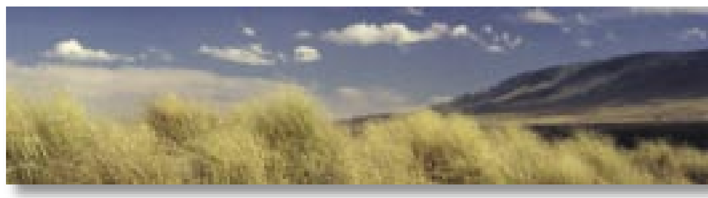
PNNL-14687-SUM

Summary of the HANFORD SITE Environmental Report for Calendar Year 2003



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INTRODUCTION

The Hanford Site lies within the semiarid Pasco Basin of the Columbia Plateau in southeastern Washington State.

This booklet summarizes the *Hanford Site Environmental Report for Calendar Year 2003*. The Hanford Site environmental report, published annually since 1958, includes information and summary data that provide an overview of the activities at the U.S. Department of Energy's (DOE) Hanford Site.

Included in this booklet are brief descriptions of (1) the Hanford Site and its mission; (2) cleanup activities at the Hanford Site; (3) estimated radiological doses to the public and biota from 2003 Hanford Site activities; (4) the status of the site's compliance with environmental regulations; and (5) information on environmental monitoring and surveillance programs and activities. This booklet was written with a minimum of technical terminology. Readers interested in more detailed information can consult the 2003 report or the technical documents cited and listed in that report. This booklet and the report are available online at http://hanford-site.pnl.gov/envreport/.

OVERVIEW
OF THE HANFORD SITE AND ITS MISSION

The Hanford Site contains a biologically diverse plant community that has been protected from disturbance for more than 50 years.

The Hanford Site lies within the semiarid Pasco Basin of the Columbia Plateau in southeastern Washington State. The site occupies an area of approximately 586 square miles located north of the city of Richland. A plutonium production complex with nine nuclear reactors and associated processing facilities, the Hanford Site played a pivotal role in the production of materials for the nation's defense for more than 40 years, beginning in the 1940s with the Manhattan Project. Today, under the direction of the DOE, Hanford contractors are engaged in one of the world's largest environmental cleanup projects.

The site has restricted public access and its large land area provides a buffer for the smaller areas on the site that historically were used for production of nuclear materials, waste storage, and waste disposal. The Columbia River flows eastward through the northern part of the Hanford Site and then turns south, forming part of the eastern site boundary.

In June 2000, the 195,000-acre Hanford Reach National Monument was established by a Presidential Proclamation to protect the nation's only un-impounded stretch of the Columbia River above Bonneville Dam and the largest remnant of the shrub-steppe ecosystem once blanketing the Columbia River Basin.

In 2003, DOE and the U.S. Fish and Wildlife Service managed the monument. The U.S. Fish and Wildlife Service administered three major management units of the monument totaling approximately 258 square miles.

These included (1) the Fitzner/Eberhardt Arid Lands Ecology Reserve Unit, a 120-square-mile tract of land in the southwestern portion of the Hanford Site; (2) the Saddle Mountain Unit, a 50-square-mile tract of land located north-northwest of the Columbia River and generally south and east of State Highway 24; and (3) the Wahluke Unit, a 87-square-mile tract of land located north and east of both the Columbia River and the Saddle Mountain Unit.

The portion of the monument administered only by DOE included the McGee Ranch/Riverlands Unit (north and west of State Highway 24 and south of the Columbia River), the Columbia River islands in Benton County, the Columbia River corridor (one-quarter mile inland from the shoreline) on the Benton County side of the river, and the sand dunes area located along the Hanford side of the Columbia River north of Energy Northwest.

Approximately 400 acres along the north side of the Columbia River, west of the Vernita Bridge and south of State Highway 243, were managed by the Washington Department of Fish and Wildlife. All these lands have served as a safety and security buffer zone for Hanford Site operations since 1943.

EPA, Washington State Departments of Ecology and Health, and Benton Clean Air Authority are responsible for monitoring and enforcing compliance with environmental regulations at Hanford.

HANFORD AT A GLANCE

Location	The U.S. Department of Energy's Hanford Site is located in southeastern Washington State near the city of Richland.
Dominant Feature	Rattlesnake Mountain on the Fitzner/Eberhardt Arid Lands Ecology (ALE) Reserve rises 3,525 feet above sea level.
Size	The site covers approximately 586 square miles.
Employees	DOE and its contractors employ 11,000 workers annually.
Mission	Hanford's mission is to safely clean up and manage the site's legacy wastes and reduce the size of the site.
Budget	The fiscal year 2003 budget was approximately $2.6 billion.
Site Management	DOE Richland Operations Office and DOE Office of River Protection
Prime Contractors	Fluor Hanford, Inc. (nuclear legacy cleanup), Battelle Memorial Institute operates Pacific Northwest National Laboratory (research and development), Bechtel Hanford, Inc. (environmental restoration), Hanford Environmental Health Foundation (occupational and environmental health services), CH2M HILL Hanford Group, Inc. (storing and retrieving waste stored in 177 underground tanks), Bechtel National, Inc. (design, build, and commission a waste treatment plant to vitrify Hanford's tank waste), and S.M. Stoller Corporation (vadose zone).

SITE DESCRIPTION

The Hanford Site is a relatively undeveloped area of shrub-steppe (a drought-resistant, shrub and grassland ecosystem) that contains a rich diversity of plant and animal species. This area has been protected from disturbance, except for fire, over the past 60 years. This protection has allowed plant species and communities that have been displaced by agriculture and development in other parts of the Columbia Basin to thrive at Hanford.

More than 100 rare plant populations of 47 different species are found on the Hanford Site. The U.S. Fish and Wildlife Service has designated 5 of these 47 as species of concern in the Columbia River Basin ecoregion. Two species (Umtanum buckwheat and White Bluffs bladderpod) are proposed as candidates for federal listing.

White Bluffs bladderpod is a plant that has been proposed as a candidate for federal listing as a species of concern.

Mule deer are one of the large mammals found on the Hanford Site. (Photo courtesy of Scott Conley)

Deer and elk are the major large mammals found on the Hanford Site. A herd of Rocky Mountain elk has inhabited the site since 1972. Coyotes also are plentiful on the site, and waterfowl are numerous along the Columbia River. The Great Basin pocket mouse is the most abundant mammal on the site. Several species of plants, fish, and birds, occurring on the Hanford Site are listed as threatened or endangered under the *Endangered Species Act of 1973*.

There are two types of natural aquatic habitat on the Hanford Site. One is the Columbia River and associated wetlands, and the second is upland aquatic sites. The upland sites include small springs, streams, and seeps located mainly on or near Rattlesnake Mountain on the Fitzner/Eberhardt Arid Lands Ecology Reserve (e.g., Rattlesnake Springs, Dry Creek, Snively Springs) and West Lake, a small, natural pond near the 200 Areas.

Salmon and steelhead are the local fish species of most interest to sport fishermen and are commonly consumed by local Native American tribes. Fall Chinook salmon spawn in the Hanford Reach of the Columbia River, the most important natural spawning area in the mainstem Columbia River. Surveys of the Hanford Reach during 2003 detected approximately 9,400 redds (salmon spawning nests); this is an increase of over 1,400 from 2002 and surpasses the peak of approximately 8,800 seen in 1989.

OPERATIONAL AREAS

The major DOE operational, administrative, and research areas on and around the Hanford Site include the following locations:

This map shows management units on the Hanford Reach National Monument and the operational areas of the Hanford Site.

- **100 Areas** – located along the south shore of the Columbia River. These are the sites of nine retired plutonium production reactors that occupy approximately 4 square miles.
- **200-West and 200-East Areas** – centrally located on the site's Central Plateau. These areas are approximately 5 and 7 miles south and west of the Columbia River and cover approximately 6 square miles.
- **300 Area** – located just north of Richland. From the early 1940s until the advent of the cleanup mission, most research and development activities at Hanford were carried out in the 300 Area. This area covers approximately 0.6 square mile.
- **400 Area** – located northwest of the 300 Area; covers approximately 0.23 square mile. The Fast Flux Test Facility (currently being decommissioned) is located in this area.
- **600 Area** – includes all of the Hanford Site not occupied by the 100, 200, 300, and 400 Areas.
- **Former 1100 Area** – located between the 300 Area and the city of Richland; the area covers 768 acres. In 1998, this area was transferred to the Port of Benton as part of DOE's Richland Operations Office economic diversification efforts and is no longer part of the site. DOE contractors continue to lease facilities in this area.
- **Richland North Area (off the site)** – includes the Environmental Molecular Sciences Laboratory and other DOE and contractor facilities, mostly office buildings in the northern part of the city of Richland.

Virtually all radioactive and chemical waste generated during Hanford operations, that will remain on the site, will be disposed on the Central Plateau.

CURRENT MISSION

For more than 40 years, Hanford Site facilities were dedicated primarily to the production of plutonium for national defense and management of the resulting waste. Hanford was the first plutonium production site in the world. In recent years, efforts at the site have focused on developing new waste treatment

The goal of DOE's strategies is to accelerate the completion of Hanford Site cleanup (excluding waste tanks) from 2070 to 2035, and possibly as soon as 2025, and to do so in a manner that protects public health and safety and the environment.

and disposal technologies and characterizing and cleaning up contamination left from historical operations. Physical challenges at the Hanford Site include millions of gallons of highly radioactive liquid waste in 177 underground storage tanks, 2,300 tons of spent nuclear fuel, 20 tons of plutonium-bearing materials, about 25 million cubic feet of buried or stored solid waste, billions of gallons of groundwater spread over about 73 square miles, contaminated with chemicals and radionuclides above drinking water standards, more than 1,700 former waste disposal sites, and about 500 contaminated facilities.

Currently, DOE's primary mission is to accelerate completion of waste cleanup. The Performance Management Plan states that the cleanup mission includes six strategies:

- Restoring the Columbia River corridor by continuing to clean up Hanford Site sources of radiological and chemical contamination that threaten the air, groundwater, or Columbia River. It is expected that most river corridor projects will be completed by 2012.
- Ending the tank waste program by 2033 by accelerating waste retrieval, increasing the capacity of the Waste Treatment Plant, and starting the process of closing waste tanks.
- Accelerating the cleanup of Hanford's other urgent risks.
- Accelerating treatment and disposal of mixed low-level waste and the retrieval of transuranic waste and its shipment off the site.
- Accelerating cleanup of the Central Plateau (200-East and 200-West Areas) from primarily inactive waste storage to active waste characterization, treatment, storage, and disposal operations which are expected to last for another 40 years.
- Accelerating cleanup and protection of groundwater beneath the Hanford Site.

The Hanford Site is a shrub-steppe landscape that contains a rich diversity of plant and animal species.

The DOE Richland Operations Office and DOE Office of River Protection jointly manage the Hanford Site through several contractors and their subcontractors. The DOE Richland Operations Office manages legacy cleanup, research, and other programs at the Hanford Site. The DOE Office of River Protection was established by Congress in 1998 as a field office to manage DOE's largest, most complex environmental cleanup project – Hanford's tank waste retrieval, treatment, and disposal.

COMPLIANCE
WITH ENVIRONMENTAL REGULATIONS

The Columbia River flows through the northern part of the Hanford Site and forms the eastern boundary of the site.

Environmental standards and regulations applicable at DOE facilities fall into three categories: (1) DOE directives; (2) federal legislation and executive orders; and (3) state and local statutes, regulations, and requirements.

Several federal, state, and local government agencies monitor and enforce compliance with applicable environmental regulations at the Hanford Site. Major agencies include the U.S. Environmental Protection Agency (EPA), Washington State Department of Ecology, Washington State Department of Health, and Benton Clean Air Authority. These agencies issue permits, review compliance reports, participate in joint monitoring programs, inspect facilities and operations, and/or oversee compliance with applicable regulations. There are specific requirements, actions, plans, and schedules identified in the Hanford Federal Facility Agreement and Consent Order (also known as the Tri-Party Agreement) and other compliance or consent agreements.

Both the DOE Richland Operations Office and the DOE Office of River Protection recognize the importance of maintaining a program of self-assessment and regulatory reporting to assure that environmental compliance is achieved and maintained at the Hanford Site.

The table on the following page summarizes DOE's compliance with federal acts in 2003. Performance related to the Hanford Federal Facility Agreement and Consent Order is described in the following subsection.

COMPLIANCE WITH FEDERAL ACTS AT THE HANFORD SITE IN 2003

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) concerns 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.

HANFORD FEDERAL FACILITY AGREEMENT AND CONSENT ORDER

A key element in Hanford's compliance program is the Tri-Party Agreement. The Tri-Party Agreement is an agreement among the EPA, Washington State Department of Ecology, and DOE to achieve compliance with provisions of the *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA) and the *Resource Conservation and Recovery Act* (RCRA).

Some Tri-Party Agreement milestones completed in 2003 were related to work on Hanford waste storage tanks.

