2.3 Activities, Accomplishments, and Issues

K. R. Price

This section describes DOE's ongoing environmental and regulatory activities. Self-assessments, inspections by regulating agencies, Tri-Party Agreement (Ecology et al. 1998) discussions, and communications with stakeholders provided mechanisms to identify environmental compliance issues. Relevant issues are discussed openly with the regulators and with the public to ensure resolution.

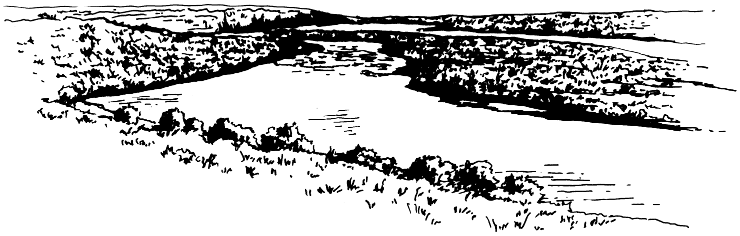
2.3.1 Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement)

R. D. Morrison

The Hanford Federal Facility Agreement and Consent Order, or Tri-Party Agreement, is an agreement for achieving compliance with CERCLA remedial action provisions and with RCRA treatment, storage, and disposal unit regulations and corrective action provisions. The Tri-Party Agreement contains a schedule, utilizing numerous enforceable major and interim milestones and unenforceable target dates, which reflects a concerted goal of achieving full regulatory compliance and remediation in an aggressive manner.

Highlights of accomplishments during 2000 under the terms of the Hanford Federal Facility Agreement and Consent Order include (associated milestone numbers are shown in parenthesis):

- Construction, installation, and acceptance testing of the K West Cask System facility modifications were completed (M-34-14A).
- The installation of RCRA groundwater monitoring wells in accordance with M-24-00L was completed at the following locations
  - three wells in the Single-Shell Tank Waste Management Area S-SX (M-24-46)
  - four wells in the Single-Shell Tank Waste Management Area T (M-24-47)
  - three wells in the Single-Shell Tank Waste Management Area TX-TY (M-24-48)
- The Hanford Tank Waste Treatment Alternatives Report (M-62-02) was completed and submitted to the EPA, the Washington State Department of Ecology, and the public.
- Remediation and backfill of 19 liquid waste sites in the 100-BC-2 Operable Unit (M-16-08B) were completed.
- The biennial assessment of information and data access needs (M-35-09B) was conducted.
- The remedial design report/remedial action work plan for the K Basins interim action (M-34-04) was submitted to EPA and the Washington State Department of Ecology for review and approval.
- The Dangerous Waste Permit Application for the Phase I Tank Waste Treatment Complex (M-20-59) was submitted to the Washington State Department of Ecology for review and approval.
- The 244-AR Vault interim stabilization project plan (M-45-11A) was submitted.
- The Site-Specific Single-Shell Tank Waste Management Area Phase I RCRA Facility Investigation/Corrective Measure Study Work



Plan Addenda for Waste Management Area B-BX-BY (M-45-53) was submitted to the Washington State Department of Ecology for review and approval.

- Complete data packages, including validation, for two cores collected from tank 241-Z-361 (M-15-37B) and a recommended regulatory pathway were provided to EPA for review.
- The B Reactor Phase II Feasibility Study Engineering Design Report was issued for Public Comment (M-93-05).
- The Hanford Site Transuranic/Transuranic Mixed Waste Project Management Plan (M-91-03) was submitted to the Washington State Department of Ecology for review and approval.
- The Waste Information Requirements Document for Fiscal Year 2001 (M-44-13D) was submitted to the Washington State Department of Ecology for review.
- Construction of upgrades in a second tank farm (M-43-13) was started.
- The annual Hanford Land Disposal Restrictions Report (M-26-01J) was submitted to the Washington State Department of Ecology for review and approval.
- Workshops on the content of the Land Disposal Restrictions Report (M-26-01K) were conducted.
- Re-negotiation of "near term" activities (prior to 9/30/2006) for single-shell tank waste retrieval (M-45-00A) was completed.
- The Final Waste Information Requirements Document for Fiscal Year 2001 (M-44-14D) was submitted to the Washington State Department of Ecology.
- The 200-TW-1 and 200-TW-2 Operable Unit work plans (M-13-23, M-13-24) were submitted to EPA and the Washington State Department of Ecology, respectively, for review and approval.
- Remedial action was initiated in the 100-FR-1 Operable Unit (M-16-13A).
- Development of a spectral gamma-logging baseline for the single-shell tank farms (M-45-50) was completed.
- Construction of a small container transuranic/transuranic mixed waste retrieval facility was completed and retrieval of small container transuranic/transuranic mixed waste was initiated from 200 Area burial grounds (M-91-04).
- Double-shell tank space evaluation (M-46-00G) was completed and submitted to the Washington State Department of Ecology and the EPA.
- The annual progress report on the development of waste tank leak monitoring/detection and mitigation activities in support of M-45-08 (M-45-09E) was submitted to the Washington State Department of Ecology for information.
- The 300 Area Special Case Waste Project Management Plan (M-92-13) was submitted to the Washington State Department of Ecology for review and approval.
- Input of characterization information was completed for high-level waste tanks for which sampling and analysis were completed per the Waste Information Requirements Document into the electronic database (M-44-16D).
- Deliverables consistent with the Waste Information Requirements Document developed for fiscal year 2000 were completed (M-44-15D).
- The 105-F Area Interim Safe Storage field activities were initiated (M-93-09).
- K West basin spent nuclear fuel removal was initiated (M-34-16).
- One 200 Area National Priority List Remedial Investigation/Feasibility Study Work Plan (M-13-00K) was submitted to EPA and the Washington State Department of Ecology for review and approval.

- The 100-HR-3 Phase I, In Situ Redox Manipulation barrier emplacement, planning and well installation was completed (M-16-27A).
- The Uranium Rich Process Waste Group (200-PW-2) work plan (M-13-25) was submitted to the Washington State Department of Ecology for review and approval.

Since this annual report was issued last year, negotiated changes to the Tri-Party Agreement established 20 new enforceable milestones. A summary of the significant changes is given in the following sections.

2.3.1.1 Waste Management

There were two change requests related to waste management approved during 2000.

Target Date M-91-11-T01 identified the need to complete and submit to the Washington State Department of Ecology the engineering study/functional design criteria for a low-level mixed waste treatment facility. The volume of waste that will actually require treatment in the conceptual facility is limited. Evaluation of this volume, processing rates, and treatment requirements led to the conclusion that an existing facility, the 2706-T Facility and its adjacent concrete pad, could be used to accomplish the required treatment operations. As a result, Target Date M-91-11-T01 was removed from the Tri-Party Agreement.

The Spent Nuclear Fuel Project in conjunction with Hanford's T Plant Facility developed a new strategy that will accelerate removal of sludge from the K Basins. The sludge will be removed from the basin floors, containerized and shipped to T Plant in accordance with requirements in the *Toxic Substances Control Act* for remote handled, transuranic waste for interim storage awaiting treatment. This will improve operational efficiency in removing spent nuclear fuel and sludge from the K Basins. Because of the importance of T Plant preparations, three new interim milestones and two new target dates were added to the Tri-Party Agreement to ensure T Plant is prepared to receive the sludge.

2.3.1.2 Environmental Restoration

Thirteen change requests related to environmental restoration were approved during 2000.

Minor modifications were made to groundwater sampling and analyses for the 100-BC-5 Operable Unit Groundwater Sampling Project.

The due date for Target Date M-93-06-T01, which requires the submittal of a surveillance and maintenance plan for the B Reactor, was extended from June 30, 2001 to June 30, 2002. This extension was necessary to complete an engineering evaluation/cost analysis to evaluate all hazards and removal action alternatives within the facility, and to accomplish a requisite public comment period.

As required by the 200 Area Remedial Investigation/Feasibility Study Implementation Plan, the annual evaluation of 200 Area operable unit priorities was completed. Based on the evaluation, the Tri-Party Agreement was modified to replace the General Process Waste Group (200-PW-4 Operable Unit) Work Plan with the Plutonium/Organic-Rich Process Waste Group (200-PW-1 Operable Unit) Work Plan under Interim Milestone M-13-26. The existing due date for this milestone was unchanged.

The Tri-Party Agreement requires that DOE specify additional interim milestones to conduct remedial investigations based on submitted operable unit work plans. To meet this requirement, three change requests were approved that established seven new interim milestones to conduct remedial investigations in Operable Units 200-CW-1, 200-CS-1 and 200-CW-5.

One change request was approved that modified four interim milestones requiring remedial actions at the 100-KR-1, 100-FR-1, and 100-HR-1 Operable Units. Activities at the 100-HR-1 Operable Unit increased due to the discovery of vadose zone plumes at sites that had been excavated. Work in the 100-FR-1 and 100-HR-1 Operable Units was affected because the start of work at these units depended on the completion of work in the 100-HR-1 Operable Unit.

Interim Milestone M-16-07B required the completion of remediation and backfill of 22 liquid waste sites and process effluent pipelines in the 100-DR-1 and 100-DR-2 Operable Units. The continued discovery of contaminated plumes in the vadose zone increased excavation, closeout, and backfill activities at these operable units. Ultimately, the completion date for M-16-07B required an extension due to the increased workload.

In October 1999, a Record of Decision Amendment was approved by DOE, EPA, and Washington State Department of Ecology changing the selected remedial action specified in the Interim Remedial Action Record of Decision for the 100-HR-3 Operable Unit. The change was the deployment of a new and innovative technology, in situ redox manipulation, to remediate the newly characterized chromium groundwater plume while still operating the existing pump-and-treat operations. The technology involves creating a permeable groundwater treatment barrier that reduces the mobility and toxicity of chromium in groundwater. Three new interim milestones were established to track progress of the in situ redox manipulation barrier.

Interim Milestone M-16-03E requires the completion of remediation of the waste sites in the 300-FF-1 Operable Unit. Washington State Department of Ecology, DOE, and EPA began an evaluation of uranium cleanup levels as part of the CERCLA process at the neighboring 300-FF-2 Operable Unit. If a lower uranium cleanup level were chosen as a result of the evaluation, the 300-FF-1 Operable Unit cleanup level would also need to be evaluated to see if further excavation would be warranted. Until evaluation results for the 300-FF-2 Operable Unit became available, it was considered appropriate to defer backfill and re-grading of the remediated waste sites at the 300-FF-1 Operable Unit. On this basis, the due date for Interim Milestone M-16-03E was extended.

Under Major Milestone M-24-00, DOE and Washington State Department of Ecology are annually required to establish the location and number of RCRA groundwater monitoring wells to be installed in the upcoming year. For 2000, it was determined that ten monitoring wells should be installed and that five wells would be installed by April 2001 in partial fulfillment of the 2001 requirements. Five new interim milestones were added to the Tri-Party Agreement requiring the installation of these 15 new monitoring wells.

Tri-Party Agreement Action Plan Appendix C contains the official list of waste management units to be remediated. Two change requests were approved which updated Appendix C to reflect the numerous changes that had occurred as sites were cleaned up, new sites discovered, and information was collected.

2.3.1.3 Office of River Protection

There was one change request approved and one "Directors Determination" issued related to the Office of River Protection during 2000.

A change request was approved which modified the description of Interim Milestones M-44-15D, M-44-15E, and M-44-15F. These interim milestones require the development of characterization information on Hanford high-level waste storage tanks. The change request requires the progress of the milestones to be reported in quarterly reports. The physical field activities identified in each milestone will continue to be completed by the existing September 30 milestone due date. However, the progress and final notification for completion of the above interim milestones will be documented in quarterly reports and year-end reports that are due on October 31 of each year.

DOE and Washington State Department of Ecology conducted extensive negotiations in 1999 and 2000 to arrive at a set of Tri-Party Agreement commitments related to the retrieval and treatment of tank waste at the Hanford Site. These negotiations did not result in a successful final agreement by the agreed due date of March 29, 2000. Under the terms of the Tri-Party Agreement and associated agreements controlling the negotiations, the Director of the Washington State Department of Ecology issued a final determination on the matters under negotiation. This determination added 26 new milestones and made numerous other adjustments to existing milestones and administrative requirements of the Tri-Party Agreement.

