulated mast (used to guide the vacuum pump intake to the waste positioned for retrieval by the in-tank vehicle). Workers plan to deploy the articulated mast in 2004 for waste retrieval in the C-200 series tanks. The entire mobile waste retrieval system, both the mast and the in-tank vehicle, is planned for deployment in 2005 to retrieve waste from the C-100 series tanks.

The DOE revised the closure plan for the single-shell tank system during 2003 based on comments received from the Washington State Department of Ecology. The process and integration necessary to achieve accelerated closure of single-shell tanks and waste management areas and the first closure activities will be performed on tank 241-C-106.

CH2M HILL Hanford Group, Inc. selected a single supplemental treatment technology, bulk vitrification, for further evaluation of treatment of retrieved low-activity tank waste and is pursuing a field assessment of that technology. The evaluation will address the feasibility of using vitrification (i.e., heating and melting inert materials to form a solid glass matrix) to immobilize low-activity waste in a form suitable for disposal. Planning and design have begun for a 2005 demonstration, and the required environmental permit applications have been submitted.

In addition, CH2M HILL Hanford Group, Inc. continues its evaluation of a separate disposal path for select mixed transuranic tank waste. The approach will include onsite treatment and packaging for shipment and final disposal at the DOE Waste Isolation Pilot Plant in New Mexico. The National Environmental Policy Act documentation and environmental permit applications have been prepared, and a contract was awarded for design and fabrication of the waste treatment and packaging system.

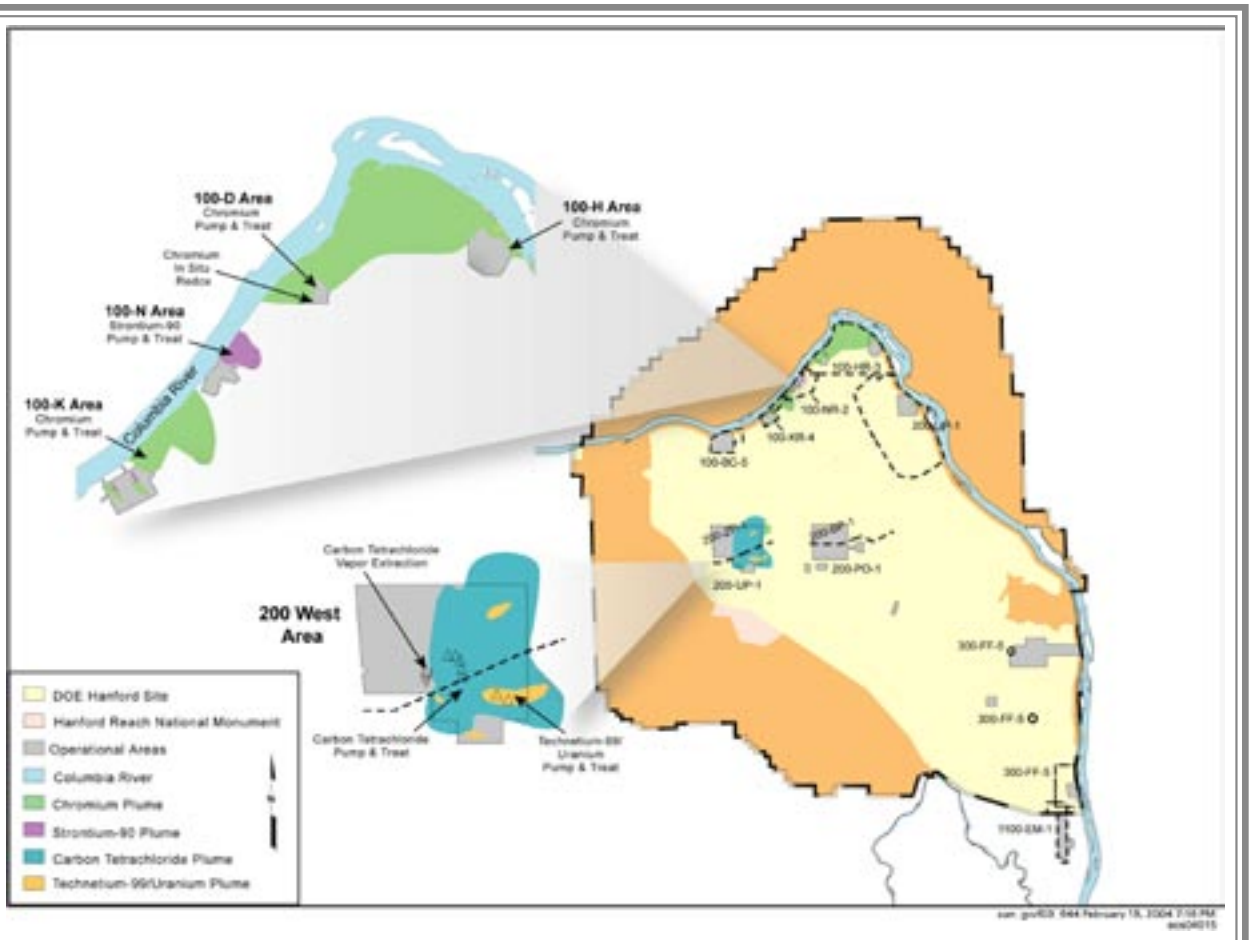

Figure S.1. Hanford Site Groundwater Pump-and-Treat and Soil-Vapor Extraction Systems