The Tri-Party Agreement (1) defines the RCRA and the CERCLA cleanup commitments at Hanford, (2) establishes responsibilities, (3) provides a basis for budgeting, and (4) reflects a concerted goal to achieve regulatory compliance and remediation with enforceable milestones in an aggressive manner. Also, the Tri-Party Agreement contains requirements for how to involve the public in Hanford Site decisions.

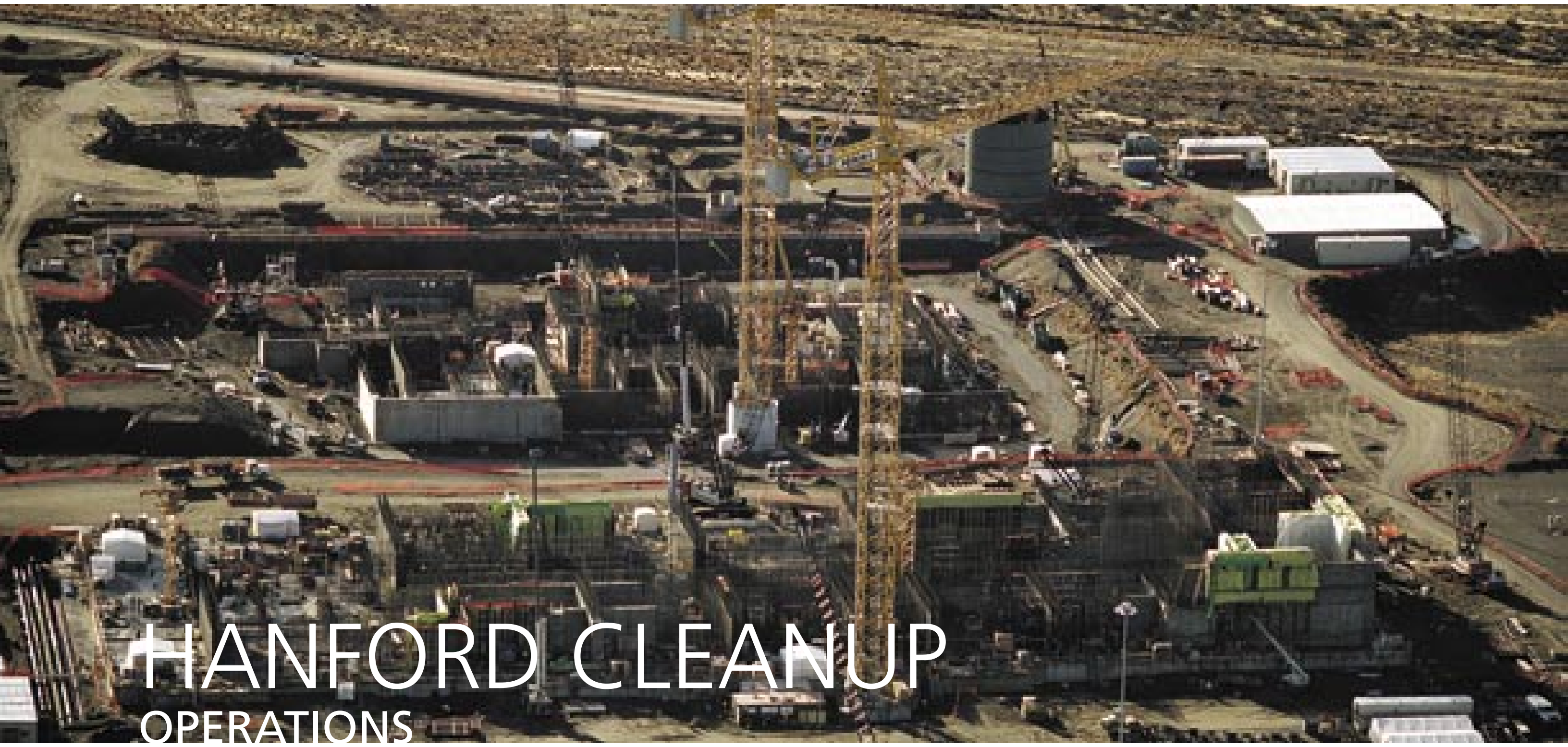
As site cleanup has progressed, significant changes to the agreement have been negotiated to meet changing conditions and cleanup needs. All significant changes to the agreement have gone through a process of public involvement to address the public's values prior to final approvals.

From 1989 through 2003, a total of 809 agreement milestones were completed and 282 target dates were met. During 2003, 25 change requests to the Agreement were approved. These change requests may be viewed on the Internet at http://www2.hanford.gov/arpir/.

During 2003, there were 36 Tri-Party milestones scheduled for completion: 35 were completed on or before their due dates, and 1 was completed 13 days beyond its due date.

ENVIRONMENTAL OCCURRENCES

Onsite and offsite environmental occurrences (spills, leaks) of radioactive and nonradioactive effluent materials during 2003 were reported to 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. Copies of occurrence reports are made available for public review in the DOE Public Reading Room located in Richland, Washington, at the Consolidated Information Center. Three environmentally significant occurrences were reported in 2003.



HANFORD CLEANUP
OPERATIONS

The Waste Treatment Plant is being built near the 200-East Area.

A major focus of DOE's environmental management mission at Hanford is cleanup and management of the site's legacy waste from more than 45 years of nuclear materials production. The work involves safe storage, treatment, and final disposal of a large amount and variety of radioactive and chemical materials. It also involves remediating hundreds of inactive waste disposal sites and stabilizing inactive facilities and the material inside them to prevent leaks or limit radiation exposures. Environmental restoration and pollution prevention are key parts of the environmental management mission.

Waste produced from Hanford cleanup operations is classified as either radioactive, non-radioactive, mixed, or dangerous. Radioactive waste is categorized as transuranic, high-level, and low-level. Mixed waste has both radioactive and dangerous non-radioactive substances. Dangerous waste contains hazardous substances. Dangerous waste is treated, stored, and prepared for disposal at several Hanford Site facilities or is shipped offsite for disposal or destruction. Some types of waste, such as used lead acid batteries and used aerosol products, are shipped offsite for recycling. Annual reports provide information about the dangerous waste generated, treated, stored, and disposed of on and off the Hanford Site.

Non-dangerous waste is waste that does not contain hazardous or radioactive substances. Non-dangerous waste generated at the Hanford Site historically was buried onsite. However, beginning in 1999, non-dangerous waste has been disposed of at an offsite landfill.

Waste in the underground tanks is chemically and physically complex.

WASTE STORAGE, TREATMENT, AND DISPOSAL

Waste management at Hanford includes designing, building, and operating a variety of facilities to store, treat, and prepare waste for disposal.

The table below provides information on the quantities of waste generated at the Hanford Site in 2003. 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 off-site sources (by weight).

This photograph shows construction of six double-shell tanks built on the Hanford Site. The tanks were later covered with 10 feet of sand and gravel.

In addition to newly generated waste, significant quantities of legacy waste remain.

WASTE TANKS

Approximately sixty percent of the nation's nuclear waste is stored in 177 underground storage tanks at the Hanford Site. DOE's goal is to safely remove the liquid waste from the tanks, separate the radioactive elements from

SOLID WASTE GENERATED DURING 2003 CLEANUP ACTIVITIES

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 the Hanford Site	Dangerous waste	490,000 pounds

The 177 radioactive waste storage tanks were built at the Hanford Site between 1943 and 1985.

non-radioactive chemicals, and create a solid form of radioactive waste that can be safely disposed. The approach selected to solidify the highly radioactive waste is called vitrification, a process that turns the waste into a stable glass-like material.

Since the 1950s, leaks from 67 single-shell tanks have been detected and some of the waste has reached the underlying groundwater. Scientists estimate that 750,000 to 1 million gallons of radioactive waste have leaked from single-shell tanks.

Through 2003, the contents of 154 of the 177 (87%) tanks had been characterized. All of the double-shell tanks and most of the single-shell tanks had been sampled; however, a number of these tanks were analyzed for a limited number of analytes.

During 2003, two tank-waste retrieval technologies were used. Waste was retrieved from one tank by dissolving and mobilizing the waste with an acid solution. In another tank, water was used to dissolve and mobilize the waste. A third waste retrieval technology, called the mobile retrieval system, continued to be evaluated. This third technology is intended for use on solid waste in the tanks. It consists of a remote controlled in-tank waste vehicle (used to push tank waste to a central location) and an articulated mast (used to guide a vacuum pump intake to the waste positioned for retrieval by the in-tank vehicle).

What is tank stabilization? Stabilizing a waste tank means that all pumpable liquids are removed from the tank; pumpable liquids are considered those that will, under force of gravity, flow from the waste to the pump intake. During 2003, ten single-shell tanks were declared stabilized. Two additional tanks are believed to be stable, but are being further evaluated. As of December 31, 2003, only one single-shell tank remains to be stabilized.

What is tank waste retrieval? Waste retrieval is achieved by removing all waste that can be accessed, mobilized, and retrieved from a tank. During 2003, waste was retrieved from two single-shell waste tanks.

IMMOBILIZATION OF WASTE CONTAINED IN UNDERGROUND TANKS

The DOE Office of River Protection is responsible for storing, retrieving, treating, and disposing of highly radioactive tank waste and closing the underground waste-tank facilities at the Hanford Site.

The Waste Treatment Plant (i.e., vitrification plant) is currently being built on the Hanford Site and the radioactive and hazardous waste stored in Hanford's underground waste tanks will be processed at this facility.

In 2003, three major components of the Waste Treatment Plant were being constructed: a waste pretreatment facility (27% complete), a vitrification facility for highly radioactive waste (10% complete), and a low-radioactivity waste vitrification facility (13% complete). Supporting facilities are being constructed also (25% complete). Tank farm facilities are currently being upgraded to deliver waste to the Waste Treatment Plan.

Summary of Liquid Waste Generated and Stored in Underground Tanks on the Hanford Site during 2003:

Volume of waste added to double-shell tanks:	2.6 million gallons
Total volume of waste in double-shell tanks at the end of 2003:	24.5 million gallons
Volume evaporated during waste treatment:	1.3 million gallons
Volume pumped from single-shell tanks during 2003:	1.6 million gallons

Vitrification uses electric power to melt glass producing materials that are added to the waste. The molten mass cools into a glass-like material that will safely hold contaminants and keep them from escaping into the environment. The vitrification process also destroys or extracts organic constituents, neutralizes or deactivates dangerous waste, and immobilizes toxic metals.

Waste vitrification chemically processes heavy metals and radioactive elements into a durable, leach-resistant glass.

The vitrified low-radioactivity waste will be disposed of in a facility on the Hanford Site. The vitrified high-radioactivity waste will be stored onsite until a geologic repository is available offsite for permanent disposal.

DOE continues to investigate systems to treat large quantities of mixed low-radioactivity waste. A treatment system is needed that can reduce the volume of waste for final disposal, isolate the radionuclides in a final waste form, and destroy the hazardous component in the waste. During 2003, three technologies were evaluated as methods to accelerate the processing of low-radioactivity tank waste and reduce costs. These technologies included:

During 2003, three technologies were evaluated as ways to reduce the volume of low-radioactivity waste and accelerate waste processing.

- *Steam reforming.* Steam is superheated and reacts with the organics in mixed low-radioactivity waste (generating hydrogen-rich gas) and isolates the radioactive and non-radioactive inorganics in a form that can be encapsulated or vitrified. The small-scale tests performed during 2003 indicated that the mass and volume of waste is reduced using this method. Steam reforming would accelerate the cleanup of tank waste by reducing the amount of waste requiring vitrification.

- *Bulk vitrification.* This process converts radioactive and mixed waste into radioactive glass within a container suitable for land disposal. Bulk vitrification would allow accelerated tank waste cleanup by reducing the amount of sodium that the Waste Treatment Plant would need to process.

- *Containerized grout.* This process would combine waste with grout-forming additives to form a solid waste suitable for safe land disposal. Containerized grout would allow acceleration of tank waste cleanup by reducing the amount of material that the Waste Treatment Plant would need to process.

LIQUID WASTE MANAGEMENT

Liquid waste is managed in treatment, storage, and disposal facilities to comply with RCRA and state regulations, as briefly described below.

The 242-A evaporator processes dilute liquid tank waste into a concentrate.

242-A EVAPORATOR

The 242-A evaporator processes dilute liquid tank waste into a concentrate. This reduces the volume of liquid waste sent to double-shell tanks for storage and reduces the potential need for additional double-shell tanks. In 2003, the evaporator treated approximately 3.8 million gallons of tank waste, and the waste volume was reduced by approximately 1.13 million gallons or approximately 29%. The process condensate was sent to the Liquid Effluent Retention Facility for interim storage while awaiting treatment in the Effluent Treatment Facility.

LIQUID EFFLUENT RETENTION FACILITY

This facility consists of three RCRA-compliant surface basins that temporarily store liquid waste, including condensate from the 242-A evaporator. The volume of wastewater being stored in the Liquid Effluent Retention Facility at the end of 2003 was 12.3 million gallons.

The three basins at the Liquid Effluent Retention Facility are lined with two, flexible, high-density polyethylene membranes.