2.3.1.4 Facilities Transition

Two change requests approved during 2000 were related to facility transition, i.e., the transition of a major facility from an expensive high maintenance shutdown/standby condition to a low maintenance, low cost, safe, stable condition to await final decommissioning.

One change request was approved that established two new milestones governing the disposition of "Rocky Flats Ash" mixed waste stored at Hanford's Plutonium Finishing Plant. Specifically, the "Rocky Flats Ash" material will be repackaged and eventually shipped to the Waste Isolation Pilot Plant in New Mexico for final disposition. This change request is also committed to begin negotiations for the transition of the entire Plutonium Finishing Plant to the Environmental Restoration Contractor by June 1, 2001.

Another change request was approved which modified one target date MX-92-06-T01, requiring the disposition of all Hanford Site Unirradiated Uranium by December 31, 2000. The modification extended the due date and established two separate target milestones: MX-92-06-T01 due by December 2001 and MX-92-06-T02 due by September 2006. These modifications were necessary to align these activities with the Hanford Site 300 Area Accelerated Cleanup Plan, the River Corridor Project, and other site priorities.

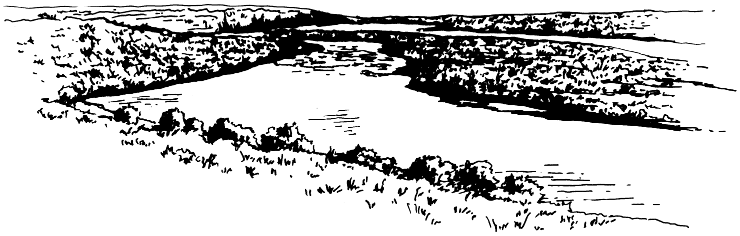
2.3.1.5 Spent Nuclear Fuel

Spent nuclear fuel from past operations at N Reactor is stored at the two K Basins, 100-K Area (see Section 2.3.3). Currently, under the Tri-Party Agreement, the fuel and sludge are being removed to safer storage facilities in the 200 Area. The Spent Nuclear Fuel Project developed a new strategy that will accelerate removal of sludge from the K Basins and improve operational efficiency in removing spent nuclear fuel from the basins. In implementing the new strategy, three interim milestones were accelerated, three were extended, three target dates were extended, and two target dates were deleted. One change request related to these actions was approved in 2000.

2.3.2 Pollution Prevention Program

D. H. Nichols

Pollution prevention is DOE's preferred approach to environmental management. The Hanford Site Pollution Prevention Program is an organized and continuing effort to reduce the quantity and toxicity of hazardous, radioactive, mixed, and sanitary waste. The program fosters the conservation of resources and energy, the reduction of hazardous substance use, and the prevention or minimization of pollutant releases to all environmental media from all operations and site cleanup activities.



The program is designed to satisfy DOE requirements, executive orders, and federal and state regulations and requirements. In accordance with sound environmental management, preventing pollution through source reduction is the first priority in this program; the second priority is environmentally safe recycling. Waste treatment to reduce quantity, toxicity, or mobility (or a combination of these) is considered only when source reduction and recycling are not possible or practical. Approved disposal to the environment at permitted sites is the last option.

Overall responsibility for the Hanford Site Pollution Prevention Program resides with the DOE Richland Operations Office. The office defines overall program requirements that each prime contractor is responsible for meeting.

Hanford Site pollution prevention efforts in 2000 helped to reduce disposal quantities through source reduction and recycling by an estimated 155,000 m^3 (202,000 yd^3) of radioactive and mixed waste, 26,000 metric tons (28,700 tons) of RCRA hazardous/dangerous waste, 860,000 liters (227,000 gallons) of process wastewater, and 1,800 metric tons (1,984 tons) of sanitary waste. Waste disposal cost savings in 2000 exceeded $46 million for these activities. During 2000, the Hanford Site recycled 430 metric tons (470 tons) of paper products and 510 metric tons (560 tons) of various metals.

2.3.3 Spent Nuclear Fuel Project

D. J. Watson

The Spent Nuclear Fuel Project was established in February 1994 to provide safe, economic, and environmentally sound management of Hanford Site spent (irradiated) nuclear fuel and to prepare the fuel for long-term storage or final disposal. During 2000, the project continued to make progress on an accelerated strategy to move spent fuel stored in the KW Basin and KE Basin, 100-K Area, away from the Columbia River and into the Canister Storage Building in the 200-East Area. The 40-year-old K Basins temporarily store 2,100 metric tons (2,300 tons) of N Reactor spent fuel and a small quantity of slightly irradiated single-pass reactor fuel. The spent fuel is removed from underwater storage in the K Basins and placed in dry interim storage in the 200-East Area. Prior to interim storage, the fuel is cleaned and packaged into containers called "multi-canister over packs." The over packs are vacuum processed to remove any water and then sealed. The vacuum processing and sealing is done at the Cold Vacuum Drying Facility located in the 100-K Area. The dried over packs are then transported to the Canister Storage Building located in the 200-East Area (see Figure 1.3). The multi-canister overpacks will be maintained in dry storage pending a decision by the Secretary of Energy on final disposition. If necessary, the repackaged spent fuel could remain in dry storage for up to 40 years. This strategy supports completion of fuel removal from the K Basins by the Tri-Party Agreement date of July 2004.

The corrosion of fuel and fuel handling operations has led to the accumulation of sludge and debris in old fuel storage canisters and on the floors of the K Basins. The majority of the sludge is in the KE Basin. The sludge, debris, and empty storage canisters will be removed after the spent fuel is removed. Water remaining in the basins will also be removed, treated at the Hanford Site 200 Areas Effluent Treatment Facility and disposed of onsite. Sludge, debris and old fuel canisters will be transported to the Environmental Restoration Disposal Facility for disposal to the extent possible. Sludge and debris that do not meet acceptance criteria for the Environmental Restoration Disposal Facility will be transferred to the appropriate onsite waste management facility. The K Basins will then be prepared for interim stabilization pending final remediation.

The Spent Nuclear Fuel Project also specifies that other spent nuclear fuel stored on the Hanford Site will be relocated to the 200-East Area Interim Storage Area or to the Canister Storage Building. Other stored spent nuclear fuel and storage locations include

- Fast Flux Test Facility fuel in the 400 Area
- Training, Research, and Isotope Production General Atomics fuel in the 400 Area
- Shippingport, Pennsylvania, reactor fuel at T Plant in the 200-West Area
- miscellaneous special case and research reactor fuels in the 324, 325, and 327 buildings in the 300 Area.

Major accomplishments of the Spent Nuclear Fuel Project in 2000 included the following items:

- completed an Operational Readiness Review to begin startup of the 105-KW Basin Fuel Removal System, Cold Vacuum Drying Facility, and Canister Storage Building
- began removing spent nuclear fuel from the 105-KW Basin on December 7, 2000
- placed the first multi-canister overpack of spent nuclear fuel into dry storage on December 19, 2000
- developed a new strategy to accelerate removal of sludge from the K Basins.

2.3.4 River Corridor Project

The mission of the River Corridor Project is to deactivate contaminated facilities in all areas of the Hanford Site to prepare for decontamination and decommissioning. The project also provides for safe and secure storage of special nuclear material, nuclear material, and nuclear fuel until these materials can be transferred to another facility, sold, or otherwise dispositioned. Within the River Corridor Project are multiple subprojects and facilities, which are discussed in the following sections.

2.3.4.1 Accelerated Deactivation Project

J. M. Barnett

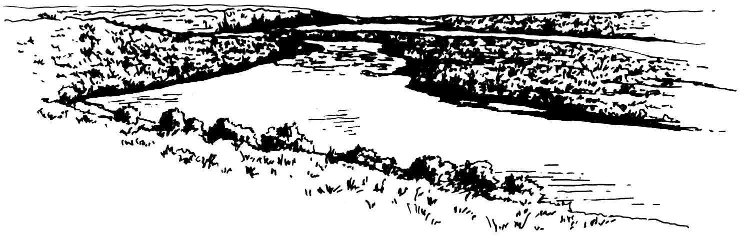
The mission of the Accelerated Deactivation Project is to complete facility deactivation and closure activities while maintaining the facilities in a safe and compliant status until they are turned over to the Environmental Restoration Program.

300 Area Fuel Supply Shutdown Subproject. The Fuel Supply Shutdown subproject includes deactivation of a building dating from 1943 that housed manufacturing equipment to produce uranium fuel for Hanford Site reactors. These processing operations were discontinued in 1987 when N Reactor was shut down. In 2000, 667 metric tons (734 tons) of uranium in the form of uranium trioxide powder were transferred to Portsmouth, Ohio.

2.3.4.2 324 and 327 Facilities Deactivation Project

M. M. Serkowski

Construction of the 324 and 327 buildings was completed and operations began in 1966 and 1953, respectively. These buildings contain hot cells that were used for radiological research and development work. Both facilities were transferred to Fluor Hanford, Inc. in 1996 for deactivation and closure.



Significant accomplishments achieved at the 324 Building in 2000 included the following:

- Size reduction activities of B-Cell equipment and storage rack continued as required per Tri-Party Agreement Milestone M-89-02.
- Dispersible materials from the B-Cell floor were collected and containerized.
- Seventeen grout containers and four mixed waste containers were packaged and shipped to the 200-West Area Burial Ground and Central Waste Complex.
- The 300 Area Special Case Waste Management Plan was developed and submitted six months ahead of schedule (Tri-Party Agreement Milestone M-92-13).
- Phase I Special Case Waste materials were packaged and removed from the facility on schedule, meeting Tri-Party Agreement Milestone M-92-14.

Significant accomplishments achieved at the 327 Building in 2000 included the following:

- One hundred three buckets of legacy waste were packaged and shipped to the Central Waste Complex. Only 29 buckets of legacy waste remain to be shipped out of 450 initial buckets.
- Three hundred fourteen grams (10 ounces) of fissile material were removed from the dry storage carousel, leaving just under 100 grams (3 ounces) in storage.
- Two drums of legacy waste were shipped to the burial ground. Only 4 containers remain to be shipped out of 19 initial containers of legacy waste.
- The interim clean out of H Cell was completed and all waste associated with that activity was shipped to the Central Waste Complex.
- All remaining irradiated fuel pin segments (a total of 335.2 grams or 10.8 ounces) were packaged and shipped to the Central Waste Complex.
- Thirty-two cubic meters (42 yd^3) of low-level waste were packaged and shipped to the low-level burial ground.

2.3.4.3 300 Area Treated Effluent Disposal Facility

C. P. Strand

In the past, the 340 Waste Handling Facility provided for the receipt, storage, and shipment of low-level, mixed, liquid waste from the 300 Area to the double-shell tanks. The accumulated waste was pumped into railcars and transported to the 200-East Area for neutralization and transferred to double-shell tanks for storage. Because the 340 Waste Handling Facility does not have a RCRA permit for hazardous waste storage, the facility ceased receiving waste in September 1998. The facility is currently in a standby mode awaiting deactivation.

Currently, industrial wastewater generated throughout the Hanford Site is accepted and treated in the 300 Area Treated Effluent Disposal Facility. Laboratories, research facilities, office buildings, and former fuel fabrication facilities in the 300 Area are the primary sources of wastewater. The wastewater consists of once-through cooling water, steam condensate, and other industrial wastewater. The facility began operation in December 1994.

This facility is designed for continuous receipt of wastewater, with a storage capacity of up to 5 days at the design flow rate of 1,100 liters per minute (300 gallons per minute). The treatment process includes iron coprecipitation to remove heavy metals, ion exchange to remove mercury, and ultraviolet light/hydrogen peroxide oxidation to destroy organics and cyanide. Sludge from the iron coprecipitation process is dewatered and used for backfill in the low-level waste burial grounds. The treated liquid effluent is monitored and discharged through an outfall to the Columbia River under a National Pollutant Discharge Elimination System permit No. WA 002591-7 (see Section 2.2.8).

Capability exists to divert the treated effluent to holding tanks before discharge, if needed, until a determination can be made for final disposal based on sampling. In 2000, ~231 million liters (61 million gallons) of wastewater were treated.