Geophysical Logging. S.M. Stoller Corporation is responsible for all geophysical logging at the Hanford Site (Section 2.3.9.3). Log data are collected in new and existing boreholes to support ongoing remedial investigation activities conducted by other Hanford contractors. S.M. Stoller Corporation is also responsible for a baseline characterization program, where the objective is to log all existing boreholes associated with waste disposal sites on the Hanford Central Plateau and establish a baseline of vadose zone contamination conditions against which future measurements can be compared to assess contaminant mobility.

Single-Shell Tank Monitoring. Monitoring activities at the single-shell tank farms identified subsurface contaminant plumes. Cobalt-60, cesium-137, europium-152, europium-154, uranium-235, and uranium-238 were the predominant gamma-emitting contaminants. Minor amounts of tin-126 and antimony-125 were also detected. Since specific contaminants have been identified and quantified, the primary focus of monitoring in 2003 was to identify changes in contaminant levels.

Waste Immobilization. The Waste Treatment Plant is being built on 26 hectares (65 acres) located on the Central Plateau outside of 200-East Area to treat radioactive and hazardous waste currently stored in 177 underground tanks (Section 2.3.9.5). Currently, three major facilities are scheduled to be constructed: a pretreatment facility, a high-level waste vitrification facility, and a low-activity waste vitrification facility. Supporting facilities will be constructed also. The River Protection Project is currently upgrading tank farm facilities to deliver waste to the Waste Treatment Plant.

During 2003, construction continued on the Pretreatment Plant building (approximately 27% complete), High-Level Waste Vitrification Plant building (approximately

10% complete), and Low-Activity Waste Vitrification Plant building (approximately 13% complete). The balance of facilities, which includes support facilities and utilities not associated with the Pretreatment Plant, High-Level Waste Vitrification Plant, or Low-Level Waste Vitrification Plant, is approximately 25% complete.

Potential Radiological Doses from 2003 Hanford Operations

During 2003, potential radiological doses to the public and biota from Hanford operations were evaluated to determine compliance with pertinent regulations and limits (Chapter 5). The methods used to calculate the potential doses are presented in Appendix E. The potential dose to the offsite maximally exposed individual in 2003 was 0.06 mrem (0.6 μSv) per year. To put this value into perspective, the national average dose from background sources (Figure S.2), according to the National Council on Radiation Protection, is approximately 300 mrem/yr (3 mSv/yr), and the current DOE radiological dose limit for a member of the public is 100 mrem/yr (1 mSv/yr).

Other Hanford Environmental Programs

Climate and Meteorology

Meteorological measurements are taken to support Hanford Site emergency preparedness, site operations, and atmospheric dispersion calculations (Section 7.1). Weather forecasting and maintenance and distribution of climatological data are provided. A complete listing of climatological data for calendar year 2003 is contained in *Hanford Site Climatological Data Summary 2003 with Historical Data*.

Calendar year 2003 was slightly warmer than normal and precipitation was above normal.