EFFLUENT TREATMENT FACILITY

Liquid effluent is treated in the Effluent Treatment Facility (200-East Area) to remove toxic metals, radionuclides, and ammonia, and destroy organic compounds. The treated effluent is stored in tanks, sampled and analyzed, and discharged to the State-Approved Land Disposal Site (also known as the 616-A crib). Treatment capacity of the facility is a maximum of 150 gallons per minute. Approximately 26 million gallons of liquid waste were treated in 2003.

200 AREA TREATED EFFLUENT DISPOSAL FACILITY

This facility collects and disposes of un-regulated waste that has been treated using best available technology/all known and reasonable treatment. The volume of unregulated waste disposed of during 2003 was 335.4 million gallons. This effluent was treated and disposed of at two 5-acre ponds on the site's Central Plateau.

300 AREA TREATED EFFLUENT DISPOSAL FACILITY

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. The facility treated and disposed of 38.43 million gallons of industrial wastewater in 2003.

The 200 Area Treated Effluent Disposal Facility treats liquid waste.

SOLID WASTE MANAGEMENT

Solid waste management includes the treatment, storage, and disposal of solid waste produced as a result of Hanford Site operations or received from off-site sources that are authorized by DOE to ship waste to the site. This waste is sent to a number of locations on the site, such as those described in the following paragraphs.

CENTRAL WASTE COMPLEX

Ongoing cleanup and research and development activities, as well as remediation activities, generated the waste received from onsite sources in 2003 and stored at the Central Waste Complex. Offsite waste came primarily from DOE research facilities, other DOE sites, and U.S. Department of Defense facilities. The waste included low-radioactivity, transuranic, or mixed waste, and radioactively contaminated polychlorinated biphenyls.

The Central Waste Complex receives waste from Hanford Site cleanup activities and from other DOE and Defense Department facilities.

WASTE RECEIVING AND PROCESSING FACILITY

The Waste Receiving and Processing Facility analyzes, characterizes, and prepares drums and boxes of waste for disposal. Waste destined for the facility includes Hanford's legacy waste as well as newly generated waste from current site cleanup activities. The waste consists primarily of contaminated cloth, paper, rubber, metal, and plastic. This facility processed and shipped 1,881 drums and 112 boxes of waste during 2003.

RADIOACTIVE MIXED WASTE DISPOSAL FACILITY

This facility is located on the Central Plateau and is made up of two RCRA-compliant rectangular landfills that have double liners and systems to collect and remove unwanted leachate. Currently, there are approximately 72,000 cubic feet of solid waste disposed of in these landfills.

The T Plant Complex operates under RCRA interim status. It provides waste treatment and storage and decontamination services for the Hanford Site.

T PLANT COMPLEX

The T Plant Complex provides waste treatment and storage and decontamination services for the Hanford Site. During 2003, equipment was decontaminated for re-use or disposal, containers of waste were re-packaged, treated, sampled, and characterized, and reactor fuel elements were shipped to the Canister Storage Building.

NAVY REACTOR COMPARTMENTS

Two disposal packages containing defueled U.S. Navy reactor compartments were received and placed in a trench in the 200-East Area during 2003. This brings the total number of reactor compartments received to 112. All Navy reactor compartments shipped to the Hanford Site for disposal have originated from decommissioned nuclear-powered submarines or cruisers.

The Washington State Department of Ecology regulates the disposal of reactor compartments as dangerous waste because lead is used as shielding. The reactor compartments also are managed as mixed waste because of their radioactivity.

Defueled reactor components from nuclear-powered submarines and cruisers are barged to the Hanford Site and buried in a trench in the 200-East Area.

CLEANUP OPERATIONS

A variety of cleanup operations are taking place on the Hanford Site. The following paragraphs describe some of the remediation projects and decommissioning activities taking place in 2003.

SPENT NUCLEAR FUEL PROJECT

In 2003, this project continued to make progress on an accelerated strategy to remove spent fuel from underwater storage in the 100-K Area Basins and place it in dry interim storage in the 200-East Area. The spent fuel will be maintained in dry storage pending a federal decision on final disposal. Major accomplishments of the Spent Nuclear Fuel Project include the following items:

- Through 2003, approximately 1,800 tons of spent nuclear fuel have been removed from the K-West Basin and transported to the Cold Vacuum Drying Facility for processing and then taken to the Canister Storage Building for storage.
- During 2003, a total of 200 shipments of spent fuel was transferred from K-East Basin to K-West Basin, completing 215 of 380 planned shipments (56% complete).

- At the Canister Storage Building, 120 fuel storage canisters were permanently closed with "N-Stamped" welds, i.e., those meeting the highest nuclear quality standards of the American Society of Mechanical Engineers. This welding project remained consistently ahead of schedule.

- At the K-West Basin, scrap-processing equipment was installed and fuel scraps were loaded into multi-canister packs.

- Aged fuel canisters were washed and loaded for disposal as low-level nuclear waste. By the end of 2003, 3,700 canisters (55% of the total) had been washed and disposed.

Workers operate the canister cleaning system as part of the Spent Nuclear Fuels Project.

SLUDGE RETRIEVAL AND DISPOSITION PROJECT

In late 2003, sludge (particulate debris containing degraded irradiated fuel, natural accumulation of insects, windblown sand and soil) retrieval at the K-Basins was separated from the Spent Nuclear Fuel Project to bring more focus and dedicated resources to sludge removal issues. At the end of 2003, the new Sludge Retrieval and Disposition Project had begun to study potential sludge treatment methods and had initiated treatment of approximately 7.85 cubic yards of sludge in a pilot program.

CENTRAL PLATEAU REMEDIATION PROJECT

This project's mission is to transition the Central Plateau from its post-operational state by deactivating and closing facilities until they can be turned over to the site contractor responsible for final disposition. The project includes the 224-B Plutonium Concentration Facility Decommissioning Project, 224-T Plutonium Concentration Facility Decommissioning Project, Accelerated Deactivation Project, 324 and 327 Facilities Deactivation Project, Equipment Disposition Project, 233-S Plutonium Concentration Facility Decommissioning Project, Central Plateau Surveillance and Maintenance Project, and Canyon Disposition Initiative.

A new multi-canister overpack is lowered into a shipping cask inside the Canister Storage Building.

ADVANCED REACTORS TRANSITION PROJECT

The goal of this project is to convert the Plutonium Recycle Test Reactor facility, and facilities used for nuclear research, into structures that are in a safe and stable condition suitable for reuse or low cost surveillance and maintenance. During 2003, facility surveillance activities were conducted.

PLUTONIUM FINISHING PLANT

The current mission at the Plutonium Finishing Plant is to stabilize, immobilize, re-package and/or properly dispose of materials containing plutonium, to deactivate and dismantle the processing facilities at the plant, and to provide for the safe and secure storage of nuclear materials until final disposal. In 2003 and early 2004, workers stabilized, immobilized, re-packaged, and/or properly disposed of nearly 19.8 tons of plutonium bearing materials in the plant.

FAST FLUX TEXT FACILITY

The Fast Flux Test Facility is being deactivated and decommissioned.

The Fast Flux Test Facility, a 400-megawatt thermal, liquid-metal, (sodium)-cooled reactor located in the 400 Area, continued to be deactivated during 2003. Repairs and upgrades to the fuel handling equipment were completed and successfully tested. Following the removal of a hold order imposed by U.S. District Court, sodium was drained from the secondary heat transport system to the Sodium Storage Facility, where it is stored pending future conversion to sodium hydroxide for use by the Waste Treatment Plant. Eighty-one fuel components were washed, packaged, and placed in approved interim storage. This included 32 un-used mixed-oxide fuel assemblies, which are now in the storage at the Plutonium Finishing Plant.

During 2003, a contract was awarded to fabricate the remainder of the interim storage casks and work to design a pump to drain the reactor vessel continued.

What does "remediation of waste sites" and "interim safe storage" of reactors mean?

Remediation of waste sites generally means the excavation of contaminated soil, packaging and/or treatment of that soil, and disposal of the soil in an approved disposal facility. Interim safe storage of reactors includes the decontamination and decommissioning of reactor support facilities (minimize reactor footprint), deactivation of all reactor components, installation of a new engineered facility cover (roof), and sealing all reactor openings. The interim safe storage facility requires minimal surveillance and maintenance and is designed for a 75-year life. (from www.bhi-erc.com/news/fact.htm)

ENVIRONMENTAL RESTORATION

Environmental Restoration at the Hanford Site involves characterizing and remediating contaminated soil and groundwater, stabilizing contaminated soil, and remediating disposal sites. It also involves decontaminating, decommissioning, and demolishing former plutonium production process buildings, nuclear reactors, and separation plants, and maintaining inactive waste sites.

Other aspects of environmental restoration include transitioning facilities into the surveillance and maintenance program and mitigating effects to biological and cultural resources from site development and environmental cleanup and restoration activities.

ENVIRONMENTAL RESTORATION DISPOSAL FACILITY

This facility was designed to serve as the central disposal site for contaminated waste removed during cleanup operations conducted under the *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA) on the Hanford Site.

Cleanup materials may include soil, rubble, or other solid waste materials contaminated with hazardous, low-radioactivity, or mixed (combined hazardous chemical and radioactive) waste. At the end of 2003, the facility had received over 4.6 million tons of contaminated soil and other waste.

By the end of 2003, the Environmental Restoration Disposal Facility had received 4.6 million tons of contaminated soil and other waste.

WASTE SITE REMEDIATION

Remediation continued through 2003 at several former waste disposal sites in the 100-B/C, 100-F, 100-K, 100-N, and 300 Areas. In 2003, a total of 558,073 tons of contaminated soil were removed from the 100 Areas remediation sites; a total of 57,970 tons of contaminated soil were removed from the 300 Area remediation sites. This soil was transported to the Environmental Restoration Disposal Facility for disposal.

STATUS OF WASTE SITE REMEDIATION

Waste Site	Contaminated Soil Removed in 2003
100-B/C Area	119,940 tons
100-F Area	78,240 tons
100-N Area	356,636 tons
100-K Area	3,257 tons
300 Area	57,970 tons

FACILITY DECOMMISSIONING PROJECT

Decontamination and decommissioning activities continued in 2003 in the 100-D/DR, 100-H, and 100-F Areas. These activities were conducted to support the interim safe storage of the four reactor buildings (D, DR, F, and H) for up to 75 years. Interim safe storage minimizes potential risks to the environment, employees, and the public and reduces surveillance and maintenance costs. These activities were conducted as non-time-critical removal actions under CERCLA.

During 2003, interim safe storage of F Reactor was completed. The D Reactor Safe Storage Enclosure design was completed, and the subcontractor initiated construction activities. The demolition of the H Reactor basin was initiated and was nearing completion.

Interim safe storage of decommissioned reactors continued in 2003.

REVEGETATION AND MITIGATION PLANNING

During November 2003, seedlings were planted on the Fitzner/Eberhardt Arid Lands Ecology Reserve.

To compensate for damage to the environment by the original construction at the Environmental Restoration Disposal Facility, a plan was approved by the DOE Richland Operations Office and U.S. Fish and Wildlife Service to re-vegetate land on the Fitzner/Eberhardt Arid Lands Ecology Reserve. The Environmental Restoration Disposal Facility mitigation project includes three separate planting elements: native grass seed and plugs and shrub seedlings. The final portion of this plan was completed in November 2003 when approximately 21,000 4-cubic-inch grass plugs and 20,000 10-cubic-inch shrub seedlings were planted on the Fitzner/Eberhardt Arid Lands Ecology Reserve.

GROUNDWATER RESTORATION

The DOE's Groundwater Remediation Project brings together all activities that affect Hanford's subsurface. Restoring the condition of the groundwater under the Hanford Site is a major focus of the project. The goals of groundwater restoration are to prevent contaminants from entering the Columbia River, reduce contamination in areas of high concentration, prevent the movement of contamination, and protect human health and the environment.

A worker samples an extraction well at the 100-NR-2 pump-and-treat facility.

The total area where contaminants in groundwater plumes exceeded drinking water standards is estimated to be approximately 73 square miles during 2003. This area occupies 12.5% of the total area of the Hanford Site. The tritium and iodine-129 plumes have the largest areas with concentrations exceeding drinking water standards. As expected, most of the maximum contaminant concentrations were detected in the 100 and 200 Areas because these areas contain the largest number of waste sites that have affected groundwater quality.

Groundwater pump-and-treat systems operated at the 100-D, 100-H, 100-K, 100-N, 200-East, and 200-West Areas in 2003. These systems pump contaminated groundwater out of the subsurface, treat it to remove the contaminants, and inject the water back into the aquifer. This form of remediation is being used at Hanford to remove carbon tetrachloride, chromium, nitrate, strontium-90, technetium-99, and uranium in order to reduce the amounts of these contaminants entering the river until a final cleanup solution is in place.

In addition to pump-and-treat remediation, use of in situ redox manipulation technology continued in the southwest portion of 100-D Area to treat chromium contamination in groundwater without removing the groundwater from the aquifer. This technology immobilized chromium by reducing the soluble, more toxic, chromate ion to highly insoluble, less toxic, chromic hydroxide.