2.3.4.4 Plutonium Finishing Plant

W. J. McKenna

In 1949, the Plutonium Finishing Plant began to process plutonium nitrate solutions into metallic form for shipment to nuclear weapons production facilities. Operation of this plant continued into the late 1980s. In 1996, DOE issued a shutdown order for the plant, authorizing deactivation and transition of the plutonium processing portions of the facility in preparation for decommissioning.

The mission is to stabilize, repackage, immobilize, and/or properly dispose of plutonium-bearing materials in the plant; to deactivate the processing facilities; and to provide for the safe and secure storage of nuclear materials until final disposition.

Significant accomplishments achieved at the Plutonium Finishing Plant during 2000 include the following:

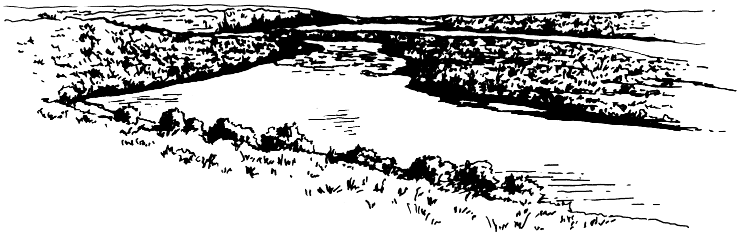
- Over 650 plutonium material items were heat stabilized in electric muffle furnaces. This is more than a fourfold increase over last year's level.
- Three major stabilization and packaging processes were brought on line, while achieving over a million safe work hours.
- Plutonium stabilization processes were operated in parallel with a special packaging system to prepare metals, oxide powder, solutions, and residues to meet packaging criteria for long-term storage.
- Installation of the special packaging system welding process was begun to prepare for an April 2001 startup.
- Extensive testing confirmed that polycube inventory (small cubes of plutonium in polystyrene) can be stabilized in existing muffle furnaces eliminating the need for new pyrolysis equipment.

2.3.4.5 Plutonium-Uranium Extraction Plant and B Plant

L. M. Dittmer

The Plutonium-Uranium Extraction Plant was transferred to the environmental restoration contractor after deactivation in 1999 and is being maintained in a surveillance and maintenance mode before decommissioning. The plant has a single effluent stack emission point that is a major emission unit as defined in 40 CFR 61. Also, there are 45 RCRA treatment, storage, and disposal vessels within the facility and containment structure. An annual roof inspection is performed from within the facility and from the outside to assess the condition of a facility that no longer has heat or utility service.

The B Plant, excluding the 296-B-1 stack, was transferred to the environmental restoration contractor in 1999. The facility effluent emission point through the 296-B-1 stack was transferred on August 10, 2000. The facility is being maintained in a surveillance and maintenance mode before decommissioning. The plant maintains two stack emission points that are a major emission unit by definition of 40 CFR 61. The plant contains 54 RCRA treatment, storage, and disposal vessels within the facility and containment structure. An annual roof inspection is performed from within the facility and from the outside to assess the condition of a facility that no longer has heat or utility service.



2.3.4.6 Waste Encapsulation and Storage Facility

F. M. Simmons

The mission of the Waste Encapsulation and Storage Facility project is to provide safe interim storage of encapsulated radioactive cesium and strontium. The facility was initially constructed as a portion of the B Plant complex and began service in 1974. In 1998, B Plant was deactivated and disconnected from the Waste Encapsulation and Storage Facility. There are currently 601 strontium fluoride capsules and 1,335 cesium chloride capsules stored at the facility. A RCRA Part A (Form 3) permit for dangerous waste storage was approved by the Washington State Department of Ecology on August 25, 2000. The capsules will be stored at the Waste Encapsulation and Storage Facility until at least 2013. The capsules then will be shipped to the vitrification plant for high-level waste vitrification. The final capsule shipment is scheduled for 2017.

2.3.5 Fast Flux Test Facility

D. A. Gantt

The Fast Flux Test Facility is a 400-megawatt thermal, liquid metal cooled reactor located in the 400 Area. It was built in the late 1970s to test plant equipment and fuel for the Liquid Metal Fast Breeder Reactor Program. The Fast Flux Test Facility operated from April 1982 to April 1992, during which time it successfully tested advanced nuclear fuels, materials, and safety designs and also produced a variety of isotopes for medical research. The reactor has been in a standby mode since December 1993. Fuel has been removed from the reactor vessel and stored in two sodium-filled vessels and in above-ground, dry storage casks. Twenty-three of the facility's 100 plant systems were deactivated.

On December 22, 1998, the Secretary of Energy announced the decision to remove the Fast Flux Test Facility from consideration as a tritium supply source. However, the Secretary asked that a program plan be developed that clearly defined other potential uses of the facility and the roles and responsibilities of potential users. A program plan was prepared and reviewed by the Nuclear Energy Research Advisory Committee. The Committee recommended that DOE proceed toward a record of decision but that a non-proliferation policy review, cost evaluation, and mission assessment be conducted to inform the Record of Decision. The committee also recommended that a comprehensive research and development plan be prepared for DOE that would include the Fast Flux Test Facility.

Based on these recommendations, the Secretary initiated a National Environmental Policy Act review of the environmental impacts associated with the restart and operation of the Fast Flux Test Facility as a nuclear research and medical isotope production facility. The *Final Programmatic Environmental Impact Statement for Accomplishing Expanded Civilian Nuclear Energy Research and Development and Isotope Production Missions in the United States, Including the Role of the Fast Flux Test Facility* was issued in December 2000 (DOE/EIS-0310). The Secretary of Energy approved the Record of Decision (66 FR 7877) on January 19, 2001. In this record of decision, the Secretary determined that the Fast Flux Test Facility should be permanently deactivated. However, the ruling was later postponed pending review. A detailed summary of the status of the Fast Flux Test Facility can be found on the project website at http://www.fftf.org/currstat/.

2.3.6 Advanced Reactors Transition Project

D. A. Gantt

The mission of this project is to transition or convert the Plutonium Recycle Test Reactor facility and other nuclear energy legacy facilities into structures that are in a safe and stable condition suitable for transfer to the environmental restoration contractor. Legacy facilities are those used for nuclear research projects conducted in the past at the Hanford Site. Although nuclear energy legacy facilities existed in many areas of the Hanford Site, the only facilities remaining to be transferred to the environmental restoration contractor are in the southeastern part of the 300 Area. The transfer process includes preparation for minimal safe surveillance and maintenance activities. Deactivation of legacy facilities also includes the disposition of non-radioactive sodium and sodium-potassium alloy originally used in the development and testing of components for use in liquid metal-cooled reactors.

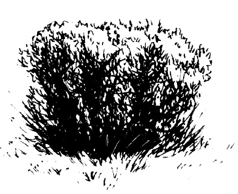
At the Plutonium Recycle Test Reactor/309 Building, located in the 300 Area, an above-grade contaminated ion exchange column and associated above grade piping were removed from the facility's transfer waste tank farm area. Inside the facility, contamination below ground level (-9.8 meter [-32 foot]) of the containment building was cleaned up. This included areas known as the A-Cell, B-Cell, C-Cell, and the reactor lower access space. Cleanup consisted of removing steel I-beams, scaffolding, materials, and unattached equipment. In the process, four 4x4x8 foot boxes (512 ft^3) were filled with contaminated debris and shipped to the low-level waste burial ground. Following the removal of the contaminated materials, the floors, sumps, and walls to a height of 2.4 meters (8 feet) were wiped down and painted. About 837 m^2 (9,000 ft^2) were wiped down and 227 liters (60 gallons) of paint were applied. The C-Cell, with a floor area of 74 m^2 (800 ft^2), was downgraded from a Contaminated Area (unpainted surface) to a Fixed Contamination Area (painted surface). The A-Cell, B-Cell, and the reactor lower access space remain as Contaminated Areas because the walls above 2.4 meters (8 feet) and the 8.2-meter (27-foot) high ceilings were not wiped down or painted.

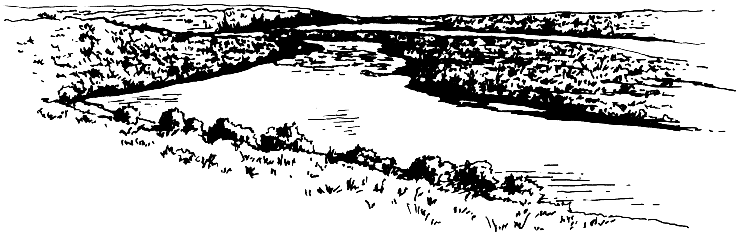
The process of cleaning residual non-radioactive sodium from small tanks, which were previously drained, was completed. Sodium-potassium alloy residuals were also cleaned from the cold trap-cooling loop in the 337 High Bay Building. In 1998, about 510 liters (135 gallons) of bulk sodium-potassium was drained from the loop and shipped offsite. The loop was then sealed under an inert cover gas. Because of an accident involving sodium-potassium alloy at the Oak Ridge, Tennessee, Y-12 Plant, the decision was made in January 2000 to react the residual sodium-potassium alloy remaining in the cold trap cooling loop. A water vapor-nitrogen process was used to convert the sodium-potassium alloy to a mixture of sodium hydroxide and potassium hydroxide, and hydrogen gas. The rinse solution was sent to the onsite Treated Effluent Disposal Facility either in drums or via the process sewer. This was the first use of the Hanford designed and built cleaning station to treat and clean a piping system. Previous work had been to treat sodium residue in empty storage tanks.

2.3.7 Office of River Protection

P. A. Powell, P. D. Henwood and R. G. McCain

Congress established the Office of River Protection in 1998 as a DOE Field Office reporting directly to the DOE Assistant Secretary for Environmental Management. The Office of River Protection is responsible for managing DOE's River





Protection Project to store, retrieve, treat, and dispose of high-level tank waste and close the tank farm facilities at the Hanford Site.

2.3.7.1 Waste Tank Status

The status of the 177 waste tanks as of December 2000 was reported in HNF-EP-0182, *Waste Tank Summary Report for Month Ending December 31, 2000*. This report is published monthly; the December report provided the following information:

- number of high-level waste tanks
  - 149 single-shell tanks
  - 28 double-shell tanks
- number of high-level waste tanks assumed to have leaked
  - 67 single-shell tanks
  - 0 double-shell tanks
- chronology of single-shell tank leaks
  - 1956: first high-level waste tank reported as suspected of leaking (tank 241-U-104)
  - 1973: largest estimated leak reported (tank 241-T-106; 435,000 liters [115,000 gallons])
  - 1988: tanks 241-AX-102, 241-C-201, 241-C-202, 241-C-204, and 241-SX-104 confirmed as having leaked
  - 1992: latest tank (241-T-101) added to list of tanks assumed to have leaked, bringing total to 67 single-shell tanks
  - 1994: tank 241-T-111 was declared to have leaked again.
  - The total estimated volume to date of radioactive waste leakage from single-shell tanks is <2.84 to 3.97 million liters (<750,000 to 1 million gallons).
- number of ferrocyanide tanks on the Watch List (Twenty-four single-shell tanks were previously on the Watch List.)
  - 0 (The ferrocyanide safety issue was closed in 1996, and all remaining tanks were removed from the Watch List.)
- number of flammable gas tanks on the Watch List (As of February 28, 2001, there were 24 tanks on the Watch List; previously there were 25.)
  - 19 single-shell tanks
  - 5 double-shell tanks (The flammable gas safety issue associated with tank 241-SY-101 was closed in January 2001, and the tank was removed from the Watch List.)
- number of organic tanks on the Watch List (Twenty single-shell tanks were previously on the Watch List.)
  - 0 (Eighteen tanks containing organic complexants were removed from the Watch List in December 1998, and two tanks containing organic solvents were removed in August 2000.)
- number of high-heat tanks on the Watch List (One single-shell tank was previously on the Watch List.)
  - 0 (Single-shell tank 241-C-106 was removed from the Watch List in December 1999.)