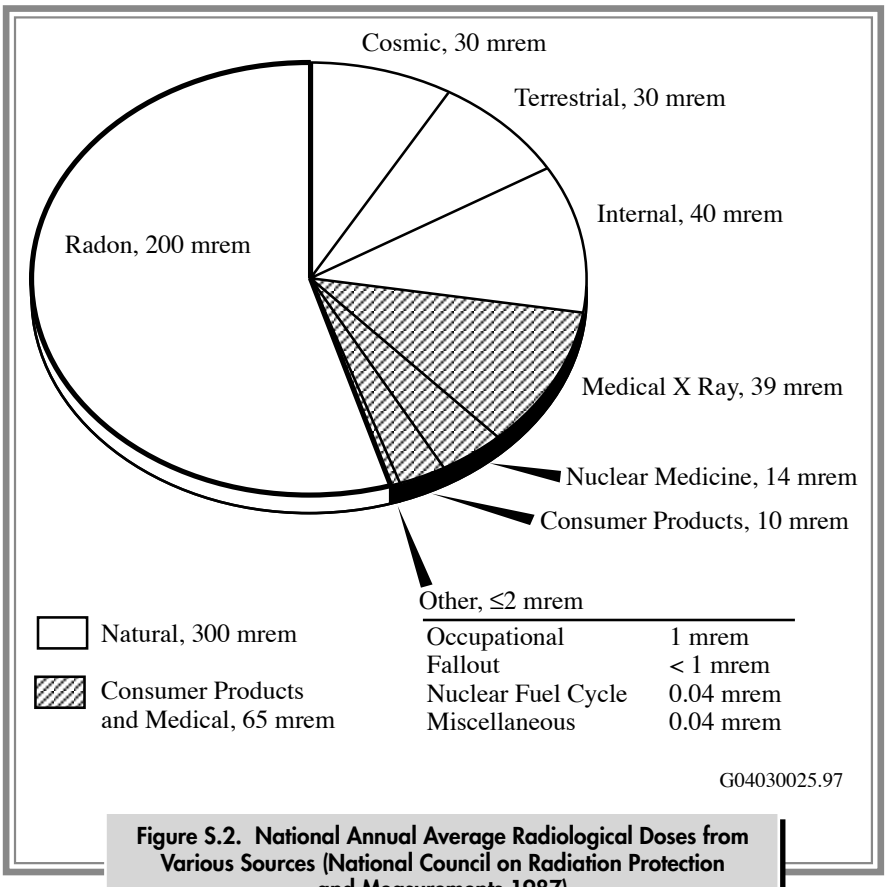

Figure S.2. National Annual Average Radiological Doses from Various Sources (National Council on Radiation Protection and Measurements 1987)

The average temperature for 2003 was 13.1°C (55.6°F), which was 1.1°C (2.0°F) above normal (12.0°C [53.6°F]). Nine months during 2003 were warmer than normal; three months were cooler than normal. January had the greatest positive departure, 3.4°C (6.2°F); and November, at 1.3°C (2.3°F) below normal, had the greatest negative departure.

Precipitation during 2003 totaled 20.7 centimeters (8.14 inches), 117% of normal (17.7 centimeters [6.98 inches]). Snowfall for 2003 totaled 22.1 centimeters (8.7 inches) (compared to an annual normal snowfall of 39.1 centimeters [15.4 inches]).

The average wind speed during 2003 was 3.5 meters per second (7.8 miles per hour), which was 0.1 meter per second (0.2 mile per hour) above normal. The peak gust for the year was 26.8 meters per second (60 miles per hour) on October 28. There were two dust storms recorded at the Hanford Meteorology Station on the Central Plateau during 2003 (March 5 and October 28). There has been an average of five dust storms per year at the Hanford Meteorology Station during the entire period of record (1945-2003).

Cultural Resources

The DOE is responsible for managing and protecting the Hanford Site's cultural and historic resources. The Hanford Cultural and Historic Resources Program, which is maintained by DOE, assures that cultural and historic resources entrusted to DOE are managed responsibly and in accordance with applicable regulatory requirements.

Pursuant to Section 106 of the *National Historic Preservation Act*, cultural resources reviews must be conducted before a federally funded, federally assisted, or federally licensed ground disturbance or building alteration/demolition project can take place. As such, cultural resource reviews are required at Hanford to identify properties within the proposed project area that may be eligible for, or listed in, the National Register of Historic Places and evaluate the project's potential to affect any such property. During 2003, 142 cultural resource reviews were requested and conducted. Of the areas reviewed, 2 were monitored during the construction phase; 6 projects required an archaeological survey; and 21 involved proposed building modifications, demolitions, and exemptions from the Programmatic Agreement for the Built Environment. The remaining reviews (113) involved areas that had been previously surveyed or were located on previously disturbed ground.

Routine monitoring of known cultural sites is performed to evaluate the potential impacts of DOE operations on cultural resources and safeguard them from adverse effects associated with natural processes or unauthorized excavations and collections that violate federal laws. Monitoring conducted during 2003 focused on erosion on Locke Island (located in the Hanford Reach), archaeological sites with natural and visitor impacts, historic buildings and structures, and Native American sites.

During 2003, 53 archaeological sites, 5 buildings, and 15 cemetery or burial locations were monitored to gather data about the characteristics of each site, processes adversely affecting the site, and changes at the site. Of the findings recorded at these monitored places, most were related to natural causes.

Locke Island contains some of the best preserved evidence of prehistoric village sites existing in the Columbia Basin. It is included within the Locke Island National Register Archaeological District. It has sustained loss due to erosion along its eastern shoreline that has affected archaeological materials. Surveys in 2003 recorded erosional losses of up to 3.3 feet, as measured perpendicularly from the Columbia River.