Three soil-vapor extraction systems designed to remove carbon tetrachloride vapor from the soil beneath the 200-West Area began operating during 1992. However, during 2003 only one system operated; the other two systems are no longer operational. Since operations began, soil-vapor extraction has removed 172,163 pounds of carbon tetrachloride from the soil.

During 2003, waste site investigations were conducted at the groundwater operable units in the 200 Areas. These studies help evaluate remedial alternatives to cleanup groundwater contamination at these operable units. A prototype surface barrier was one of the alternatives monitored. A surface barrier can reduce the infiltration of water that drives contaminants through the soil to groundwater.

Groundwater can be pumped from the subsurface and treated to remove contaminants. This process, referred to as a pump-and-treat system, is being used at Hanford.

SUMMARY OF GROUNDWATER REMEDIATION

Location	Startup Date	Contaminant	Mass Removed Calendar Year 2003	Mass Removed – Since Startup
		Groundwater Pump-and-Treat Systems		
100-D and 100-H Areas	1997	Hexavalent chromium	94.7 pounds	450.4 pounds
100-K Area	1997	Hexavalent chromium	80.9 pounds	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	1,761 pounds	17,302 pounds
200-West Area (200-UP-1) Operable Unit	1994	Carbon tetrachloride	6 pounds	57.4 pounds
	1994	Nitrate	7,035 pounds	60,290 pounds
	1994	Technetium-99	0.0222 pound	0.2316 pound
	1994	Uranium	40.1 pounds	399 pounds
		Soil-Vapor Extraction		
200-West Area	1992	Carbon tetrachloride	658 pounds	172,163 pounds

This photo shows a well that is part of a groundwater pump-and-treat system in the 100-K Area. This system reduces chromium contamination in groundwater near the Columbia River.

During 1999, DOE initiated the development of a computer assessment tool that will enable the users to model the movement of contaminants from all waste sites at Hanford through the soil, groundwater, and Columbia River and estimate the impact of contaminants on human health, the ecology, and local cultures and economies. This tool was named the System Assessment Capability and it can be used to examine the risk consequences of cleanup alternatives.

Changes were made to this tool in 2003. Also, the results of site-wide assessments were used in several planning efforts at Hanford during 2003. Assessments performed with the System Assessment Capability identified the BC cribs and trenches as one of the waste sites where groundwater protection could be enhanced through acceleration of remedial actions.

POLLUTION PREVENTION PROGRAM

This program focuses on conservation of resources and energy, reduction of hazardous substance use, and prevention or minimization of pollutant releases to all environmental media from all operations and site cleanup activities.

Environmental management involves recycling techniques to minimize the quantity of waste disposed. During 2003, Hanford activities recycled 2,579 tons of sanitary and hazardous waste.

In 2003, the efforts of the program reduced the quantity of disposed waste by recycling 2,579 tons of sanitary and hazardous waste. This recycled waste included 439.18 tons of paper, 277.58 tons of iron/steel, 80.87 tons of non-ferrous metal, and 37.04 tons of computers and hardware. Also, an affirmative procurement goal (purchasing products containing recycled material) was met in 2003.

A goal for the reduced generation of routine hazardous waste was exceeded. During 2003, 23.2 cubic yards of routine hazardous waste was generated on the Hanford Site; this exceeded the goal of 21.4 cubic yards. This was largely due to cleanup of a diesel oil spill at the Waste Treatment Project.

POTENTIAL RADIOLOGICAL DOSES
FROM 2003 HANFORD OPERATIONS

Potential radiological doses to the public and selected biota from Hanford Site operations were evaluated during 2003 to determine compliance with applicable regulations, standards, and DOE limits.

In 2003, scientists evaluated potential radiological doses to the public and biota resulting from exposure to Hanford Site liquid effluents and airborne emissions to determine compliance with pertinent regulations and limits. The maximally exposed individual is a hypothetical person who is assumed to live at a particular location and have a lifestyle which makes it unlikely that any other member of the public would have received a higher radiological dose from Hanford releases during 2003. The maximally exposed individual was determined to be in the Sagemoor area of Franklin County, Washington, during 2003 and his/her potential dose from site operations was calculated to be 0.06 millirem.

The current DOE radiological dose limit for a member of the public is 100 millirem per year. Therefore, the maximally exposed individual potentially received 0.06% of the DOE limit. Primary pathways contributing to this dose were the consumption of fish from the Columbia River, consumption of foods irrigated with water withdrawn from the Columbia River downstream of Hanford, inhalation of air downwind of Hanford, and consumption of food products grown downwind of Hanford.

SUMMARY OF POTENTIAL RADIOLOGICAL DOSES FROM 2003 HANFORD OPERATIONS

Radiological Dose	Dose Parameters	Dose
Average radiological dose from natural sources and consumer products	The dose includes sources such as cosmic, terrestrial, internal, and radon.	300 millirem per year
DOE's annual radiological dose limit for a member of the public	The dose includes air, drinking water, food, recreation, and external radiation exposure pathways.	100 millirem per year
Maximally exposed individual	This hypothetical person's diet, dwelling place, and other factors were chosen to maximize the combined doses from all reasonable environmental pathways of exposure to radionuclides in Hanford Site effluents and emissions. In 2003, this individual was located in the Sagemoor Area of Franklin County.	0.06 millirem per year
Collective dose	The collective dose is based on a population residing within 50 miles of Hanford Site operating areas.	0.5 person-rem per year
Maximum Hanford Site boundary dose	Boundary dose rates are not used to calculate annual doses to the general public because no one can actually reside at the boundary locations. The highest boundary location exposure rate in 2003 was measured along the 100-N Area shoreline of the Columbia River. The maximum boundary dose is based on thermoluminescent dosimeter readings.	0.011 millirem per hour
Dose to people consuming drinking water at the Fast Flux Test Facility	The potential dose to Fast Flux Test Facility workers assumes a consumption of 0.26 gallon per day of drinking water from onsite wells for 250 days.	0.15 millirem per year
Maximum dose to non-DOE workers on the site (per Clean Air Act standards)	Doses to members of the public employed at non-DOE facilities that were outside access-controlled areas on the Hanford Site; only considers the air pathway, not water pathway.	0.0035 millirem per year
Individual dose from non-DOE sources	Various non-DOE industrial sources of public radiation exposure exist at or near the Hanford Site.	0.0023 millirem per year

ENVIRONMENTAL MONITORING

A herd of Rocky Mountain elk has inhabited the Hanford Site since 1972.

Environmental monitoring at the Hanford Site includes near-facility environmental monitoring, surface environmental surveillance, groundwater monitoring, and vadose zone monitoring. 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 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 protection of the Columbia River, human health, the environment, treatment of groundwater contamination, and limitation of groundwater migration. Vadose zone monitoring and characterization are conducted to better understand the physical and chemical properties of the vadose zone and vadose zone contamination. Environmental monitoring and surveillance results for 2003 are summarized in the following table.

HANFORD SITE MONITORING RESULTS FOR 2003

Media	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 water but similar to those seen in local groundwater. However, concentrations in river water downstream 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 around single-shell waste tanks to detect changes or trends in contaminants. Characterization of vadose zone contaminants occurred at inactive 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 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.

FACILITY MONITORING

Liquid effluent and airborne emissions that could contain radioactive or hazardous constituents were continually monitored when released to the environment at the Hanford Site. Facility operators performed the monitoring mainly through analyzing samples collected near points of release to the environment.

Effluent and emission monitoring data were evaluated to determine the degree of regulatory compliance for each facility and/or the entire site. The evaluations were also useful to assess the effectiveness of effluent treatment and pollution-management practices.

In 2003, 63 radioactive-emissions discharge points were active in the 200 Areas.

In 2003, only facilities in the 200 Areas discharged radioactive liquid effluent to the ground, and this occurred at a state permitted disposal site. Radioactive air emissions usually come from a building stack or vent. Radioactive emissions discharge points on the site in 2003 were located in the 100, 200, 300, 400, and 600 Areas.

Non-radioactive air pollutants were also monitored in 2003. The amounts of pollutants produced by diesel-powered electrical generating plants were calculated from the quantities of fossil fuel consumed. The amount of ammonia discharged to the atmosphere from 200 Area facilities was also calculated (36,000 pounds).

RADIOACTIVE LIQUID EFFLUENT

Hanford Site liquid effluent that normally or potentially contain radionuclides include cooling water, steam condensate, process condensate, and wastewater from laboratories and chemical sewers. This wastewater was sampled and analyzed for gross alpha and gross beta levels as well as for selected radionuclides.

Air samplers on the site were located primarily around major operational areas to maximize the ability to detect radiological contaminants resulting from site operations.

RADIOACTIVE AIRBORNE EMISSIONS

Radioactive airborne emissions from the Hanford Site to the surrounding region are a potential source of human exposure. Most of the radionuclides in emissions at the site are nearing levels indistinguishable from low concentrations in the environment that occur naturally or originated from atmospheric nuclear weapons testing. The termination of nuclear processing operations and the site environmental cleanup mission are largely responsible for this downward trend in radioactive emissions at Hanford.

Most radionuclides in airborne emissions from the Hanford Site are nearing levels indistinguishable from the low concentrations in the environment that occur naturally or originated from atmospheric nuclear weapons testings.

Radioactive air emissions were monitored continuously at points of discharge to the environment, usually from a stack or vent, and samples were analyzed for gross alpha and gross beta concentrations as well as for selected radionuclides. Selection of specific radionuclides sampled, analyzed, and reported was based on (1) an evaluation of maximum potential of unmitigated emissions hypothetically expected from known radionuclide inventories in a facility or outside activity area, (2) the sampling criteria given in contractor environmental compliance manuals, and (3) the potential of each radionuclide to exceed normal operating ranges by levels requiring immediate personnel alert.

The main sources of air emissions in 2003 are summarized in the following paragraphs.

In the 100 Areas, radioactive airborne emissions originated from evaporation at the water-filled K-East and K-West Basins (which contain irradiated nuclear fuel), Cold Vacuum Drying Facility, 105-KW integrated water treatment filter system, and a low-level radiological laboratory.

In the 200 Areas, primary sources of radionuclide emissions were the Plutonium Finishing Plant, T Plant, inactive Plutonium-Uranium Extraction Plant, Waste Encapsulation and Storage Facility, underground waste storage tanks, and waste evaporators. In 2003, 63 radioactive emission discharge points were active in the 200 Areas.

The 300 Area primarily has laboratories and research facilities. The main sources of airborne radionuclide emissions were the 324 Waste Technology Engineering Laboratory, 325 Applied Chemistry Laboratory, 327 Post-Irradiation Laboratory, and 340 Vault and Tanks. During 2003, there were 22 radioactive emission discharge points in the 300 Area.

Continuous monitoring of radioactive emissions involves analyzing samples collected near points of discharge to the environment.

The 400 Area includes the shutdown Fast Flux Test Facility, Maintenance and Storage Facility, and Fuels and Materials Examination Facility. During 2003, there were five radioactive emission discharge points in the 400 Area.

The 600 Area has the Waste Sampling and Characterization Facility, where low-level radiological and chemical analyses were performed on various types of samples. During 2003, the 600 Area had two radioactive emission discharge points active.

NEAR-FACILITY MONITORING

Near-facility environmental monitoring is defined as routine monitoring near facilities that have the potential to discharge, or have discharged, stored, or disposed of radioactive or hazardous contaminants.

Monitoring locations are associated with active and inactive nuclear facilities and active and inactive waste storage or disposal facilities such as burial grounds, cribs, ditches, ponds, underground waste storage tanks, and trenches.

AIR

During 2003, routine monitoring for radioactivity in air near Hanford Site facilities used a network of continuously operating samplers at 82 locations.

Air samplers were generally located within approximately 1,500 feet of sites and/or facilities having the potential for, or history of, environmental releases and were predominantly located in the prevailing downwind direction.

Air samples collected in 2003 from areas located at or directly adjacent to Hanford Site facilities had higher radionuclide concentrations than did those samples collected farther away. However, radionuclide concentrations in most air samples collected near facilities in 2003 were at or near background levels.

During 2003, personnel collected air samples from a network of continuously operating samplers at 82 locations near Hanford Site facilities.

100-N AREA SPRING WATER

Groundwater springs and/or shoreline seepage wells along the Columbia River at the 100-N Area (sometimes called N Springs) are sampled annually. During October 2003, samples were collected from ten shoreline wells.

During 2003, strontium-90 was detected in 8 of 10 samples collected from N Springs but all concentrations were below the DOE derived concentration guide for strontium-90. Tritium and gamma-emitting radionuclide concentrations in all samples were below analytical detection limits.

A monitoring well, located near the shoreline, was used to estimate the discharge of radionuclides to the Columbia River at the 100-N Area. This discharge estimate was used to compute the potential radiological doses received by the offsite public and biota in 2003.

Riverbank spring water was collected from wells near 100-N Area shoreline and analyzed for contamination.