To date, 125 of the 149 (84%) single-shell tanks have been stabilized and the program is ahead of schedule. At the end of 2000, intrusion prevention work was completed on 108 single-shell tanks. This involved capping off connecting pipes, risers, and pit covers to prevent any liquids from entering the tanks. Partial interim isolation was completed on 40 single-shell tanks. This involved capping off in the same manner as intrusion prevention except risers and piping were required to stabilize the tanks.

During 2000, four tanks (241-S-103, 241-SX-104, 241-SX-106, and 241-U-103) were declared stabilized. Waste was pumped from 14 single-shell tanks into the double-shell tank system. Portions of the waste in tanks 241-S-102, 241-S-103, 241-S-106, 241-S-109, 241-SX-101, 241-SX-103, 241-SX-105, 241-U-102, 241-U-103, 241-U-105, 241-U-106, 241-U-109, 241-A-101, and 241-AX-101 were removed. This pumping removed 2.3 million liters (600,000 gallons) of waste from the single-shell tanks. The addition of this waste and dilution water to the double-shell tank system required the transfer of 11 million liters (3 million gallons) of waste from the double-shell tank system in the 200-West Area to the double-shell tank system in the 200-East Area, through the new 10.5-kilometer (6.5-mile) cross-site transfer pipeline. The ability to transfer waste safely from 200-West Area to 200-East Area has allowed a significant amount of single-shell tank waste to be transferred to the safer and environmentally compliant double-shell tank system. For the safe and timely removal of waste from the single-shell tank system, temporary transfer piping (above ground and shielded) has been installed. This has enhanced the schedule of single-shell tanks to be pumped, because the old underground lines had a tendency to leak.

To assure safe storage and retrieval, 136 of 177 (76%) tanks have been characterized. Characterization data and resulting safety controls have allowed the safe storage of tank waste and the removal of tanks from the Watch List. Currently, the first 14 tanks for waste feed delivery have been selected. Sampling has been performed in 12 of these tanks, with characterization analysis performed on 11 of them. This characterization information is being used to improve the design and operation of the Waste Treatment Facility.

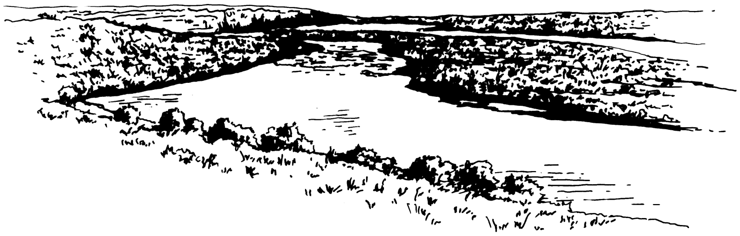
2.3.7.2 Waste Tank Safety Issues

The Waste Tank Safety Program was established in accordance with the Public Law 101-510, *Defense Authorization Act*, Section 3137, "Safety Measures for Waste Tanks at Hanford Nuclear Reservation" (1990). The focal point of the program is the identification and resolution of safety issues involving high-priority waste tanks. The tasks to resolve safety issues are planned and implemented in the following order: 1) evaluate and define the associated safety issue, 2) identify and close any associated unreviewed safety questions, 3) mitigate any hazardous conditions to ensure safe storage of the waste, 4) monitor waste storage conditions, and 5) resolve the respective safety issues. Each of these steps has supporting tasks of some combination of monitoring, mathematical analyses, laboratory studies, and in-tank sampling or testing. The path followed depends on whether the waste requires treatment or can be stored safely by implementing strict controls.

The Safety Issue Resolution Project focused on resolution of safety issues involving flammable gas, organic complexants and organic solvents, high-heat, and criticality. The tanks of concern were placed on a Watch List and categorized by safety issue. By 1996, all 24 ferrocyanide tanks had been removed from the Watch List, and the issue was deemed resolved by DOE and the Defense Nuclear Facilities Safety Board. In 1998, 18 tanks containing organic complexants were removed from the Watch List, and in August 2000, the remaining tanks containing organic solvents were taken off the Watch List. The high-heat tank (241-C-106) was removed from the Watch List in 1999. At the end of 2000, 25 flammable gas tanks remained on the Watch List, but in January 2001 tank 241-SY-101 was removed after DOE, Defense Nuclear Facility Safety Board, and other stakeholders agreed the safety issue for that tank had been resolved. Currently, 24 flammable gas tanks remain on the Watch List.

2.3.7.3 Watch List Tanks

In early 1991, all Hanford Site high-level waste tanks were evaluated and organized into categories to ensure increased attention and monitoring. Other safety concerns, including flammability,



uncontrolled reactions, and the possibility of nuclear criticality in a waste tank are discussed below.

Flammable Gas. The Flammable Gas Safety Issue involves the generation, retention, and potential release of flammable gases by tank waste. Twenty-five tanks were identified and placed on the Watch List. In prior years, work controls were instituted to prevent introduction of spark sources into these tanks, and evaluations were completed to ensure that installed equipment was intrinsically safe.

Conditions within tank 241-SY-101 changed in 1997, which led to a continuous rise in the waste level. In February 1998, the DOE Richland Operations Office declared an unreviewed safety question related to the waste surface level changes. The responsible contractor formed a project team to remediate the waste level rise and a project plan was issued (HNF-3824). During 1999, the increasing level of waste in tank 241-SY-101 was stopped through the transfer and dilution of the waste in this tank. Approximately one-half of the original waste in tank 241-SY-101 was removed, and the remainder of the waste in the tank was diluted with water. This reduced the flammable gas generation rate by a factor of 10 and decreased the specific gravity to a point where the generated gases are no longer retained and a mixer pump was no longer required to induce gas releases. The safety issue for tank 241-SY-101 was declared resolved in January 2001 and the tank was removed from the Watch List.

Hydrogen monitors were installed on all 25 tanks on the Flammable Gas Watch List; in addition, another 17 monitors were installed to gather more data on a variety of tanks and operations. These systems were designed to continuously monitor for hydrogen and trigger an alarm if the hydrogen concentration reaches a preset level. They also have the capability to obtain grab samples for additional analyses. In 2000, 14 of the systems were shut down because monitoring data showed that flammable gas releases in these tanks were much too small to be of concern.

The Tri-Party Agreement milestone for resolution of the flammable gas safety issue is scheduled for completion by September 2001.

High-Heat Tank. This safety issue was resolved in December 1999, based on the transfer of the majority of the waste in tank 241-C-106 into tank 241-AY-102. This safety issue concerned the generation of heat from a large inventory of radionuclides in tank 241-C-106, a single-shell tank in the 200-East Area that required water additions and forced ventilation for evaporative cooling. The retrieval and transfer of 712,000 liters (188,000 gallons) of waste was completed in 1999. In December 1999, DOE approved the closure of the high-heat safety issue for tank 241-C-106, and removed it from the High-Heat Watch List.

Organic Tanks. This safety issue involves the potential for uncontrolled exothermic reactions of organic complexants and organic solvents present in some of the tanks. DOE identified 20 single-shell tanks for the Organic Watch List between 1991 and 1994. In 1998, DOE closed the organic complexant safety issue and removed 18 tanks containing organic complexant from the Watch List. In August 2000, DOE declared the organic solvent safety issue resolved and removed the remaining two organic tanks from the Watch List.

Criticality. DOE closed the safety issue on the potential for criticality in the high-level waste tanks in 1999. Additional analyses, stronger tank criticality prevention controls, and improved administrative procedures and training (WHC-SD-WM-SARR-003) provided the technical basis to resolve the safety issue and satisfy the related Tri-Party Agreement milestone. No tanks were ever put on the Watch List for criticality concerns.

2.3.7.4 Vadose Zone Characterization Near Single-Shell Underground Waste Storage Tanks

Baseline vadose zone characterization was completed in 1999. Baseline data were reported in tank summary data reports for all 133 single-shell tanks with capacities of 2 million liters (530,000 gallons) or greater (100-series tanks), and in tank farm reports for each of the 12 single-shell tank farms. Since the original baseline data were acquired, additional data have been collected, new analysis techniques have been developed, and additional insights into the nature and distribution of contamination in the vadose zone have been gained. An addendum to each tank farm report was prepared during 2000 to provide additional data and revise previous visualizations (three-dimensional drawings) of the subsurface contaminant distribution. A brief discussion of specific fiscal year 2000 activities and a general summary of the results of the fiscal year 1995 to fiscal year 2000 baseline characterization is included in Section 7.2. Complete results of the Tank Farms Vadose Zone Characterization Program are posted on the Internet at http://www.doegjpo.com/programs/hanf/HTFVZ.html.

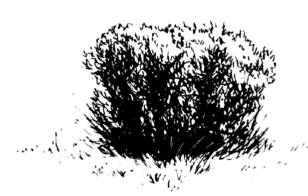
The characterization serves as a baseline against which future measurements can be compared to identify and track gamma-emitting radionuclides in the vadose zone. Thus, a comprehensive routine monitoring program for selected boreholes around single-shell tanks is being developed. The baseline characterization effort will also be extended to existing boreholes in the vicinity of former liquid waste disposal sites across the Hanford Site.

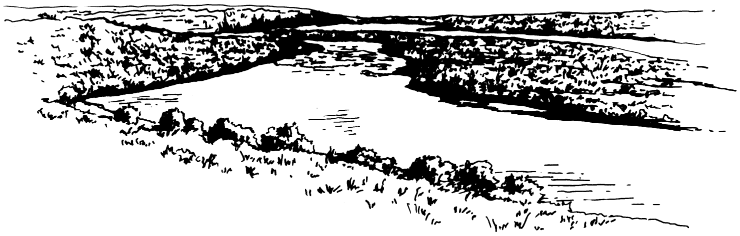
2.3.7.5 Waste Immobilization

Approximately 204 million liters (54 million gallons) of radioactive and hazardous waste, accumulated from more than 40 years of plutonium production operations, are stored in 149 underground single-shell tanks and 28 underground double-shell tanks. The River Protection Program is currently upgrading facilities to deliver waste to the planned Waste Treatment Plant. During the past year, ~300 meters (~1,000 feet) of safer, regulatory compliant, waste transfer piping was installed. The 241-AY pump pit also was upgraded to achieve regulatory compliance by repairing the concrete structure, installing leak detectors, and sealing the inside walls. Also, a more reliable computer-based master pump shutdown system was designed to halt pumping in the event of a leak.

In support of waste feed delivery to the Waste Treatment Plant, two full-scale working mixer pump prototypes were successfully tested in tank 241-AZ-101, with waste that will eventually be removed and treated. The mixer pump demonstration provided information on the safety of pump operation, quantity of sludge mobilized, power consumption, and settling rates of the mobilized sludge. These new mixer pumps will be installed in numerous other tanks, to prepare the millions of gallons of waste for treatment.

During December 2000, the Office of River Protection awarded a contract to Bechtel-Washington, to design and build the Waste Treatment Facility. The facility will be built on 26 hectares (65 acres) located in the central plateau of Hanford's 200-East Area. Three major facilities to be constructed will include a pretreatment facility, a high-level waste vitrification facility, and a low-level waste vitrification facility, as well as, supporting facilities. At this time, the 26-hectare (65-acre) site has been cleared, with road and utility construction progressing. Electrical substation construction was started, with the placement of two transformers near the facility site.





2.3.8 Solid Waste Management

Solid waste may be from work on the Hanford Site or from sources offsite that are authorized by DOE to ship waste to the site. Treatment, storage, and disposal of solid waste takes place at a number of locations on the Hanford Site. Information about specific locations is contained in the following sections.

2.3.8.1 Central Waste Complex

D. G. Saueressig

Waste is received at the Central Waste Complex in the 200-West Area (see Figure 1.3) from sources at the Hanford Site and any offsite sources that are authorized by DOE to ship waste to the Hanford Site for treatment, storage, and disposal. Ongoing cleanup, research and development activities on the Hanford Site, as well as remediation activities, generate most of the waste received at the Central Waste Complex. Offsite waste has been primarily from other DOE sites and U.S. Department of Defense facilities. The characteristics of the waste received vary greatly, including low-level, transuranic, or mixed waste, and radioactively contaminated polychlorinated biphenyls.