Monitoring of historic buildings during 2003 focused on Bruggemann's Warehouse, the only pre-1943 cobblestone structure remaining on the Hanford Site; the First Bank of White Bluffs building; Coyote Rapids Pumping Plant; Hanford town site electrical substation; and the Hanford town site high school. The buildings were photographed and locations of structural deterioration were identified.

Places with cemeteries or known human remains include locations that are sacred to the Wanapum, Yakama Nation, Confederated Tribes of the Umatilla Indian Reservation, and the Nez Perce Tribe. Overall, places with human remains were found to be stable during 2003. No violations were noted.

Native American and public involvement are important components of cultural resource management. During 2003, four tribal meetings on cultural resources provided

a venue for exchange of information between DOE, tribal staff members, and site contractors about projects and work on the Hanford Site. Similarly, a public issues exchange meeting was held during 2003 to hear comments and recommendations of the interested public concerning the management of cultural and historic resources at Hanford.

Since 2000, the public and Tribes provided comments on drafts of the *Hanford Cultural Resources Management Plan*. The management plan was submitted to DOE for approval in December 2002, and was approved and published in February 2003.

In addition, interviews are occasionally conducted with early residents of areas now part of the Hanford Site as well as Native Americans, former Hanford Site workers, and current site employees to document the historical perspective of those present during past Hanford operations. In 2003, past interviews were inventoried and summarized in the *Hanford Cultural Resources Laboratory Oral History and Ethnography Task Annual Report*.

Biological Control Program

The Biological Control Program was established in 1998 to prevent, limit, clean up, or remediate the impact of contaminated or undesirable plants or animals to the environment or to human health and safety. The program integrates (1) expanded radiological surveillance, (2) control of plants and animals, (3) cleanup of legacy and new contamination, and (4) restoration of sites affected by radioactive contamination spread by plants and animals.

During 2003, there were no incidents of offsite contamination from plants or animals, and all reported cases of new contamination on the site were cleaned up or scheduled for cleanup. Onsite, 32 incidents of contaminated vegetation occurred. This is a decrease of 52% compared to the peak year of 1999 (84), but a two-fold increase over 2002 (16).

There were approximately 17,000 animal control responses in 2003, and approximately 750 trap/bait stations were used to control populations of rodents in and near facilities and offices. Increased vegetation control continued to provide fewer locations for animals to hide and live in critical areas. There were 26 contaminated animals discovered during 2003. This is approximately 57% less than the peak number of 46 in 1999, but is a 2.6-fold increase over the total for 2002 (10).

Flying insects on the Hanford Site were routinely monitored for radiological contaminants. Nineteen of the contaminated animal samples collected in 2003 were related to flying insects (wasps) in the area of the H Reactor decommissioning effort.

Ten plant species categorized as noxious by the U.S. and Washington State Departments of Agriculture, and found to be replacing native species on the Hanford Site, are on a high priority list for control at the Hanford Site. These species are yellow star thistle (*Centaurea solstitialis*), rush skeletonweed (*Chondrilla juncea*), medusahead (*Taeniatherum asperum*), babysbreath (*Gypsophila paniculata*), dalmatian toadflax (*Linaria genistifolia ssp. Dalmatica*), spotted knapweed (*Centaurea maculosa*), diffuse knapweed (*Centaurea diffusa*), Russian knapweed (*Acroptilon repens*), saltcedar (*Tamarix spp.*), and purple loosestrife (*Lythrum salicaria*). Because these species can adversely affect the natural habitat, they are specifically targeted for control by chemical, physical, or cultural (i.e., introducing natural insect predators) means.

Community-Operated Environmental Surveillance Program

This program was initiated in 1990 to increase the public's involvement in and awareness of Hanford's environmental surveillance program. During 2003, four radiological air sampling stations were operated at schools near the Hanford Site. Area teachers at Basin City, Richland, and Toppenish, Washington, and at Edwin Markham Elementary School in Franklin County manage the stations.

Quality Assurance

Comprehensive quality assurance programs, which include various quality control practices and methods to verify data, are maintained by monitoring and surveillance projects to assure data quality. The programs are implemented through quality assurance plans designed to meet requirements of the American National Standards Institute/American Society of Mechanical Engineers and

DOE Orders. Quality assurance plans are maintained for all activities, and auditors verify conformance. Quality control methods used in 2003 included replicate sampling and analysis, analysis of field blanks and blind reference standards, participation in interlaboratory crosscheck studies, and splitting samples with other laboratories.

In 2003, sample collection and laboratory analyses were conducted using documented and approved procedures. When sample results were received, they were screened for anomalous values by comparing them to recent results and historical data. Analytical laboratory performance on the submitted double blind samples, the EPA Laboratory Intercomparison Studies Program, and the national DOE Quality Assessment Program indicated that laboratory performance was adequate overall, was excellent in some areas, and needed improvement in others.