Soil and vegetation samples were collected near waste disposal sites and from locations downwind and near or within the boundaries of operating facilities and remediation sites.

SOIL AND VEGETATION

Near-facility soil and vegetation samples were collected on, or adjacent to, former waste disposal sites and from locations downwind and near or within the boundaries of operating facilities and remediation sites. Samples were collected to evaluate long-term trends in environmental accumulation of radioactive material and to detect potential migration and deposition of facility emissions. During 2003, 82 soil samples and 65 vegetation samples were collected for analysis.

In soil samples, cobalt-60, strontium-90, cesium-137, plutonium-239/240, and uranium were detected consistently in 2003. The concentrations of these radionuclides were elevated near and within facility boundaries when compared to historical concentrations measured at distant locations.

In vegetation samples, cobalt-60, strontium-90, cesium-137, plutonium-239/240, and uranium were detected consistently in 2003. Concentrations of these radionuclides in vegetation were elevated near and within facility boundaries compared to concentrations measured at distant communities. The results demonstrate a high degree of variability.

INVESTIGATIVE SAMPLING

Investigative samples collected in 2003 included soil, vegetation, and animals.

Investigative sampling was conducted in the operations areas to monitor the presence or movement of contaminants in areas of known or suspected contamination or to verify radiological conditions at specific project sites.

Investigative samples collected in 2003 included soil, vegetation, and animals. During 2003, there were 30 instances of radiological contamination in investigative soil samples. Of the 30, 19 were identified as speck or soil speck contamination. One of the investigative soil samples was submitted for radioisotopic analysis. Twenty-two of the 30 locations were cleaned up, and the contaminated soil was disposed of in burial grounds. At the remaining sites, the contamination levels did not exceed cleanup criteria, and the soil was left in place.

In 2003, there were 32 instances of radiological contamination in investigative vegetation samples, which included tumbleweeds, tumbleweed fragments, and gray rabbitbrush and 30 instances of radiological contamination in investigative soil samples. Also in 2003, 26 wildlife-related incidents were investigated; from these, nine samples were submitted for laboratory analysis.

SURFACE ENVIRONMENTAL SURVEILLANCE

The Surface Environmental Surveillance Project monitors the concentrations of radionuclides and chemicals in environmental media and assesses the potential effects of these materials on the environment and the public. Samples of air, surface water, sediment, soil, natural vegetation, agricultural products, fish, and wildlife are collected periodically. Analyses include the measurement of radionuclides and chemicals, including metals and anions. In addition, ambient external radiation is measured. Background concentrations of contaminants measured at distant locations were compared with concentrations measured on the Hanford Site and at perimeter and community locations.

More than 3,100 environmental surveillance measurements and samples were collected in 2003 and more than 17,000 analytical results were obtained.

AIR

In 2003, airborne radionuclide samples were collected by 44 continuously operating samplers: 23 on the Hanford Site, 11 near the site perimeter, 8 in nearby communities, and 2 in distant communities. Four of the stations were managed and operated by local school teachers as part of a DOE-sponsored effort to promote public awareness of Hanford Site environmental monitoring programs.

Air samples were collected at four community-operated environmental surveillance stations that were managed by local school teachers.

The potential influence of emissions from Hanford Site activities on local radionuclide concentrations was evaluated by comparing differences between concentrations measured at distant locations within the region and concentrations measured at the Hanford Site perimeter.

During 2003, the average gross alpha air concentration measured at Hanford was higher than the average level measured at a distant location and the difference was statistically significant. Generally, the average gross alpha concentrations measured in 2003 were similar to the 5-year average concentrations measured from 1998 through 2002.

The annual average gross beta concentration measured in air on the site in 2003 was slightly higher than the average gross beta concentration measured at the distant location and the difference, although small, was statistically significant. Generally, the average gross beta concentrations reported during 2003 were similar to concentrations reported from 1998 through 2002.

The concentrations of radionuclides in air samples collected on and around the site during 2003 were well below DOE derived concentration guides.

Average tritium concentrations measured in 2003 were slightly higher than average values reported for 1998 through 2002. The highest measured concentration was only 0.074% of the DOE derived concentration guide for tritium.

Iodine-129 analyses were performed on samples collected downwind of the Plutonium-Uranium Extraction (PUREX) Plant, at two downwind site-perimeter locations, and at a distant location (Yakima). Concentrations measured onsite were elevated compared to those measured at the site perimeter, and perimeter levels were higher than those measured at the distant location, indicating a Hanford source. Onsite and perimeter air concentrations of iodine-129 in 2003 were consistent with the levels observed from 1998 through 2002.

Plutonium-238 was detected in three onsite air samples during 2003; the maximum concentration was 8,000 times less than the DOE derived concentration guide for plutonium-238. Plutonium-239/240 was detected in 6 of 40 samples collected onsite and in 1 of 52 samples collected offsite. The maximum concentration was 0.07% of the DOE derived concentration guide for plutonium-239/240.

Monitoring air particulates (dust) is done using a tapered element oscillating microbalance (TEOM). The instrument records hourly average concentrations.

AIR PARTICULATE MONITORING

Monitoring the amount of particulate matter (dust) in air began at Hanford during February 2001, after the decrease in vegetative cover caused by the 2000 wildfire. Data are collected at the Hanford Meteorology Station near the 200-West Area. The EPA 24-hour average standard concentration for PM_{10} is 150 µg/m^3. Daily average concentrations measured on the Hanford Site exceeded that limit two times in 2003. These exceedances appeared to be the result of high winds.

SURFACE WATER, SEDIMENT, AND DRINKING WATER

Samples of surface water and sediment on and near Hanford were collected and analyzed to determine potential impacts to the public and aquatic environment from Hanford-originated contaminants.

Surface water bodies included in routine surveillance were the Columbia River and its associated riverbank springs, onsite ponds, and offsite irrigation sources. Water in the Columbia River continues to be designated Class A (Excellent) by the state. This designation means the water is suitable for essentially all needs including drinking water and recreation. Sediment surveillance was conducted for the Columbia River and riverbank springs. The quality of drinking water on the Hanford Site also was monitored routinely.

COLUMBIA RIVER WATER

The Columbia River is the second largest river in the continental United States in terms of total flow and is the dominant surface-water body on the Hanford Site; the river flows through the northern part of the site and forms part of the site's eastern boundary. Radiological and chemical contaminants enter the Columbia River along the Hanford Reach through (1) seepage of contaminated groundwater and (2) permitted, direct-discharge of liquid effluent from Hanford facilities. Water samples were collected from the river at various locations throughout the year and analyzed to determine compliance with applicable water quality standards.

Samples of river water and sediment are collected to determine the impact of Hanford contaminants on surface water bodies.

All radiological contaminant concentrations measured in Columbia River water in 2003 were less than DOE derived concentration guides. The concentrations of tritium, iodine-129, and total uranium were higher downstream from the site than upstream from the site, indicating a possible contribution from Hanford along the Hanford Reach. All concentrations were similar to those observed in recent years.

Transect (multiple samples collected across the Columbia River) and near-shore sampling in 2003 revealed elevated tritium levels along the Benton County shoreline near the 100-N Area, Hanford town site, 300 Area, and at Richland (downstream of the site), compared to concentrations in samples collected from the opposite river shoreline and upstream of the site near the Vernita Bridge.

Water in the Columbia River continues to be designated Class A (excellent) by the state of Washington.

Total uranium concentrations were elevated along the Benton and Franklin County shorelines near the 300 Area and along the Franklin County shoreline at Richland. The highest concentration (1.2 pCi/L) was seen along the Franklin County shoreline at Richland and likely resulted from groundwater seepage and water from irrigation return canals on the Franklin County shore of the river that contained naturally occurring uranium.

In 2003, strontium-90 concentrations in Hanford Reach river water for both transect and near-shore samples were similar to concentrations at other locations except for the 100-N Area. Slightly elevated strontium-90 concentrations were detected in some transect samples collected at Benton County near-shore locations at the 100-N Area.

All radiological concentrations in Columbia River water samples collected in 2003 were below regulatory limits and similar to those observed in the past.

Several metals and anions were detected in transect samples collected upstream and downstream of the site. Concentrations were below regulatory limits. Arsenic, antimony, cadmium, lead, nickel, and zinc were detected in most transect samples, with similar levels at most locations. Beryllium, cadmium, chromium, lead, selenium, silver, and thallium were detected occasionally.

Chloride, nitrate, and sulfate concentrations were slightly elevated in transect samples collected near the Hanford shoreline at the 300 Area and Hanford town site. Chloride, nitrate, and sulfate concentrations were elevated, compared to mid-river samples, along the Franklin County shoreline at Richland and likely resulted from groundwater seepage associated with extensive irrigation north and east of the Columbia River. Concentrations at Richland were also elevated compared to concentrations measured in samples collected upstream of the site at the Vernita Bridge. All anion concentrations in Columbia River water samples collected in 2003 were below regulatory limits and similar to those observed in the past.

Samples of Columbia River sediment were collected at the McNary Dam pool downstream of the Hanford Site.

COLUMBIA RIVER SEDIMENT

During 2003, samples of Columbia River surface sediment were collected at the McNary Dam pool (downstream of the site), from the Priest Rapids Dam pool (upstream of the site), and along the Hanford Reach

Radionuclides consistently detected in river sediment sampled adjacent to and downstream of the Hanford Site during 2003 included potassium-40, strontium-90, cesium-137, uranium-238, plutonium-238, and plutonium-239/240. The concentrations of all other radionuclides were below detection limits for most samples. Cesium-137 and plutonium isotopes exist in worldwide fallout, as well as in effluent from Hanford Site facilities. Potassium-40 and uranium occur naturally in the environment, and uranium is also present in Hanford Site effluent.

Radionuclide concentrations reported in river sediment in 2003 were similar to those reported for previous years and there were no obvious differences between locations.

RIVERBANK SPRING WATER

All riverbank spring water samples collected during 2003 were analyzed for gamma-emitting radionuclides, gross alpha, gross beta, and tritium. Samples from selected springs were analyzed for strontium-90, technetium-99, iodine-129, and uranium-234, uranium-235, and uranium-238. All samples were analyzed for metals and anions. Volatile organic compounds were analyzed at selected locations.

Tritium, strontium-90, technetium-99, iodine-129, uranium-234, uranium-235, and uranium-238, were detected in spring water in 2003. All radiological contaminant concentrations measured in riverbank spring water during 2003 were less than the DOE derived concentration guides.

What are DOE derived concentration guides?

DOE Environmental radiation protection standards are published in DOE Order 5400.5. The DOE primary radiation standard for protection of the public is 100 mrem per year. To determine whether concentrations of radionuclides in the air or water may cause an exposure greater than this standard, DOE developed derived concentration guides. The derived concentration guides specify the concentration of a radionuclide that an individual can consume, inhale, or be immersed in continuously 365 days a year without receiving a dose greater than 100 mrem per year.

Derived concentration guides are not exposure limits but are simply reference values to allow comparison of radionuclide concentrations in environmental media. These guides establish limits for public radiation dose and give guidance to keep radiation exposure to members of the public as low as reasonably achievable.

RIVERBANK SPRING SEDIMENT

In 2003, sediment samples were collected at riverbank springs in the 100-B, 100-F, and 300 Areas. Radionuclide concentrations in riverbank springs sediment were similar to those detected in river sediment with the exception of uranium concentrations in 300 Area spring sediment, which were roughly twice background levels measured at Priest Rapids Dam.

Metal concentrations in riverbank springs sediment samples in 2003 were similar to concentrations in Hanford Reach sediment samples. Detectable amounts of most metals were found in all river sediment samples in 2003. Maximum and median concentrations of most metals were higher for sediment collected upstream of the site at Priest Rapids Dam compared to either Hanford Reach or McNary Dam sediment. The concentrations of cadmium, mercury, silver, and zinc had the largest differences between locations. Currently, there are no Washington State freshwater sediment quality criteria for comparison to the measured values.

All radiological contaminant concentrations measured in riverbank spring water during 2003 were less than DOE derived concentration guides.

ONSITE POND WATER AND SEDIMENT

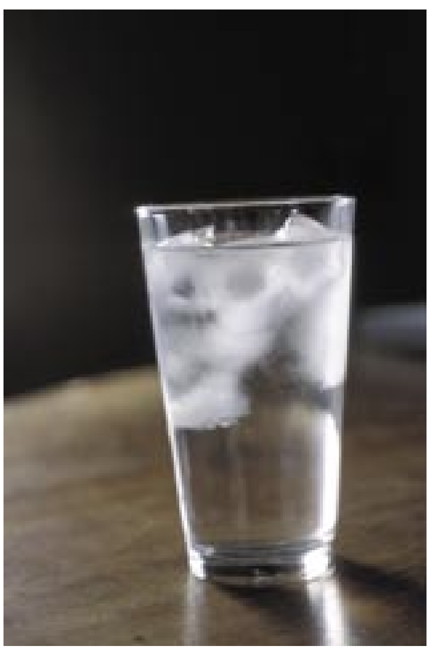
Water was collected from the Fast Flux Test Facility process water pond, and water and sediment were collected from West Lake. The ponds are inaccessible to the public but were accessible to migratory waterfowl and other animals, creating a potential biological pathway for dispersion of contaminants. All radionuclide concentrations in onsite pond water were less than the DOE derived concentration guides and state ambient surface-water quality criteria levels. West Lake sediment had detectable concentrations of gross alpha, gross beta, strontium-90, cesium-137, and uranium isotopes. Levels of these contaminants in 2003 were similar to levels measured in past years.