The Central Waste Complex can store as much as 22,710 m^3 (29,705 yd^3) of low-level mixed waste and transuranic waste. This capacity is adequate to store the projected volumes of low-level, transuranic, mixed waste, and radioactively contaminated polychlorinated biphenyls to be generated, assuming on-schedule treatment of the stored waste. Treatment will reduce the amount of waste in storage and make room for newly generated mixed waste. The dangerous waste designation of each container of waste is established at the point of origin based on process knowledge or sample analysis.

2.3.8.2 Waste Receiving and Processing Facility

H. C. Boynton

The Waste Receiving and Processing Facility began operations in 1997 and analyzes, characterizes, and prepares drums and boxes of waste for disposal. The 4,800-m^2 (52,000-ft^2) facility is located near the Central Waste Complex in the 200-West Area (see Figure 1.3). The facility is designed to process ~6,800 drums and 70 boxes of waste annually for 30 years.

Waste destined for the Waste Receiving and Processing Facility includes Hanford's legacy waste as well as newly generated waste from current site cleanup activities. The waste consists primarily of contaminated clothing, gloves, facemasks, and small tools. Processed waste that qualifies as low-level waste and meets disposal requirements is direct-buried onsite. Low-level waste not meeting direct burial requirements is processed in the facility for onsite burial or prepared for future treatment at other onsite or offsite treatment, storage, and disposal facilities. Waste designated at the facility to be transuranic is certified and packaged for shipment to the Waste Isolation Pilot Plant in Carlsbad, New Mexico, for permanent disposal. Other materials requiring further processing to meet disposal criteria are retained, pending treatment.

2.3.8.3 Radioactive Mixed Waste Disposal Facility

D. E. Nester

The Radioactive Mixed Waste Disposal Facility is located in the 218-W-5 low-level waste burial ground in the 200-West Area and is designated as trenches 31 and 34 (see Figure 1.3). Trench 34 began to be used for disposal during September 1999. Prior to this, trenches 31 and 34 were used for storage. Trench 31 will continue to be used for storage, when needed, to accommodate large items awaiting disposal into trench 34. Currently, there are ~900 m^3 (1,177 yd^3) of waste contained in about 670 waste packages disposed in Trench 34. No waste is currently stored in Trench 31. The trenches are rectangular landfills, with approximate base dimensions of 76 by 30 meters (250 by 100 feet). The bottoms of the excavations slope slightly, giving a variable depth of 9 to 12 meters (30 to 40 feet). These trenches comply with RCRA requirements because they have double liners and systems to collect and remove leachate. The bottom and sides of the facilities are covered with a layer of soil (1 meter [3 feet]) to protect the liner system during fill operations. There is a recessed section at the end of each excavation that houses a sump for leachate collection. Access to the bottom of each trench is provided by ramps along the perimeter walls.

2.3.8.4 T Plant Complex

B. M. Barnes

The T Plant complex in the 200-West Area (see Figure 1.3) provides waste treatment and storage and decontamination services for the Hanford Site. The T Plant complex currently operates under interim status. Waste handling activities at the T Plant complex in 2000 included the following:

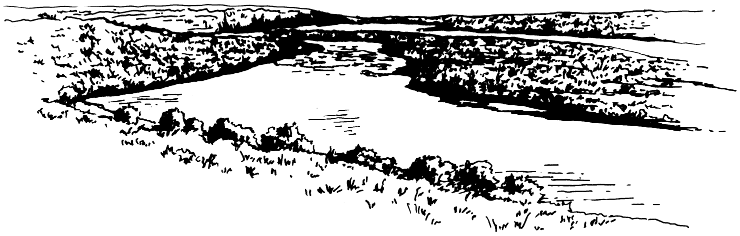
- perform content verification of waste being shipped to solid waste facilities for storage or disposal
- re-package and/or sample waste to meet solid waste acceptance criteria or to determine acceptability of waste for treatment
- treat dangerous and mixed waste to meet RCRA requirements for land disposal
- decontaminate equipment to allow for reuse or disposal as waste
- store 27 metric tons (30 tons) of spent reactor fuel (from Shippingport, Pennsylvania) in a water basin.

2.3.8.5 Radioactive Mixed Waste Treatment and Disposal

D. E. Nester

During 2000, 1,285 m^3 (1,681 yd^3) of DOE mixed waste were treated and/or direct disposed. The waste materials were obtained from a number of projects including the following:

- 1,179 m^3 (1,542 yd^3), or about 1,000 packages of various sizes, of mixed waste debris previously stored at the Central Waste Complex were shipped to the Allied Technology Group Mixed Waste Treatment Facility located in Richland, Washington. Allied Technology Group used their RCRA permitted treatment process of macroencapsulation to make the debris compliant with EPA Land Disposal Restriction requirements. The treated waste was then returned to Hanford for final disposal at the Radioactive Mixed Waste Disposal Facility.
- 78 m^3 (102 yd^3), or 375 drums, of mixed waste consisting of inorganic solids from the Effluent Treatment Facility were removed from storage at the Central Waste Complex. The waste was shipped to the Radioactive Mixed Waste Disposal Facility and prepared for disposal. The drums were visually inspected and void-filled as necessary to meet disposal requirements. The drums were then placed into the Radioactive Mixed Waste Disposal Facility for final disposal.
- 28 m^3 (37 yd^3), or one large package, of mixed waste debris was cleaned from the Canyon Deck area of Hanford's T Plant facility. The mixed waste debris was macroencapsulated at T Plant to meet EPA Land Disposal Restriction requirements. The treated waste was then shipped to the Radioactive Mixed Waste Disposal facility for final disposal.



2.3.8.6 Radioactive Mixed Waste Treatment Contracts

D. E. Nester

In November 1995, DOE awarded a contract to Allied Technology Group, Richland, Washington, for thermal treatment of Hanford's mixed waste in accordance with RCRA and the *Toxic Substances Control Act*. During December 2000, Allied Technology Group initiated treatment of Hanford's thermally treatable waste with the use of their newly obtained GASVIT® treatment technology. The treated waste was returned to Hanford for burial at the Radioactive Mixed Waste Disposal Facility. Allied Technology Group is expected to increase their thermal treatment capacity during 2001 until they reach their RCRA/*Toxic Substance Control Act* permitted levels.

During 1997, a competitive procurement was conducted for the processing of mixed waste requiring non-thermal treatment in accordance with RCRA. The contract was also awarded to Allied Technology Group. During 2000, Allied Technology Group processed 1,179 m^3 (1,542 yd^3) of Hanford's mixed waste debris via this contract. The treated waste was returned to Hanford for disposal at the Radioactive Mixed Waste Disposal Facility.

2.3.8.7 Reactor Compartments

S. G. Arnold

Eight disposal packages containing defueled United States Navy reactor compartments were received and placed in Trench 94 in the 200-East Area during 2000. All eight reactor compartments were from submarines. This brings the total number of reactor compartments received to 94. All reactor compartments shipped to the Hanford Site for disposal have originated from decommissioned nuclear-powered submarines or cruisers.

2.3.9 Liquid Effluent Treatment

Hazardous and untreated radioactive liquid waste is no longer discharged directly to the environment at the Hanford Site. Liquid effluents are managed in treatment, storage, and disposal facilities to comply with RCRA and state regulations.

2.3.9.1 242-A Evaporator

S. S. Lowe

Storage space is limited in the double-shell tanks to support remediation of tank waste and cleanup of the Hanford Site. The 242-A evaporator in the 200-East Area concentrates dilute liquid tank waste by evaporation (see Figure 1.3). The volume of tank waste is reduced to eliminate the need to construct additional double-shell tanks. The concentrated tank waste is returned to the double-shell tanks for storage. One campaign was conducted at the 242-A evaporator in 2000. The run treated 5.07 million liters (1.34 million gallons) of tank waste and produced 3.09 million liters (815,000 gallons) of process condensate. One 242-A evaporator campaign is planned for 2001, and two campaigns are planned in 2002.

Effluent treatment and disposal capabilities are available to support the continued operation of the 242-A evaporator. The Effluent Treatment Facility near the 200-East Area was constructed to treat the process condensate from the 242-A evaporator and other radioactive liquid waste. The process condensate is sent to the Liquid Effluent Retention Facility for interim storage while awaiting treatment in the Effluent Treatment Facility. Cooling water and non-radioactive steam condensate from the 242-A evaporator are discharged to the 200 Areas Treated Effluent Disposal Facility.

2.3.9.2 Liquid Effluent Retention Facility

S. S. Lowe

The Liquid Effluent Retention Facility in the 200-East Area (see Figure 1.3) consists of three RCRA-compliant surface impoundments to temporarily store process condensate from the 242-A evaporator and other aqueous waste. The Liquid Effluent Retention Facility provides equalization of the flow and pH of the feed to the Effluent Treatment Facility. Each basin has a maximum capacity of 29.5 million liters (7.8 million gallons). Generally, spare capacity is maintained in the event a leak should develop in an operational basin. Each basin is constructed of two, flexible, high-density, polyethylene membrane liners. A system is provided to detect, collect, and remove leachate from between the primary and secondary liners. Beneath the secondary liner is a soil/bentonite chain barrier should the primary and secondary liners fail. Each basin has a mechanically tensioned floating membrane cover constructed of very low-density polyethylene to keep out unwanted material and to minimize evaporation of the basin contents. The facility began operation in April 1994 and receives liquid waste from both RCRA- and CERCLA-regulated cleanup activities. Approximately 42.3 million liters (11.2 million gallons) of aqueous waste were stored in the basins at the end of 2000.

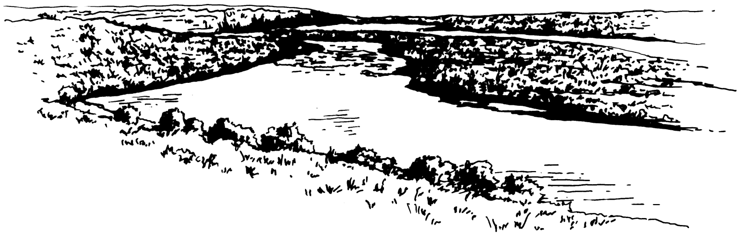
2.3.9.3 200 Areas Effluent Treatment Facility

S. S. Lowe

Liquid effluents are treated in the Effluent Treatment Facility (200-East Area, see Figure 1.3) to remove toxic metals, radionuclides, and ammonia, and destroy organic compounds. The treated effluent is stored in verification tanks, sampled and analyzed, and discharged to the State-Approved Land Disposal Site (also know as the 616-A crib). The treatment process constitutes best available technology and includes pH adjustment, filtration, ultraviolet light/peroxide destruction of organic compounds, reverse osmosis to remove dissolved solids, and ion exchange to remove the last traces of contaminants. The facility began operation in December 1995. Treatment capacity of the facility is 570 liters per minute (150 gallons per minute). Approximately 88.6 million liters (23.4 million gallons) of aqueous waste were treated in 2000.

The treated effluent is sampled to verify that the radioactive and hazardous waste constituents have been reduced to regulatory levels, then discharged via a dedicated pipeline to the State-Approved Land Disposal Site. The disposal site is located north of the 200-West Area (see Figure 1.3) and consists of an underground drain field. Tritium in the liquid effluent cannot be removed practically, and the location of the disposal site maximizes the time for migration of contaminated groundwater to reach the Columbia River and, thus, allow time for radioactive decay. The disposal site is permitted under the WAC 173-216 State Waste Discharge Permit Program. The discharge permit requires monitoring of the groundwater and the treated effluent to ensure that levels for certain constituents are not exceeded. Permit limits were not exceeded in 2000. The discharge permit for the Effluent Treatment Facility was renewed in 2000.

Secondary waste from treating aqueous waste is concentrated, dried, and packaged in 208-liter (55-gallon) drums. The solid secondary waste from treating RCRA-regulated aqueous waste is transferred to the Central Waste Complex for subsequent treatment (if needed to meet Land Disposal Restriction treatment standards) and disposal in the mixed waste disposal unit in the 200-West Area. The solid secondary waste from treating CERCLA-regulated aqueous waste is disposed of in the Environmental Restoration Disposal Facility near the 200-West Area (see Figure 1.3).



2.3.9.4 200 Areas Treated Effluent Disposal Facility

S. S. Lowe

The 200 Areas Treated Effluent Disposal Facility is a collection and disposal system for non-RCRA permitted waste streams. The individual waste streams must be treated or otherwise comply with "best available technology/all known available and reasonable treatment." Implementation of regulatory "best available technology/all known available and reasonable treatment" is the responsibility of the generating facilities. The major components of the 200 Areas Treated Effluent Disposal Facility include ~18 kilometers (~11 miles) of buried pipeline connecting three pumping stations, one disposal sample station (6653 Building) and two 2-hectare (5-acre) disposal ponds located east of the 200-East Area. The facility began operation in April 1995 and has a capacity of 12,900 liters per minute (3,400 gallons per minute). There are currently 15 waste streams being sent to the 200 Areas Treated Effluent Disposal Facility (see Figure 1.3). Approximately 502 million liters (133 million gallons) of effluent were discharged altogether in 2000.

The discharge from the 200 Areas Treated Effluent Disposal Facility must comply with limits in the WAC 173-216 State Waste Discharge Permit. The discharge permit requires monitoring of the effluent and the groundwater to ensure that concentrations for certain constituents are not exceeded. End-of-pipe sampling and continuous on-line monitoring (for flow, pH, and conductivity) of the combined waste stream is performed at the 6653 Building. The individual generating facilities also are required to perform on-line monitoring and sampling; the requirements depend on the individual waste streams. There were two non-compliances with the discharge permit in 2000 and both were corrected (see Section 2.2.8.1). One was for not achieving the specified practical quantification level when analyzing for a particular contaminant. The other was for use of a non-accredited laboratory for tritium analysis.

The discharge permit for the 200 Areas Treated Effluent Disposal Facility was renewed in 2000.

2.3.9.5 Miscellaneous Streams

D. M. Korematsu-Olund

In February 1995, Washington State Department of Ecology approved a *Plan and Schedule for Disposition and Regulatory Compliance for Miscellaneous Streams* (DOE/RL-93-94). This plan and schedule required that all miscellaneous streams be permitted under WAC 173-216. Categorical permits were used to permit miscellaneous streams with similar characteristics. Categorical permits have been issued for the following:

- hydrotesting, maintenance, and construction discharges. Permit # ST-4508 was issued in May 1997
- cooling water discharges and uncontaminated streams condensate. Permit # ST-4509 was issued in May 1998
- industrial stormwater discharge. Permit # ST-4510 was issued in April 1999.

The permitting process was completed in 1999 with the issuance of the last Categorical Permit ST-4510. All compliance milestones identified in the plan and schedule (DOE/RL-93-94) have been fulfilled, and the annual submittal of the Hanford Site Miscellaneous Streams Inventory report is no longer required.

In January 2000, DOE issued the *Pollution Prevention and Best Management Practices Plan for State Waste Discharge Permits ST 4508, ST 4509, and ST 4510* (DOE/RL-97-67). This plan summarized the compliance requirements stated in all the categorical permits and set conditions for the individual streams. The pollution prevention and best management practices plan details implementation of remediation activities to prevent further contamination of groundwater.

In compliance with WAC 173-218, which requires registration of Class V underground injection control wells, a significant and ongoing effort to verify location and status of all Class V underground injection control wells on the Hanford Site was begun in February 2000. A large number of underground injection control wells were determined to be inactive and were removed from the list of active wells. The information gathered will be compiled and submitted to the Washington State Department of Ecology in 2001, as required.

2.3.10 Revegetation and Mitigation Planning

A. L. Johnson and M. R. Sackschewsky

Valuable wetland habitat was created near the Columbia River in the process of excavating fill material from Borrow Pit 24 to use as backfill at waste sites in the nearby 100-B/C Area. Restoration of the pit was initiated during the final phase of material excavations by creating channels and islands and exposing the water table. This process combined a restoration project with a construction project to create a valuable wildlife habitat at little to no additional cost to the project. Wetland species including cattails and willows have begun to inhabit the area.

Some of the native sagebrush plants in Horn Rapids Park that were burned during the June 2000 wildfire were replaced. Approximately 8,100 sagebrush plants were planted by volunteers from the local community along transects within the park and adjacent to the Yakima River. The planted sagebrush will help replace habitat and provide a seed source to the area.

The final phase of revegetation on the 100-B/C liquid effluent disposal sites 116-C-5, 116-B-1, and 116-B-11 was completed. The 5.27-hectare (13-acre) area was planted with 2,600 sagebrush plants following the hydroseeding of native grasses and forbs in December 1999. The planted sites will be monitored for 5 years to ensure the planting effort is successful.

In concert with the U.S. Fish and Wildlife Service, ~80,000 bareroot and potted sagebrush plants were planted on about 80 hectares (200 acres) at 9 locations on the Fitzner/Eberhardt Arid Lands Ecology Reserve Unit during December 2000. This effort was the last phase of sagebrush planting as mitigation for the disturbance of sagebrush habitat resulting from the development of the site and infrastructure for the planned waste vitrification facility.

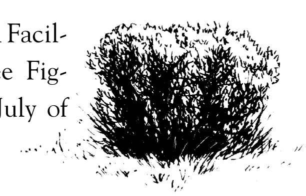
2.3.11 Environmental Restoration Project

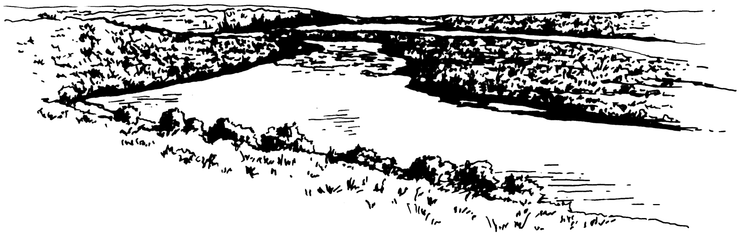
J. G. April, C. J. Kemp, R. R. Nielson, R. V. Roeck, M. A. Casbon, R. A. Carlson, J. F. Ollero, and C. W. Hedel

DOE selected a contractor in 1994 to oversee environmental restoration projects at the Hanford Site. The Environmental Restoration Project includes characterization and remediation of contaminated soil and groundwater, sitewide vadose zone/groundwater project integration, decontamination and decommissioning of facilities, surveillance and maintenance of inactive waste sites, and the transition of facilities into the surveillance and maintenance program.

2.3.11.1 Environmental Restoration Disposal Facility

The Environmental Restoration Disposal Facility is located near the 200-West Area (see Figure 1.3). The facility began operations in July of





1996 and is designed to serve as the central disposal site for contaminated waste removed during cleanup operations conducted under CERCLA on the Hanford Site. In order to provide a protective barrier, the facility was constructed with a RCRA subtitle C compliant double liner and leachate collection system. In 2000, waste was first placed into the new cells that were constructed in 1999. Later in 2000, an interim cover was placed over portions of cells 1 and 2 that had been filled to their final configuration. Cleanup materials disposed in the facility include soil, rubble, or other solid waste materials contaminated with hazardous, low-level radioactive or mixed (combined hazardous, chemical, and radioactive) waste. As of early 2001, the facility had received 2.4 million metric tons (2.65 million tons) of contaminated soil and other waste.

2.3.11.2 Waste Site Remediation

Full-scale remediation of waste sites began in the 100 Areas in 1996. Remediation and backfill activities continued through 2000 at several liquid waste disposal sites in the 100-B/C, 100-D/DR, and 100-HR remediation areas located in the 100-B/C, 100-D, and 100-H Areas, respectively. In July 2000, work began in the 100-FR and 100-NR remediation areas located in the 100-F and 100-N Areas, respectively. Figure 1.1 shows the former reactor areas along the Columbia River.

In the 100-B/C Area, 12 waste sites were backfilled in 2000. Through December 2000, 621,100 metric tons (685,000 tons) of contaminated soil were removed and shipped to the Environmental Restoration Disposal Facility.

In the 100-D/DR Area, 67,000 metric tons (74,000 tons) of soil were removed from 10 waste sites. Twelve waste sites were backfilled. Through December 2000, 641,000 metric tons (709,000 tons) of contaminated soil were removed and shipped to the Environmental Restoration Disposal Facility.

In the 100-HR Area, 190,600 metric tons (211,000 tons) of soil were removed from the nine waste sites. Through December 2000, 412,000 metric tons (455,000 tons) of contaminated soil were removed and shipped to the Environmental Restoration Disposal Facility.

In the 100-FR Area, 148,300 metric tons (164,000 tons) of soil were removed from four waste sites. The startup of the remedial actions at 100-FR completed Tri-Party Agreement Milestone M-16-13A.

In the 100-NR Area, an Interim Remedial Action Record of Decision and Closure Plan was issued under the Tri-Party Agreement for cleanup of six treatment, storage, and disposal units within the 100-NR-1 Operable Unit on January 19, 2000. The Record of Decision integrated CERCLA and RCRA objectives and specified a cleanup remedy of remove/treat/dispose for the treatment, storage, and disposal units. Remedial design for the treatment, storage, and disposal units was completed in mid-2000. In July 2000, remediation began at the 116-N-3 treatment, storage, and disposal unit as required by the Hanford Sitewide RCRA Permit. Through 2000, ~25,000 metric tons (28,000 tons) of soil were removed from 116-N-3 as well as from two other treatment, storage, and disposal units, 120-N-1, 120-N-2, and associated waste site, 100-N-58. Remediation of the 116-N-3 treatment, storage, and disposal units is scheduled to continue through 2001 with completion planned for 2002.

An interim record of decision was issued for the 100 Areas Burial Grounds on September 16, 2000. It specified a cleanup remedy to remove/treat/dispose of contaminated soil, structures, and debris at the 100 Areas Burial Ground sites. This was the last interim record of decision required for the 100 Area waste sites.

Remediation work at the 300-FF-1 Operable Unit began in the 300 Area in 1997 (see Figure 1.1). Historically, both chemical and radiological materials were disposed of at the 300-FF-1 waste sites. In 2000, remediation operations excavated nearly 94,700 metric tons (104,600 tons) of contaminated soils and debris that were shipped to the Environmental Restoration Disposal Facility. Over 408,700 metric tons (531,200 tons) have been removed through 2000. Remediation of the 316-2 North Process Pond, and 300 Area Landfills 1A (300-49) and 1B (300-50) was completed in 2000.

A record of decision (EPA 1999) was issued for the 100 Areas remaining sites in 1999. The record of decision includes ~200 waste sites that were not previously addressed in the 1995 100 Areas record of decision, or the 1997 amendment to the 100 Areas record of decision (100 Areas solid waste burial sites and waste sites at 100-N Area were not included). It specified a remove/treat/dispose remedy, for contaminated soil, structures, and debris at 46 of the remaining sites. The cleanup remedy is the method applied to 100 Areas record of decision sites and is consistent with other cleanup actions that are currently being conducted within the 100 Areas. The remainder of the sites is classified as candidate sites for confirmatory sampling to determine if there is residual contamination above cleanup levels. Contaminated sites will move directly into remove/treat/dispose and others will be closed out based on the confirmatory sampling efforts. In 1999, DOE began design of remedial actions for the remaining sites. These actions were completed in early 2000.

2.3.11.3 Facility Decommissioning Project

Decontamination and decommissioning activities continued in 2000 in the 100-DR, 100-H, and 100-F Areas. During the year, all planned demolition (including valve pit, exhaust plenum, and all below-grade tunnels) was completed at the 105-DR and 105-F reactors, excluding the 105-F Reactor Fuel Storage Basin. Ancillary facilities that supported the 105-DR and 105-F reactors (except for 117-DR) were removed and disposed. A subcontract was awarded for the 105-DR and 105-F safe storage enclosure pourback work. Pourbacks are the process of enclosing openings in the safe storage enclosure wall with structural concrete to prevent inadvertent pest or weather intrusion. The subcontractor has completed nearly all of the required pourbacks. These activities support the interim safe storage of the reactor buildings.