Irrigation water was tested three times in 2003. Radionuclide concentrations were below DOE derived concentration guides and Washington State water quality criteria levels.

OFFSITE IRRIGATION WATER

Water samples were collected from a Franklin County irrigation canal downstream from the Hanford Site at Riverview and from the Horn Rapids irrigation pumping station in north Richland. As a result of public concerns, sampling was conducted to document the levels of Hanford-produced radionuclides in water used by the public for food-crop irrigation. Consumption of vegetation irrigated with Columbia River water downstream of the site has been identified as one of the primary pathways contributing to the potential dose to the hypothetical maximally exposed individual and any other member of the public.

Irrigation water was sampled three times in 2003 during the irrigation season. Unfiltered samples of water were analyzed for gross alpha, gross beta, gamma emitters, tritium, strontium-90, uranium-234, uranium-235, and uranium-238. In 2003, radionuclide concentrations measured in irrigation water were comparable to levels detected in Columbia River water. All concentrations were below their respective DOE derived concentration guides and Washington State ambient surface-water quality criteria levels.



The drinking water on Hanford is tested regularly. During 2003, all drinking water systems complied with Washington State and EPA standards.

HANFORD SITE DRINKING WATER

The quality of Hanford Site drinking water is monitored by collecting and analyzing drinking water samples and comparing the resulting analytical data with established drinking water standards and guidelines.

The national primary drinking water regulations of the Safe Drinking Water Act apply to the drinking water supplies at the Hanford Site. In Washington, these regulations are enforced by the Washington State Department of Health.

All DOE-owned drinking water systems on the Hanford Site were in compliance with Washington State and EPA annual average radiological drinking water standards in 2003, and results were similar to those observed in recent years.

FOOD AND FARM PRODUCTS

Food products, including milk, leafy vegetables, potatoes, fruits, honey, and wine were collected routinely in 2003 at several locations surrounding the Hanford Site to determine the potential influence of Hanford Site releases on locally grown foods. Samples were collected primarily from locations in the prevailing downwind directions where airborne emissions or contaminated dust from the site could be deposited. Samples were also collected at upwind and distant locations to provide information on background radiation levels in food.

Milk samples were analyzed for strontium-90, iodine-129, tritium, and gamma-emitting radionuclides such as cesium-137. The strontium-90 concentrations in milk samples during 2003 were the highest maximum concentrations reported in milk samples since the early 1990s. The reason for these elevated levels is being investigated. Iodine-129 concentrations in milk declined when nuclear materials production ended at Hanford and have remained low. No cesium-137 was detectable in 2003 milk samples. Results of tritium analyses were not available when this report was prepared.

Milk samples were collected around the Hanford Site in 2003 and analyzed for radiological contaminants.

Concentrations of manmade gamma-emitting radionuclides (cesium-137 and cobalt-60) in vegetable samples collected in 2003 were all less than their respective detection limits. Strontium-90 was detected in three of six vegetable samples collected during 2003, with the highest concentration measured at an upwind location. Strontium-90 and gamma-emitting radionuclides were detected in potato samples.

Tomato and apple samples were analyzed for gamma-emitting radionuclides and strontium-90. No measurable levels of gamma-emitting radionuclides were detected. Strontium-90 was found above the analytical detection limit in one tomato sample collected from the Riverview area. Tritium was monitored in all tomato samples collected during 2003, but was not found at detectable levels.

Two samples each of red and white wine were obtained from wineries located downwind of the Hanford Site in Franklin County and upwind of the site in the Yakima Valley. They were analyzed for gamma-emitting radionuclides and tritium. Tritium concentrations in wine samples for 2003 were not available for this report. There were no manmade gamma-emitting radionuclides detected in 2003 wine samples.

Samples of local red and white wine were analyzed for gamma-emitting radionuclides and none were found in the samples during 2003.

FISH AND WILDLIFE

Contaminants in fish and wildlife that inhabit the Columbia River and Hanford Site are monitored because wildlife have access to areas of the site containing radioactive or chemical contamination, and fish can be exposed to contamination entering the river along the shoreline. In addition, detection of contaminants in wildlife may indicate that wildlife are entering contaminated areas (burrowing in waste burial grounds) or that materials are moving out of contaminated areas (through blowing dust or food-chain transport). Consequently, fish and wildlife samples are collected at selected locations annually.

Some fish and wildlife species exposed to Hanford contaminants might be harvested for food and may potentially contribute to offsite public exposure.

FISH SAMPLES

In 2003, five mountain whitefish were collected between 100-N and 100-D Areas, and one whitefish was collected from an upstream site near Vantage, Washington. Fillets (muscle) samples were analyzed primarily for cesium-137 and carcass samples were analyzed for strontium-90. The results from the nearby and distant locations were compared.

Cesium-137 and strontium-90 results were below their respective analytical detection limits in all fish samples collected and analyzed during 2003.

Canada goose samples were tested for radionuclide levels. The results suggest that Canada geese are not accumulating measurable amounts of cesium-137 along the Hanford Reach.

CANADA GEESE

Radionuclide levels were measured in 12 Canada goose samples collected and analyzed during 2003. No gamma-emitting radionuclides, including cesium-137, were detected in any of the samples. The analytical results suggest that Canada geese are not accumulating measurable amounts of cesium-137 along the Hanford Reach of the Columbia River.

Strontium-90 concentrations in goose bones were all above the analytical detection limit and levels found during 2003 in Hanford Reach and background area samples were similar. The results for 2003 samples were similar to results in 2001 and show an increase in strontium-90 concentrations when compared to values reported from 1995 through 2000. While the apparent increases in 2001 and 2003 are noteworthy, the measured maximum concentrations were below 0.05 pCi/g wet weight and concentrations would need to exceed approximately 60 pCi/g wet weight to be near the DOE dose limit of 0.1 rad per day.

Rabbit samples were collected at 100-N and 200 Areas.

RABBITS

Rabbits are useful for detecting localized radioactive contamination onsite because they have relatively small home ranges, occupy burrows in potentially contaminated soil, and can enter fenced-restricted areas that contain radioactive waste materials.

In the fall of 2003, ten rabbits were collected at the 100-N and 200 Areas, and eleven were collected at distant locations. All rabbits were monitored for cesium-137 in muscle tissue and strontium-90 in bones.

Cesium-137 concentrations in muscle samples from seven of ten rabbits collected on the Hanford Site during 2003 were below the analytical detection limit. The other rabbit samples contained detectable levels of cesium-137, but concentrations were too low to contribute substantially to any public dose.

Strontium-90 concentrations in bone tissues from the ten rabbits collected on the Hanford Site during 2003 were all above the analytical detection limit. Three of the four highest concentrations were found in samples collected near the 100-N Area. Results from rabbits collected near the 100-N Area have historically been higher and more variable than results obtained from offsite reference areas. This indicates a portion of the rabbit population has been exposed to 100-N Area sources of strontium-90.

What is a sentinel organism?
Organisms that are best suited for accumulating contaminants are termed "sentinel organism." The Asiatic clam may be a potential candidate to monitor contaminants in groundwater seeping into the Columbia River from shoreline springs.

SENTINEL ORGANISMS

For environmental purposes, biological organisms can be used to (1) detect and quantify contaminants in an environment and (2) indicate damage to an ecosystem. Organisms that are best suited for accumulating contaminants are termed "sentinel species."

Asiatic clams may be one of the best sentinel organisms along the Hanford Reach of the Columbia River for DOE cleanup and monitoring objectives on the Hanford Site. These clams live in shallow shoreline areas, are relatively immobile their entire life, and are filter-feeders that feed on plankton. These characteristics make the Asiatic clam a potential candidate organism for monitoring contaminants in groundwater seeping into the Columbia River from shoreline springs.

From November 2002 through March 2003, Asiatic clams were collected along the Hanford Reach for analysis.

From November 2002 through March 2003, Asiatic clams were collected along the Hanford Reach to evaluate the usefulness of this species as a sentinel organism. Samples were collected near the river's low-water mark along a transect extending into the river perpendicular to the shoreline.

Concentrations of most metals and radionuclides in the clam samples were at or below levels found in samples collected upstream near the Vernita Bridge. Chromium concentrations were consistently elevated compared to concentrations at Vernita Bridge. Strontium-90 levels in clam shells were highest near the 100-N and 100-H Areas. Technetium-99 was found in shell samples collected near the 100-B/C and 300 Areas at levels that were elevated compared to levels in samples collected upstream of the site.

Crayfish and sculpin samples were also collected during 2003 from a reference region upstream of the Hanford Site. Crayfish samples did not contain any gamma-emitting radionuclides above their respective minimum detectable levels.

All samples contained measurable quantities of strontium-90 but technetium-99 was not detected in any of the samples.

Sculpins were collected and analyzed for gamma-emitting radionuclides, strontium-90, and technetium-99 in 2003. None of these contaminants were found in sculpin samples.

Thermoluminescent dosimeters were positioned 3.3 feet above the ground at 27 locations along the Columbia River shoreline.

EXTERNAL RADIATION AND RADIOLOGICAL SURVEYS

EXTERNAL RADIATION

External radiation is defined as radiation originating from a source external to the body. It consists of a natural component and a manmade component, which includes radionuclides generated for or from nuclear medicine, power, research, waste management, and consumer products containing nuclear materials (such as home smoke detectors). External radiation on and around the Hanford Site is measured using thermoluminescent dosimeters and, at a limited number of offsite locations, pressurized ionization chambers.

In 2003, environmental surveillance thermoluminescent dosimeters were positioned 3.3 feet above the ground at 33 locations on the Hanford Site, 11 locations around the perimeter of the site, 9 locations in surrounding communities including 2 at distant locations, and 27 locations along the shore of the Columbia River from the Vernita Bridge to the mouth of the Yakima River. Dosimeters were collected and read quarterly.

External radiation surveys were conducted quarterly at 13 shoreline locations.

Pressurized ionization chambers are situated at four offsite community-operated monitoring stations. Real-time exposure rate data are displayed at each station to provide information to the public and to serve as an educational tool for the teachers who manage the stations.

The highest dose rate (96 millirem) measured by environmental surveillance thermoluminescent dosimeters onsite in 2003 was at the north side of the 300 Area. The 2003 maximum perimeter dose was at the Rattlesnake Springs location on the Fitzner/Eberhardt Arid Lands Ecology Reserve. The Columbia River shoreline location with the highest average reading was along the 100-N Area. Over the past 5 years, the maximum dose rates along the 100-N Area shoreline have decreased as a result of cleanup efforts.

RADIOLOGICAL SURVEYS

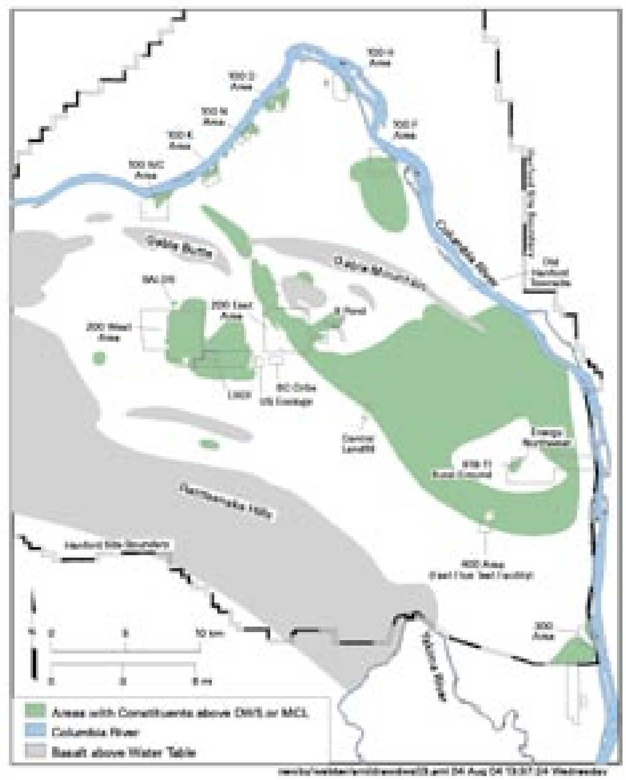
Geiger counters and microrem meters were used quarterly to perform radiological ground-contamination surveys at 13 Columbia River shoreline locations. These measurements were made to estimate radiation exposure levels attributed to sources on the Hanford Site, to estimate levels along the Hanford Reach shoreline, and to help assess exposure to onsite personnel and offsite populations. The surveys showed that radiation levels at the selected locations were comparable to levels observed at the same locations in previous years. The highest dose rate was measured along the 100-N shoreline; the lowest dose rate was measured at the south end of the Vernita Bridge.