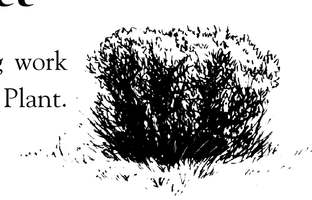
A baseline change proposal was approved to accelerate the 105-F Reactor Fuel Storage Basin demolition, initiated in late September. Demolition work at the 105-DR reactor has been completed, and work to clean out and demolish the 105-F Fuel Storage Basin has been initiated. Removal and characterization of the upper 5.2 meters (17 feet) was completed and, with regulatory approval, will be reused as backfill. A Brokk™ excavator was procured to assist with the contaminated debris removal. DOE/RL has issued a letter of direction articulating responsibilities for the disposition of any spent nuclear fuel found in the fuel storage basin, and engineering documentation required to proceed with the work is nearly completed.

Project closeout reports for the demolition of the 119-DR Exhaust Air Filter Sampling Building, 116-D and 115-DR exhaust stacks, and the 108-F Biology Laboratory were completed. Submittal of these reports constitutes formal completion of the demolition projects for these ancillary facilities.

Decontamination and decommissioning activities also began at the 105-D and 105-H reactor buildings. These activities included biological cleanup, legacy waste removal, asbestos abatement, liquid pipe checks, and other pre-demolition activities.

2.3.11.4 233-S Plutonium Concentration Facility Decontamination Project

Decontamination and decommissioning work Area adjacent to the Reduction-Oxidation Plant.



This work is being performed under a non-time-critical removal action under CERCLA. The 233-S facility and associated process equipment were used to concentrate plutonium produced at the Reduction-Oxidation Plant from 1955 to 1967. Loadout hood dismantlement and removal, ventilation system exhaust ducting removal, gross decontamination of the process hood, and viewing room equipment removal were completed in 2000. The facility poses special challenges to workers, engineering methods, safety documentation, and work methods because of the estimated large quantities of fissile material and high levels of contamination.

2.3.11.5 Surveillance/ Maintenance and Transition Project

This project performs surveillance and maintenance of inactive facilities and waste sites until final disposition can commence. The project also provides for the transfer, or transition, of facilities and waste sites into the Environmental Restoration Program after deactivation has been completed. Facilities transferred in 1998 and 1999 include Plutonium-Uranium Extraction Plant, B Plant, and 224-B Building facilities. Also, the project performs surveillance and maintenance of the Reduction-Oxidation Plant, U Plant, 224-U Building, N Reactor, B Reactor, C Reactor, and the 105-KE and 105-KW reactors (excluding the fuel storage basins). The project maintains 14 interim status RCRA treatment, storage, and disposal units awaiting closure. Also, the project maintains three major air emission stacks and two minor emission stacks as defined by 40 CFR 61.

Outdoor tasks within the project include the Radiation Area Remedial Action Program, which is responsible for the surveillance, maintenance, and decontamination or stabilization of 955 inactive waste sites that include former cribs, ponds, ditches, trenches, unplanned release sites, and burial grounds. These sites are maintained by performing periodic surveillances, radiation surveys, and herbicide applications and by initiating timely responses to identified problems. The overall objective of this project is to maintain these sites in a safe and stable configuration until final remediation strategies are identified and implemented. The main focus of this objective is to prevent the contaminants in these sites from spreading in the environment.

This project also analyzed the final status/condition of the canyon facilities (i.e., large concrete structures formerly used in Hanford Site production missions) that the project currently oversees and those that are coming to the project through facility transition activities. The U Plant canyon disposition initiative is evaluating the potential use of the canyon facilities as waste disposal units, or disposal in place with a cap, compared to standard decontamination and decommissioning of the facilities. A CERCLA feasibility study is being prepared for the U Plant facility that will result in a Record of Decision in 2002.

2.3.12 Groundwater/Vadose Zone Integration Project

T. M. Wintczak, M. J. Graham, G. B. Mitchem, and C. D. Wittreich

The Groundwater/Vadose Zone Integration Project brings together all activities that affect Hanford's subsurface, and ultimately, the Columbia River. Many of these activities are part of multiple cleanup projects that report to different managers and contractors. See Section 7.0 for information on monitoring and characterization activities.

A focus of the Groundwater/Vadose Zone Integration Project involves preparation of a cumulative impact assessment of Hanford Site radioactive and hazardous contaminants that have, or may, affect the many uses and users of the Columbia River. The project continues to work on the design of a system assessment capability to meet the needs identified in the Columbia River Comprehensive Impact Assessment Part II report (DOE/RL-96-16). To be successful, the project must:

- adopt a sitewide approach to project planning, funding, and data and information management to support cleanup decisions
- ensure that management attention is maintained on the subsurface and river resources
- be recognized for technical and scientific excellence in all products
- establish and ensure effective two-way communication with diverse project participants.

2.3.12.1 Groundwater Restoration

The overall objectives of groundwater restoration are to:

- protect aquatic receptors in the river bottom substrate from contaminants in the groundwater entering Columbia River
- reduce contamination in the areas of highest concentration
- prevent further movement of contamination
- protect human health and the environment.

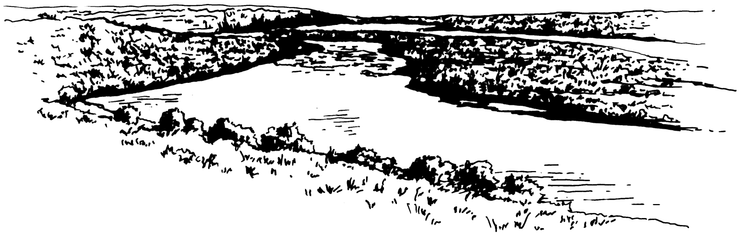
Summary descriptions of the groundwater restoration activities are discussed below.

Chromium. Groundwater contaminated with chromium underlies portions of the 100-D, 100-H, and 100-K Areas (the 100-HR-3 and 100-KR-4 Operable Units) and is of concern because of a potential to impact the Columbia River ecosystem. Low levels of chromium are toxic to aquatic organisms, particularly those that use the riverbed sediment as habitat (DOE/RL-94-102, DOE/RL-94-113). The relevant standard for protection of freshwater aquatic life is 10 mg/L of chromium (WAC 173-201A). Chromium concentrations exceeding 600 mg/L have been measured in the pore-water sediments of the Columbia River (BHI-00778). In 1994, a groundwater extraction system was installed in the 100-D Area to test chromium removal from groundwater using ion exchange technology. Following the approval of the record of decision in 1996 (EPA 1996), full-scale pump-and-treat systems were constructed in the 100-D, 100-H, and 100-K Areas. The objective of the pump-and-treat systems is to remove chromium contamination in the groundwater and thus minimize impacts to the Columbia River.

In 2000, the total amount of groundwater treated by the 100-D and 100-H pump-and-treat systems was 305.1 million liters (80.6 million gallons), with the removal of 30 kilograms (66.2 pounds) of chromium. To date, more than 959.1 million liters (253.3 million gallons) of groundwater have been treated, with 103.1 kilograms (227.3 pounds) of chromium removed (DOE/RL 2000-14). Treated groundwater is re-injected into the aquifer upgradient from the 100-H Area extraction wells. Groundwater from both the 100-D and 100-H sites is treated in the 100-H Area using separate treatment systems.

In 2000, the 100-KR pump-and-treat system treated 286.7 million liters (75.5 million gallons) of groundwater. During the process, 33.5 kilograms (73.8 pounds) of chromium were removed. Total chromium removed since operations began is 113.9 kilograms (251 pounds) through treatment of 908 million liters (239.9 million gallons) of water. Treated groundwater is re-injected into the aquifer upgradient from the 100-KR-4 extraction wells.

To further evaluate chromium and other groundwater contamination that might enter the Columbia River between monitoring wells, 178 aquifer sample tubes were installed in 1997 along and parallel to the Columbia River shoreline. The distance between the sample tubes was ~610 meters



(2,000 feet), except in known chromium plumes, where this was reduced to ~305 meters (1,000 feet). Sample tubes are constructed of 0.6-centimeter (0.25-inch) inner-diameter polyethylene tubing with a screen at the bottom that is placed anywhere from 0.9 to 9 meters (3 to 30 feet) below ground surface. Sample tube installations begin upstream from the 100-B/C Area and continue downstream ~40 kilometers (25 miles) to near the Old Hanford Townsite. Sample tube locations are shown in Figure 7.1.8.

In the fall of 2000, samples were collected from 34 sample tube locations. These samples were analyzed for chromium, nitrate, sulfate, tritium, strontium-90, total uranium, gross beta, and carbon-14. The results are being used to characterize groundwater near the Columbia River in support of remediation operations, monitoring objectives, and other environmental programs. Sample tube data provide site-specific information on the distribution of chromium that enters the river at locations near sensitive ecological receptors (e.g., salmon spawning areas). Additional discussion of chromium in groundwater in the 100 Areas is presented in Section 7.1.6.2.

In addition to pump-and-treat remediation, a technology called in situ redox manipulation was selected to remediate a high-concentration area beginning in 2000. The in situ redox manipulation technology creates a chemically reduced zone within a portion of the contaminated aquifer. As chromium-contaminated groundwater flows through the barrier, it is converted from a dissolved toxic form to a non-toxic solid form. The technology was initially tested and successfully applied during a chromium treatability test in the 100-D Area from 1997 to 1999.

Barrier construction is still underway in 2000 and will continue into 2001. At the end of the year, it was 165 meters (543 feet) in length and 15 meters (48 feet) wide. The final barrier should be over 680 meters (744 feet) long. The barrier will intercept and neutralize chromium-contaminated groundwater moving from the aquifer to the Columbia River. The current pump-and-treat systems will also continue to operate.

Strontium-90. The 100-NR-2 (N Springs) pump-and-treat system began operating in 1995 north of the N Reactor complex and was designed to reduce the flux of strontium-90 to the Columbia River. The pump-and-treat system operates extraction wells to maintain hydraulic capture. Groundwater is pumped into a treatment system to remove the strontium-90 contamination, with treated water re-injected upgradient into the aquifer. The system was upgraded in 1996 and has continued to operate through 2000. About 106 million liters (28 million gallons) were processed in fiscal year 2000. During that period, 0.18 curies of strontium were removed from the groundwater. Over 551.9 million liters (145.5 million gallons) of groundwater have been processed since the system began operation, removing 0.91 curies of strontium.

Carbon Tetrachloride. The carbon tetrachloride plume in the 200-West Area (originating in the 200-ZP-1 Operable Unit) covers over 11 square kilometers (4.2 square miles). The 200-ZP-1 pump-and-treat system has operated since 1997. In 2000, 300.4 million liters (80.3 million gallons) of groundwater were treated, removing over 1,183 kilograms (2,608 pounds) of carbon tetrachloride. A total of ~1.25 billion liters (356 million gallons) have been processed since startup, removing 9,570 kilograms (21,098 pounds) of carbon tetrachloride.

Uranium, Technetium-99, Carbon Tetrachloride, and Nitrates. Treatment of the groundwater plume underlying the 200-UP-1 Operable Unit in the 200-West Area continued throughout 2000. The contaminant plume contains uranium, technetium-99, carbon tetrachloride, and nitrate. A pump-and-treat system has operated since 1994 to contain the high concentration area of the uranium and technetium-99 plume. During early operations, groundwater was treated using ion-exchange resin to remove the uranium and technetium-99, and granular activated carbon to remove carbon tetrachloride. Since 1997, contaminated groundwater has been transferred by pipeline to Basin 43 at the 200 Areas Effluent Treatment Facility. Sophisticated treatment technology removes all four contaminants. Treated groundwater is then discharged north of the 200-West Area at the State-Approved Land Disposal Site.

The pump-and-treat system operated continually during the year 2000, except for a few scheduled shutdowns, including a brief period in early January because of concerns about possible computer problems. The single extraction well was used to pump 63.2 million liters (16.6 million gallons) of groundwater, which were treated to remove 5.6 grams (0.0124 pound) of technetium-99, 13.6 kilograms (29.9 pounds) of uranium, 1.66 kilograms (3.6 pounds) of carbon tetrachloride, and 2,807 kilograms (6,188 pounds) of nitrate. The pump-and-treat operation made significant progress toward reducing technetium-99 concentrations to below required cleanup concentration levels, but less progress was made with uranium (DOE/RL-99-79).