Water samples are collected at aquifer tubes along the Columbia River shoreline

GROUNDWATER MONITORING

Workers sampled 652 monitoring wells and 48 Columbia River shoreline aquifer tubes during fiscal year 2003 to determine the distribution and movement of contaminants in Hanford Site groundwater. Many of the wells were sampled multiple times during the year.

One thousand six hundred and twelve samples of Hanford groundwater were analyzed for chromium, 1,170 for nitrate, and 917 for tritium. Other constituents frequently analyzed for included carbon tetrachloride, technetium-99, and uranium, which were analyzed in approximately 580 samples. Tritium and iodine-129 plumes have the largest areas with concentrations exceeding drinking water standards. Nitrate is a widespread contaminant in Hanford Site groundwater, with plumes originating from the 100 and 200 Areas and from offsite industry and agriculture. Carbon tetrachloride, trichloroethene, chromium, strontium-90, technetium-99, and uranium are also found in smaller plumes.



This map shows the distribution of major radiological and chemical contamination in groundwater at concentrations above drinking water standards. These contaminant plumes are estimated to cover approximately 73 square miles.

Groundwater levels in the 200 Areas continued to drop, causing eleven monitoring wells at the Hanford Site to go dry during 2003. Changes in groundwater flow or chemistry also impacted the effectiveness of monitoring networks. During 2003, drillers installed seven new RCRA monitoring wells, nine CERCLA wells, and two wells for research on chromate bioremediation.

Monitoring in 2003 indicated that the site's largest contaminant plume (tritium) is gradually decreasing in size and will continue to shrink because of dispersion and radioactive decay (the half-life of tritium is 12.35 years). Chromium levels continued to increase in the central part of the 100-D Area between the influence of two groundwater pump-and-treat remediation systems that operated during 2003.

The vadose zone is the area between the ground surface and the water table.

VADOSE ZONE MONITORING AND CHARACTERIZATION

Historically, the vadose zone at industrialized and waste disposal areas at the Hanford Site has been contaminated with large amounts of radioactive and non-radioactive materials. Depending on such factors as the makeup of the soil, geology of the area, nature of the waste, and amount of water or other fluids available to mobilize the contaminant, contaminants can move downward and laterally through the soil column, can be chemically bound to soil particles (and immobilized), or can be contained by geologic formations.

Radioactive and hazardous waste in the vadose zone are potential sources of continuing and future groundwater contamination. Subsurface source characterization, vadose zone monitoring, soil-vapor monitoring, and vadose zone remediation were conducted in 2003 to better understand the distribution and mechanisms that control the movement of subsurface contamination.

The results of vadose zone characterization studies improve understanding of the distribution and movement of contamination between the ground surface and the water table.

VADOSE ZONE CHARACTERIZATION

During the year, vadose zone characterization activities were completed to evaluate the effectiveness of remediation actions and to characterize existing vadose zone contaminant plumes to help plan future remediation actions. The intent of characterization is to gain as much information as possible about the type and extent of contamination present. Also, characterization can help assess the remediation activities.

The results of extensive geochemical characterization of core samples from Waste Management Area TX-TY became available in 2003. These data allow comparison of contaminated vadose zone sediment with uncontaminated sediment and descriptions of contaminant plumes beneath the single-shell waste storage tanks in the vicinity of the boreholes. In addition, two boreholes were drilled and sampled at Waste Management Area T.

Soil-vapor sampling and analysis were done as part of the remedial investigation for the 200-PW-1 Operable Unit. This activity was done to locate carbon tetrachloride release sites with the potential to impact groundwater in the future. Also, boreholes and test pits were excavated to gather characterization data to support remediation of past-practice liquid disposal facilities in the 200-CS-1 Operable Unit.

Finally, laboratory experiments were completed to help predict the movement of uranium in the vadose zone at waste sites in the Hanford Site 300 Area.

VADOSE ZONE MONITORING

Vadose zone monitoring is fundamentally different from characterization. Once the nature of contamination is known, the measurements required to detect changes are much simpler to implement. In general, monitoring uses simpler equipment and data analysis methods. The value of monitoring is in detecting changes or trends in successive measurements over time. In most cases, recording information at regular intervals is sufficient to demonstrate stability or to detect movement in a particular plume of contamination.

Leachate and soil-gas monitoring continued at the Solid Waste Landfill and the Environmental Restoration Disposal Facility. Also, soil-gas monitoring at the carbon tetrachloride expedited-response-action site continued during 2003.

Leachate and soil-gas monitoring continued at the Environmental Restoration Disposal Facility during 2003.

VADOSE ZONE STUDIES

Vadose zone studies are designed to result in new, innovative methods for cleanup and monitoring. The studies during 2003 included the application of geochemical tools to study the interactions between vadose zone porewater and contaminants, infiltration studies at a monitored prototype surface barrier site, development of new tools to measure the influx of water into the subsurface, and use of computer modeling to estimate future behavior of surface barriers.

Surface barriers form an integral part of DOE 's waste management strategy. At the Hanford Site alone an estimated 200 barriers with design lives of 500 to 1,000 years are planned for an area of approximately 1,000 acres. Proven designs, as well as reliable, accurate, and cost-effective monitoring techniques, are needed to ensure post-closure compliance. Studies about surface barriers continued during 2003 in an effort to determine what types of surface barriers would work best at Hanford.

Studies of surface barriers continued in an effort to determine what types of barriers would work best at Hanford waste sites.

Understanding how precipitation moves through the soil and affects waste sites is important for cleanup decisions.

During 2003, a summary of 15 years of testing at the Field Lysimeter Test Facility became available. These studies help researchers understand how surface barriers will perform and also how the natural system will perform as it is re-established over waste sites. A lysimeter is a structure used to measure drainage of liquids, such as precipitation, through soil. The lysimeter tests show how soil type and layering, vegetation, and precipitation can impact deep drainage rates, which is one of the key factors that influences the release of contaminants from a waste site and the transport of the contaminants through the vadose zone to groundwater. Understanding just how much precipitation (rain and snow) get past the root zone and into the waste helps DOE understand potential future impact from waste that will remain at Hanford. This information is essential for effective cleanup decisions.

QUALITY ASSURANCE

Quality assurance and quality control practices are incorporated into all aspects of the Hanford Site environmental monitoring and surveillance programs. Quality assurance programs are conducted to assure data quality.

They are implemented through 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 include, but are not limited to, replicate sampling and analysis, analysis of field blanks and blind reference standards, participation in interlaboratory cross-check studies, and splitting samples with other laboratories. Sample collection and laboratory analyses are conducted using documented and approved procedures. When sample results are received, they are screened for anomalous values by comparing them to recent results and historical data.

Quality assurance and quality control practices are incorporated into all aspects of site environmental monitoring and surveillance programs.

Quality assurance/quality control for environmental monitoring and surveillance programs also include procedures and protocols to document instrument calibrations; conduct program-specific activities in the field; maintain groundwater wells to assure representative samples were collected; and avoid cross-contamination by using dedicated well sampling pumps.

OTHER HANFORD ENVIRONMENTAL PROGRAMS

Ecological systems are monitored to determine the status of plant and animal populations on the Hanford Site.

At the Hanford Site, a variety of environmental and cultural resource activities are performed to comply with laws and regulations, enhance environmental quality, and monitor the impact of environmental pollutants from site operations. Meteorological information is provided around the clock on the site in the event of a suspected or actual release of radioactive or hazardous material to the atmosphere. Comprehensive climatological data records are maintained to use in environmental impact assessment and dose reconstruction.

Scientists monitor the aquatic and terrestrial ecosystems at Hanford. Specific plant and animal species and habitats are assessed to determine (1) the status of threatened, endangered, or commercially/recreationally important species and habitats and (2) to identify impacts of Hanford Site operations on flora and fauna. Cultural resources on the site also are identified and evaluated to determine impacts from site operations. Historic buildings and structures are evaluated for their historic significance.

WEATHER HIGHLIGHTS FOR 2003

The average temperature was 55.6˚F, which was 2.0˚F above normal (53.6˚F). Nine months were warmer than normal; three months were cooler than normal. Precipitation totaled 8.14 inches, 117% of normal (6.98 inches). Snowfall totaled 8.7 inches, compared to an annual normal snowfall of 15.4 inches.

The average wind speed was 7.8 miles per hour, which was 0.2 mile per hour above normal. The peak gust for the year was 60 miles per hour on October 28. There were two dust storms recorded at the Hanford Meteorology Station 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).

CLIMATE AND METEOROLOGY

The Hanford Meteorology Station is located on the Central Plateau between the 200-East and 200-West Areas. Meteorological measurements are taken to support Hanford Site emergency preparedness and response, site operations, and atmospheric dispersion calculations for dose assessments. Hanford Site meteorologists provide weather forecasting to help manage weather-dependent operations and compile climatological data for environmental studies and to help assess the environmental effects of site operations.

Hourly observations of wind direction, wind speed, and air temperature are made at multiple levels on a 408-foot tower near the Hanford Meteorology Station.

In addition, data are acquired from the Hanford Meteorological Monitoring Network, which consists of 30 remote monitoring stations. Most of the stations are on the Hanford Site; however, eight are offsite. All stations provide meteorological data every 15 minutes to a central computer located at the Hanford Meteorology Station.

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.

Bruggemann's warehouse is the only historical cobblestone structure remaining on the Hanford Site.

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.

In late 2003, the U.S. Fish and Wildlife Service and DOE conducted emergency stabilization at the First Bank of White Bluffs building. Built in 1907, the bank is the only surviving building from the pre-1943 town site.

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.

The Coyote Rapids Pumping Plant was built in 1908 and operated until 1943. It is one of the historic buildings being considered for preservation on the Hanford Site.

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.

The Importance of Hanford's Cultural and Historical Resources

Hanford is an important place to many people. The site holds great sacred meaning to Native Americans, many of whom believe their ancestors have lived here from time immemorial. Hanford is also important to those who lived on pre-Hanford homesteads and town sites during the early twentieth century. And finally, the many Manhattan Project and Cold War structures serve as symbols of events that changed the world.

The U.S. Department of Energy is committed to assuring that significant cultural resources are managed and maintained in a way that considers the preservation of their historic, archaeological, architectural, and cultural values.

During 2003, Hanford contractors requested 142 cultural resource reviews.

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.*

ECOSYSTEM MONITORING AND ECOLOGICAL COMPLIANCE

Ecosystem monitoring at Hanford is conducted to assess the status of plant and animal populations on the Hanford Site, maintain biotic inventory data for the site, and assist in implementing ecosystem management policies. The status of rare plant populations and plant community types, Chinook salmon, mule deer, and breeding birds were monitored as part of the project.

There were 9,400 Chinook salmon spawning nests (redds) observed during aerial surveys of the Hanford Reach during 2003. This is an increase over 2002 numbers and surpasses the peak number counted in 1989.

FALL CHINOOK SALMON

In 2003, approximately 9,400 fall Chinook salmon spawning nests (redds) were observed in aerial surveys of the Hanford Reach of the Columbia River. This is an increase in redds of nearly 1,400 from 2002 and surpasses the peak of approximately 8,800 seen in 1989.

Aerial surveys do not yield absolute redd counts because visibility varies, depending on water depth and other factors, and because the number of redds in high-density locations cannot be counted accurately. However, redd survey data generally agree with adult salmon escapement estimates obtained by state and federal agencies within the region.

MULE DEER

The health of resident mule deer on Hanford has been routinely monitored to assess onsite environmental quality.

The health of resident mule deer on Hanford has been routinely monitored to assess onsite environmental quality. After the fall hunting season of 2003, five complete surveys were conducted during November and December 2003 and January 2004; 244 deer were observed, noting age and sex. In addition, the presence or absence of velvet covered antlers was noted as an indication of male reproductive condition.

The survival estimate during 2003 ranged between 47 to 55 fawns per 100 adult female deer. The survival results in 2003 from the deer population in the north region of the site were the second highest in the 10 years of surveys; the estimates for the herd in the south region of the site exceeded the highest documented survival rates.

Estimates of the frequency of testicular atrophy in antlered deer ranged from 3% to 7% between 1994 and 1997. During 2003, no bucks were seen with signs of testicular atrophy.

BREEDING BIRD SURVEYS

For the past 16 years, roadside surveys have been used to monitor bird populations on the Hanford Site. Four survey routes have been monitored that represent distinct vegetation cover types on the Hanford Site to determine which species use the site and to evaluate trends in the abundance of shrub-steppe birds. Of particular interest is the status of breeding birds on the site.

Trends were evaluated for the entire avian community as well as for the two most abundant species: Western meadowlarks and horned larks. The information gathered in 2003 and prior years revealed a decline in the number of species counted along each of the four routes. Meadowlarks, one of the most commonly occurring birds in the shrub-steppe, declined significantly along all four survey routes, whereas the number of horned larks declined significantly on only one route.

One reason for the decline could be recent wildfires on the site that have eliminated large portions of the shrub habitat. The trends at Hanford seem to mirror regional trends and appear to be associated with an overall decline and fragmentation of shrub-steppe habitat.