2.3.12.2 Vadose Zone Remediation

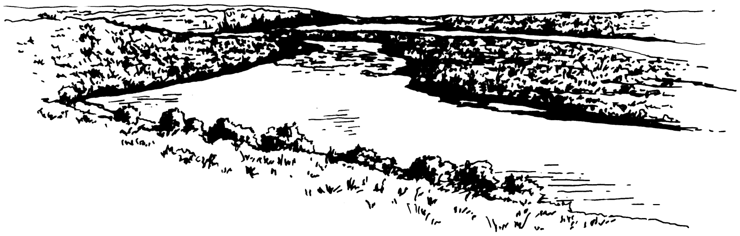
Soil vapor extraction systems designed to remove carbon tetrachloride vapor from the vadose zone beneath the 200-West Area began operating in 1992 and continued through 1999. Soil vapor extraction has been conducted in the vicinity of three historical carbon tetrachloride disposal sites: the 216-Z-1A-tile field, the 216-Z-9 trench, and the 216-Z-18 crib. Soil vapor is either pumped or flows naturally through granular activated carbon, which absorbs carbon tetrachloride. The granular activated carbon is then shipped offsite for treatment.

Soil vapor extraction systems operate at three different flow rates; 14.2-m^3 per minute (500-ft^3 per minute), 28.3-m^3 per minute (1,000-ft^3 per minute), and 42.5-m^3 per minute (1,500-ft^3 per minute). However, all three pumping systems were maintained in standby mode during 2000. Passive soil vapor extraction systems, which use atmospheric pressure fluctuations to remove carbon tetrachloride vapor from the vadose zone, were installed at wells near the 216-Z-1A-tile field and 216-Z-18 crib in 1999. These passive systems operated throughout 2000. Since operations began, soil vapor extraction has removed 76,460 kilograms (168,560 pounds) of carbon tetrachloride from the vadose zone.

2.3.12.3 Vadose Zone Characterization in the 200 Areas

Remedial investigation/feasibility study activities continued in 2000 at soil waste sites in the 200 Areas. Work was performed within the characterization and regulatory framework defined in the 200 Area Remedial Investigation/Feasibility Study Implementation Plan (DOE/RL-98-28). Work was performed at several operable units, which were at various stages of the CERCLA Remedial Investigation/Feasibility Study process. Summary descriptions of activities performed in 2000 are provided below.

200-CW-1 Gable Mountain Pond/B Pond Cooling Water Operable Unit. The 200-CW-1 Gable Mountain Pond/B Pond and Ditches Cooling Water Operable Unit consists of former ponds and ditches located within the 200-East Area and north and east of the 200-East Area. These sites received mostly cooling water from facilities such as the Plutonium-Uranium Extraction Plant and B Plant. A draft remedial investigation report was prepared for regulator review (DOE/RL-2000-35) that evaluated the results of the fieldwork (i.e., the remedial investigation) performed the previous year. The report analyzed soil contaminant data collected from 27 test pits, 2 boreholes, and 191 soil samples from four waste sites (216-A-25 pond, 216-B-2-2 ditch, 216-B-3-3 ditch, and 216-B-3 pond) as reported in BHI-01367.



200-CS-1 Chemical Sewer Operable Unit. The 200-CS-1 Operable Unit consists of waste sites that received chemical sewer wastewater from major plant facilities in both the 200-West and 200-East Areas. A remedial investigation/feasibility study work plan was approved in 2000 that defines planned remedial investigation activities at four representative waste sites (216-S-10 pond, 216-S-10 ditch, 216-B-63 trench, and 216-A-29 ditch). The work included installation of vadose zone boreholes and test pits to collect soil samples, and conduct geophysical logging (DOE/RL-99-44).

200-CW-5 U Pond/Z Ditches Cooling Water Operable Unit. The 200-CW-5 Operable Unit consists of waste sites that received cooling water, steam condensate, and chemical sewer waste from facilities in the 200-West Area, including U Plant, powerhouse and laundry facilities, 242-S evaporator, and the Plutonium Finishing Plant and associated facilities. A remedial investigation/feasibility study work plan was approved in 2000 that defines planned remedial investigation activities at one representative waste site (216-Z-11 ditch). This work plan (DOE/RL-99-66) includes installation of vadose zone boreholes to collect soil samples and conduct geophysical logging.

200-PW-2 Uranium-Rich Process Waste Operable Unit. Waste sites in this operable unit received uranium-rich condensate/process waste, primarily from waste streams generated at U Plant, Reduction-Oxidation Plant, and Plutonium-Uranium Extraction Plant, as well as B Plant and Semi-Works facilities. The draft work plan (DOE/RL-2000-60) was prepared and submitted for regulator review. The work plan proposes remedial investigation activities at four representative waste sites (216-A-19 trench, 216-B-12 crib, 216-A-10 crib, and 216-A-36B crib). The work includes installation of vadose zone boreholes to collect soil samples and conduct geophysical logging.

200-TW-1 Scavenged Waste and 200-TW-2 Tank Waste Operable Units. The 200-TW-1 Scavenged Waste Operable Unit consists of waste sites, mostly cribs and trenches, that received waste associated with uranium recovery activities at U Plant. The 200-TW-2 Tank Waste Operable Unit consists of waste sites, mostly cribs and trenches, that received waste from the decontamination process at B Plant and T Plant. The draft work plan (DOE-RL-2000-38) was prepared and submitted for regulator review. The work plan proposes remedial investigation activities at three representative waste sites (216-T-26 crib in the 200-TW-1 Operable Unit, and the 216-B-7A crib and 216-B-38 trench in the 200-TW-2 Operable Unit).

200-PW-1 Plutonium/Organic-Rich Process Waste Operable Unit. The 200-PW-1 Plutonium/Organic-Rich Process Waste Operable Unit contains waste sites that received significant quantities of both carbon tetrachloride and plutonium as well as other contaminants associated with process waste from the Plutonium Finishing Plant and Plutonium Reclamation Facility. A remedial investigation/feasibility study work plan for this operable unit was started in 2000 and scheduled for completion in 2001. Remedial investigation activities are expected to focus on two representative waste sites including the 216-Z-1A tile field and the 216-Z-9 trench.

During 2000, a proof-of-principle test was performed at the 216-Z-1A Tile Field to assess the ability of a small-diameter passive neutron probe to detect soil contaminated at or above the level designated for transuranic waste (100 nCi/g). Prior spectral gamma logging results showed that the tile field soil was contaminated with transuranic isotopes at levels above 100 nCi/g. Results for the passive neutron probe mirrored the gamma logging results, and the 100 nCi/g transuranic waste threshold was clearly discernible (BHI-01436). The passive neutron probe technique also was noted to be cost-effective.

200-BP-1 Prototype Hanford Barrier Performance Monitoring. Performance monitoring of the Prototype Hanford Barrier continued in

2000. Activities included water balance monitoring, stability surveys, and biotic surveys. Improved probes for automated monitoring of soil water content and storage were installed. An annual letter report[a] was prepared to document the monitoring results.

2.3.13 Research and Technology Development

T. M. Brouns

The Tanks Focus Area was created in 1994 by DOE's Office of Environmental Management to integrate tank waste remediation efforts across the DOE complex. In support of the Office of River Protection, the Tanks Focus Area addressed a number of high priority issues in 2000. Many of these activities contributed to improved tank farm operations, while others will support future waste retrieval, treatment, and tank closure activities at the Hanford Site.

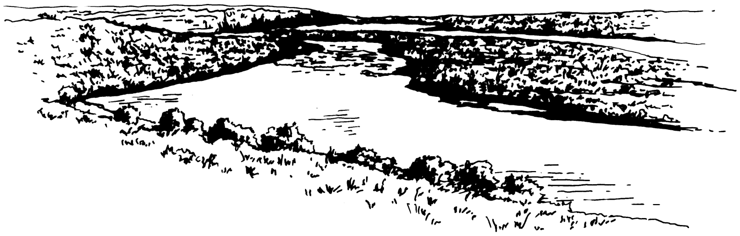
2.3.13.1 Corrosion Control

The Tanks Focus Area assisted in developing and deploying electrochemical noise corrosion probes in Hanford waste tanks to guard against tank wall corrosion and to reduce waste volumes. In January 2000, an improved corrosion probe was installed in double-shell tank 241-AN-105 located in the AN tank farm, 200-East Area. Features of the new probe add to the functionality of the system, provide a better understanding of the relationship between corrosion and other tank operations parameters, and optimize the use of the tank riser that houses the probe. Four probes are now installed in tanks at the AN tank farm, and a central monitoring station was installed in the AN-271 instrument building in August 2000 to collect data from the probes. Data are integrated at the monitoring station for real-time comparative analyses. Replacement of current baseline chemistry monitoring techniques with corrosion monitoring equipment is being considered.

2.3.13.2 Mobile Variable Depth Fluidic Sampler Demonstration

A new mobile sampling system that uses power fluidics technology to collect and transfer Hanford tank waste samples is being designed and tested. Consistent with RCRA sampling requirements, the modified sample collection method uses an upright (as opposed to inverted) sample bottle with a septum and a needle, thereby achieving the RCRA-required zero headspace in the bottle. An initial demonstration of the fluidic sampling method in January 2000 resulted in some sand surrogates remaining in the sample reservoir. Subsequent tests on the redesign showed that surrogates containing sand completely drained from the sample holdup reservoir into the sample bottle. Conceptual design of the above-riser sample station and deployment platform was also initiated in 2000, followed by a technical review with a broad range of users directly involved in the project. The new sampling method will provide a representative, and preferably rapid, sampling and analysis system so that feeds to the cross-site waste transfer line and to both the low-level liquid waste and high-level liquid waste treatment facilities can be staged successfully with a minimum impact on tank space.

(a) Letter Report CCN 083132, *200-BP-1 Prototype Hanford Barrier Annual Monitoring Report for Fiscal Year 2000*, from M. J. Graham, Bechtel Hanford, Inc., to B. L. Foley, DOE Richland Operations Office, Richland, Washington, dated October 19, 2000.



2.3.13.3 Remote Pit Operation Enhancements at Hanford

The use of a remote system for pump pit operations would reduce worker exposure and enable more thorough removal of discarded materials. In March 2000, a kickoff meeting was held to review the functions and requirements needed for a remote pit operations system and to develop procurement specifications. The remote system needed to be protected from excessive contamination, easily dismantled, transported and stored, and at the same time function correctly during pump pit operations. It was determined that a dexterous arm on the end of a vehicle-mounted boom would likely meet the requirements for the system. Later in 2000, a contract for the manipulator arm, the critical component of the remote "Pit Viper" system, was issued.

2.3.13.4 Pipeline Unplugging Demonstrations

Pipelines for transferring tank waste is typically buried and contaminated with highly radioactive materials. Pipeline unplugging technologies must both locate the plug and perform an unplugging task without causing damage to the pipelines. Identification of viable commercial technologies to recover from potential waste transfer line plugging is critical to ensure continuous feed delivery and waste transfer operations at Hanford. Three pipelines representative of actual waste transfer line configurations were constructed in 1999 in a test bed at Florida International University to demonstrate commercial technologies for locating and unplugging pipelines. Following successful validation testing of the pipelines in 2000, four commercial vendors demonstrated their technologies to remove blockages of various sizes and compositions. Methods used included traditional "plumbing" type mechanical methods, and more innovative processes of fluidic wave action and sonic resonance vibration. Testing data will be used to help select the most efficient, cost-effective, and safest technologies for unplugging waste transfer pipes at the Hanford Site.

2.3.13.5 Double Salt Experiments

The high ionic strength of Hanford Site tank waste solutions can lead to uncertainties in equilibrium calculations for transporting dissolved saltcake. As new discoveries of double salts in Hanford tank waste is uncovered, the model database for predicting waste transfer behaviors requires updating. A series of calculations was performed on concentrated sodium nitrate to compare experimental results with predictions made by the Environmental Simulation Program for actual Hanford saltcake dissolution in an effort to improve the Environmental Simulation Program database. Approximately 180 double-salt samples were prepared in 2000 to conduct aging experiments. The data will be used to determine the effectiveness of the saltcake dissolution process with double salts and at higher operating temperatures. Data from this effort will be used to expand the Environmental Simulation Program model to include information on critical double salts found in Hanford waste.