Roadside surveys are used to monitor bird populations on the Hanford Site. The number of Western Meadowlarks continued to decline; one reason could be the destruction of shrub habitat due to fires.

Big Sagebrush communities at Hanford provide habitat for birds and other wildlife.

VEGETATION SURVEYS AND MONITORING

More than 100 rare plant populations of 47 different species listed by the Washington Natural Heritage program as endangered, threatened, sensitive, review or watch list are found on the Hanford Site. The U.S. Fish and Wildlife Service has designated 5 of these 47 species as species of concern in the Columbia River Basin. Two species, Umtanum buckwheat and White Bluffs bladderpod, are proposed as candidates for federal listing.

In addition to rare plant populations, several areas on the Hanford Site are designated as special habitat types with regard to potential occurrence of plant species of concern listed by Washington State. They include areas that could support populations of rare annual plants that have been documented in adjacent habitat.

In 2003, areas where rare annual plants had been previously documented were resurveyed several times in April and May. No rare plants were seen during these surveys.

ECOLOGICAL COMPLIANCE

The policies of DOE's Richland Operations Office require that all projects having the potential to adversely affect biological resources have an ecological compliance review performed before the project begins. This review determines if the project will comply with the *Endangered Species Act and the Migratory Bird Treaty Act*.

Ecological compliance reviews also examine whether other significant resources such as Washington State listed species of concern, wetlands, and native shrub-steppe habitats are adequately considered during the project planning process. Where effects are identified, mitigation action is prescribed. Mitigation actions can include avoidance, minimization, rectification, or compensation.

Since many projects on the site occur during times of the year when plants are not growing, and the plants are difficult to identify or evaluate, each operational area is surveyed each spring. These baseline surveys provide information about habitat types and species inventories and abundance that can be used throughout the year to assess potential project impacts.

A total of 149 ecological compliance reviews were performed during 2003 in support of general Hanford activities. An additional 34 reviews were performed in support of environmental restoration activities.

BALD EAGLES

Bald eagles have wintered along the Hanford Reach for many years, however there have been no successful nesting pairs. During November 2003, a pair of adult eagles returned to occupy the historical nest site in the vicinity of the former White Bluffs town site. However, visual surveys revealed the eagles discontinued occupancy of the nest sometime during February or March 2003. The reasons for the eagles abandoning their nest have not been determined.

STEELHEAD

In February 2003, two to three steelhead redds (nesting sites) were discovered near the Columbia River shoreline adjacent to the 300 Area. Steelhead in this

FEDERAL OR WASHINGTON STATE THREATENED AND ENDANGERED SPECIES THAT OCCUR OR POTENTIALLY OCCUR ON THE HANFORD SITE

Common Name	Scientific Name	Federal	State
Plants			
awned halfchaff sedge	*Lipocarpha (= Hemicarpha) aristulata*		Threatened[a]
desert dodder	*Cuscuta denticulata*		Threatened[a]
Geyer's milkvetch	*Astragalus geyeri*		Threatened[a]
grand redstem	*Ammannia robusta*		Threatened[a]
loeflingia	*Loeflingia squarrosa var. squarrosa*		Threatened[a]
lowland toothcup	*Rotala ramosior*		Threatened[a]
persistent sepal yellowcress	*Rorippa columbiae*	Species of concern[b]	Threatened[a]
rosy pussypaws	*Calyptridium roseum*		Threatened[a]
Umtanum desert buckwheat	*Eriogonum codium*	Candidate[c]	Endangered[d]
White Bluffs bladderpod	*Lesquerella tuplashensis*	Candidate[c]	Threatened[a]
white eatonella	*Eatonella nivea*		Threatened[a]
Fish			
bull trout[e]	*Salvelinus confluentus*	Threatened[a]	Candidate[c]
spring-run Chinook salmon	*Oncorhynchus tshawytscha*	Endangered[d]	Candidate[c]
steelhead	*Oncorhynchus mykiss*	Endangered[d]	Candidate[c]
Birds			
American white pelican	*Pelecanus erythrorhychos*		Endangered[d]
bald eagle[f]	*Haliaeetus leucocephalus*	Threatened[a]	Threatened[a]
ferruginous hawk	*Buteo regalis*	Species of concern[b]	Threatened[a]
sandhill crane	*Grus canadensis*		Endangered[d]
western sage grouse	*Centrocercus urophasianus phaios*	Candidate[c]	Threatened[a]

(a) Species likely to become endangered in the foreseeable future.
(b) Species that are not currently listed or candidates under the Endangered Species Act of 1973, but are of conservation concern within specific U.S. Fish and Wildlife Service regions.
(c) Species that are believed to qualify for threatened or endangered species status, but for which listing proposals have not been prepared.
(d) Species in danger of extinction within all or a significant portion or its range.
(e) Reported, but seldom observed on the Hanford Site.
(f) Currently under review for change in status (delisting).

location are listed as endangered under the Endangered Species Act. DOE prepared a biological evaluation of the potential impact of Hanford work on the steelhead and came to the conclusion that although work could affect the fish, it is not likely to affect them adversely. This biological evaluation was sent to the National Oceanographic and Atmosphere Administration Fisheries in December 2003, and in January 2004 they agreed with DOE's determination.

SAGE SPARROW

The big sagebrush communities found on the Hanford Site provide habitat for several bird species including the sage sparrow. Monitoring and analysis efforts in 2003 attempted to better quantify the relationship between the presence of breeding and nesting sage sparrows and habitat characteristics.

Surveys were conducted between March and June 2003. Twenty-four sparrows were detected during 34 surveys. Preliminary data analysis found all sage sparrows occupied territories containing big sagebrush. Other shrub species occurring in some of the sparrow's territories included bitterbrush and spiny hopsage. Evaluation of the vegetation characteristics indicated that the sage sparrow occupied territories where there were more shrub and bare ground cover and less annual grasses and forbs.

yellow starthistle

These are two of ten plants classified as noxious weeds on the Hanford Site. (photos courtesy of Washington State Noxious Weed Control Board)

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 plants or animals On the Hanford Site, there were 32 incidents of contaminated vegetation in 2003. This is a decrease of 52% compared to the peak year of 1999 when 84 incidents occurred.

There were 26 contaminated animals discovered in 2003. This is approximately 57% less than the peak number in 1999 when 46 were identified; however, this 2003 number is an increase from 2002 when only 10 contaminated animals were discovered.

spotted knapweed

Ten plant species categorized as noxious by the U.S. and Washington State Departments of Agriculture are on a high priority list for control at the Hanford Site. These species include: yellow starthistle, rush skeletonweed, medusahead, babysbreath, Dalmatian toadflax, spotted knapweed, diffuse knapweed, Russian knapweed, saltcedar, and purple loosestrife. In 2003 and prior years, these species were controlled by hand pulling, applications of herbicides or chemicals, biological control agents, and attrition.

STAKEHOLDER INVOLVEMENT

Members of the Tribal Nations join in cultural resource management activities on the Hanford Site.

Many entities have a role in DOE's mission of environmental restoration, waste management, and protection of the Columbia River at the Hanford Site. Stakeholders include federal, state, and local regulatory agencies; environmental groups; regional communities and governments; and the public. Indian tribes and Nations also have a special and unique involvement with the Hanford Site and maintain a government-to-government relationship with DOE.

Several federal, state, and local regulatory agencies are responsible for monitoring and enforcing compliance with applicable environmental regulations at the site. Major agencies include the U.S. Environmental Protection Agency, Washington State Department of Ecology, Washington State Department of Health, and Benton County Clean Air Authority. The Hanford Natural Resource Trustee Council was established in 1996 through a memorandum of agreement signed by the Hanford trustees. The council consists of members from federal and state agencies as well as Tribal Nations. Federal trustees at Hanford include the U.S. Department of Energy, U. S. Department of Interior represented by the U.S. Fish and Wildlife Service, U.S. Bureau of Land Management, and U.S. Department of Commerce represented by the National Oceanic and Atmospheric Administration. State organizations include the Washington State Department of Ecology, Washington Department of Fish and Wildlife, and the Oregon Department of Energy. The Tribal Nations include the Yakama Nation, Confederated Tribes of the Umatilla Indian Reservation, and the Nez Perce Tribe. The primary purpose of the council is to facilitate the coordination and cooperation of the trustees in their efforts to mitigate the effects to natural resources that result from either hazardous substance releases on the Hanford Site or remediation of those releases. The council met four times in 2003 to discuss issues associated with the cleanup of the Central Plateau and the Columbia River Corridor. Additional information is available at http://www.hanford.gov/boards/nrtc.

Tribal members work with site contractors during field surveys to identify cultural resource sites.

THE ROLE OF INDIAN TRIBES AND NATIONS

The Hanford Site is located on land ceded to the United States government by the Yakama Nation and the Confederated Tribes of the Umatilla Indian Reservation in the Treaties of 1855.

These tribes, as well as the Nez Perce Tribe, have treaty fishing rights on portions of the Columbia River. These tribes reserved the right to fish at all usual and accustomed places and the privilege to hunt, gather roots and berries, and pasture horses and cattle on open and unclaimed land. The Wanapum are not a federally recognized tribe, but have historic ties to the Hanford Site as do the Confederated Tribes of the Colville Reservation, whose members are descendants of people who used the area now known as the Hanford Site.

Many areas on the Hanford Site have special significance to tribal members.

The Hanford Site environment supports a number of Native American foods and medicines and contains sacred places important to tribal cultures. The tribes hope to safely use these resources in the future and want to assure themselves the Hanford environment is clean and healthy.

American Indian tribal governments have a special and unique legal and political relationship with the government of the United States, defined by history, treaties, statutes, court decisions, and the U.S. Constitution. In recognition of this relationship, the DOE and each tribe interact and consult directly.

Members and representatives of the Confederated Tribes of the Umatilla Indian Reservation, Yakama Nation, Nez Perce Tribe, and Wanapum People were actively involved at Hanford during 2003.

PUBLIC PARTICIPATION

The public is provided opportunities to provide input and influence decisions through many forums, including Hanford Advisory Board meetings, Tri-Party Agreement activities, *National Environmental Policy Act* public meetings covering various environmental impact statements, and other involvement programs. The Office of Communications at DOE's Richland Operations Office coordinates the planning and scheduling of public participation activities for the Hanford Site.

Public meetings help keep citizens informed about Hanford decisions.

The *Hanford Site Tri-Party Agreement Public Involvement Community Relations Plan* outlines how public information and involvement activities are conducted for Tri-Party Agreement decisions. The plan can be found on the Internet at http://www.hanford.gov/crp/toc.htm.

A mailing list of about 3,300 individuals who have indicated an interest in participating in Hanford Site decisions is maintained. To inform the public of upcoming opportunities for public participation, *The Hanford Update* (a synopsis of all ongoing and upcoming Tri-Party Agreement public involvement activities) is published bimonthly and distributed to this list.

To allow Hanford stakeholders and others to access up-to-date information, documents from the Tri-Party Agreement's Administrative Record and Public Information Repository are available on the Internet at http://www2.hanford.gov/arpir.

The public can obtain information about cleanup activities via a toll free telephone line (800-321-2008), which is maintained by Washington State Department of Ecology. Members of the public can request information about any public participation activity and receive a response by calling the Office of Communications (DOE Richland Operations Office) at (509) 376-7501.

A calendar of public involvement opportunities can be found on the Internet at http://www.hanford.gov/calendar/.

Citizens of the state of Washington and neighboring states may influence Hanford Site cleanup decisions through public participation activities.

The Hanford Advisory Board consists of 31 members who represent a broad cross section of interests. The board is engaged in discussions with representatives from the Tri-Party Agreement agencies on major cleanup issues; plans to treat tank waste, and the role of supplemental technologies; storage, treatment and/or disposal of waste; and budget priorities.

The board held six 2-day meetings during 2003 and issued 12 pieces of consensus advice. Information about the Hanford Advisory Board, including copies of its advice and responses can be found on the Internet at http://www.hanford.gov/boards/hab/index.htm.

REPORT INQUIRIES

Inquiries about this booklet or comments and suggestions about its content may be directed to Mr. D. C. (Dana) Ward, U.S. Department of Energy, Richland Operations Office, Closure Division, P.O. Box 550, Richland, Washington 99352 (Dana_C_Ward@rl.gov) or to Mr. T. M. (Ted) Poston, K6-75, Pacific Northwest National Laboratory, P.O. Box 999, Richland, Washington 99352 (ted.poston@pnl.gov).

Copies of this summary booklet and the 2003 report have been provided to many public libraries in communities around the Hanford Site and to several university libraries in Washington and Oregon. Copies also can be found at DOE's Public Reading Room located in the Consolidated Information Center, Room 101L, in Richland, Washington. Copies of the 2003 report can be obtained from Mr. R. W. (Bill) Hanf, K6-75, Pacific Northwest National Laboratory, P.O. Box 999, Richland, Washington 99352 (bill.hanf@pnl.gov) while supplies last. The reports can be accessed on the Internet at http://hanford-site.pnl.gov/envreport.