6.1 Cleanup Operations

This section describes ongoing cleanup and remediation activities on the Hanford Site.

6.1.1 Groundwater Remediation Project

B. H. Ford

The U.S. Department of Energy (DOE) established the Groundwater/Vadose Zone Integration Project in 1997. On July 1, 2002, the project was transferred from the environmental restoration contractor, Bechtel Hanford, Inc., to Fluor Hanford, Inc. and designated as the Groundwater Remediation Project. The Groundwater Remediation Project team includes staff from Fluor Hanford, Inc.; CH2M HILL Hanford Group, Inc.; and Pacific Northwest National Laboratory, as well as support from other national laboratories and universities. The purpose of the Groundwater Remediation Project is to coordinate all projects at the Hanford Site involved in characterization, monitoring, and remediation of groundwater and vadose zone contamination, with the overall objective of protecting the Columbia River.

The 200 Area's Waste Site Remedial Actions group within the Groundwater Remediation Project was transferred to the Central Plateau Remediation Project during 2004, and is now designated as the Decontamination and Decommissioning Project. Information on groundwater and vadose zone remediation systems in use in 2004 is summarized in Section 8.7.

6.1.2 Waste Site Investigations and Remediation Activities in the 200 Areas

L. C. Hulstrom

Remedial investigation/feasibility study activities continued during 2004 at soil waste sites in the 200 Areas. Work was performed within the characterization and regulatory framework defined in the *200 Areas Remedial Investigation/Feasibility Study Implementation Plan – Environmental Restoration Program* (DOE/RL-98-28). Work was performed at a number of operable units, which were at various stages of the *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA) remedial investigation/feasibility study process. The following summary provides descriptions of activities that were performed during 2004.

200-CW-1 Operable Unit. The 200-CW-1 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 cooling water from facilities such as the Plutonium-Uranium Extraction (PUREX) and B Plants. Preparation of a feasibility study for the operable unit was completed in 2003. The feasibility study refines remedial action objectives and remedial technologies originally identified in DOE/RL-98-28 and develops and evaluates remedial alternatives for the representative sites in the 200-CW-1 Operable Unit. The results of the remedial alternative evaluations of the representative sites are applied to the analogous sites in the operable unit as defined in DOE/RL-98-28. The feasibility study includes ecological screening level and baseline risk assessments. In addition to the 200-CW-1 Operable Unit waste sites,

the 200-CW-3 Operable Unit and several other 200-North Area waste sites are included in the feasibility study based on negotiations with state and federal regulatory agencies on the Central Plateau *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement, Ecology et al. 1989) milestones. Under Tri-Party Agreement Milestone M-015-38A, the feasibility study and proposed plan were submitted to the state and federal regulatory agencies on March 31, 2003. Comments from the regulatory agencies have been incorporated. In addition, ecological sampling was conducted on two of the 200-CW-1 waste sites in the fall of 2003. Additional ecological sampling was conducted in the spring of 2004. The feasibility study is undergoing revision to incorporate the data from these sampling events and to support the public review of the proposed plan. The feasibility study report is made available during the public review of the proposed plan as supporting information since it contains much more detail than what is presented in the proposed plan.

200-CS-1 Operable Unit. The 200-CS-1 Operable Unit consists of waste sites that received sewer wastewater containing chemicals from major plant facilities in both the 200-West and 200-East Areas. A remedial investigation/feasibility study work plan (DOE/RL-99-44) was approved during 2000 that defines planned remedial investigation activities at four representative waste sites of the operable unit: the 216-S-10 pond, 216-S-10 ditch, 216-B-63 trench, and 216-A-29 ditch. A borehole at the 216-S-10 pond was installed during 1999 and completed as a *Resource Conservation and Recovery Act* (RCRA) groundwater monitoring well. Test pit characterization work was completed in 2002 at the 216-A-29 ditch and partially completed at the 216-B-63 trench. The final remedial investigation activities were performed in 2003 and included characterization work at the 216-B-63 trench, 216-S-10 pond, and 216-S-10 ditch. In addition, three boreholes (one at each waste site) were installed at the 216-A-29 ditch, 216-B-63 trench, and 216-S-10 ditch. The borehole at the 216-S-10 ditch was completed as a RCRA groundwater monitoring well. During 2004, the remedial investigation report (DOE/RL-2004-17), was submitted to the regulatory agencies, fulfilling Tri-Party Agreement Milestone M-015-39B. Upcoming activities for 2005 include developing a feasibility study and proposed plan, plus a closure plan for this operable unit.

200-CW-2, 200-CW-4, 200-CW-5, and 200-SC-1 Operable Units. The 200-CW-2, 200-CW-4, 200-CW-5, and 200-SC-1 consolidated operable unit group consists of waste sites that received cooling water, steam condensate, and chemical sewer waste from facilities in the 200-West Area, including the U Plant, powerhouse and laundry facilities, 242-S evaporator, Plutonium Finishing Plant and associated facilities, Reduction-Oxidation (REDOX) Plant, T Plant, Plutonium-Uranium Extraction (PUREX) Plant, and Waste Encapsulation and Storage Facility. The 200-CW-5 remedial investigation/feasibility study work plan (DOE/RL-99-66) was approved in 2000 and defined planned remedial investigation activities at one representative waste site, the 216-Z-11 ditch. This work plan directed field characterization using driven soil probes and geophysical logging to locate the area with the highest levels of transuranic contamination for subsequent borehole sampling. A revision of the work plan was issued in March 2004.

Data from the field work described in the 2000 work plan were compiled into a remedial investigation report (DOE/RL-2003-11), which was provided to the regulatory agencies for review during May 2003 in fulfillment of Tri-Party Agreement Milestone M-015-40B. Review comments were incorporated and conditional approval of the remedial investigation report was received from the U.S. Environmental Protection Agency (EPA), pending resolution of two issues. The first issue was resolved with EPA in June 2004. The requested information for the second issue was transmitted to EPA for review and approval in early 2005.

In 2003, a feasibility study was initiated to evaluate the remedial alternatives that could be applied to the waste sites in the 200-CW-2, 200-CW-4, 200-CW-5, and 200-SC-1 Operable Units. This feasibility study (DOE/RL-2004-24), was submitted to the state and federal regulatory agencies for review, fulfilling the Tri-Party Agreement Milestone M-15-40C. Work in 2005 will concentrate on finalizing the document and preparing a proposed plan for public review.

200-LW-1 and 200-LW-2 Operable Units. The waste sites in the 200-LW-1 and 200-LW-2 Operable Units received two types of waste: liquid waste resulting from 300 Area process laboratory operations that supported radiochemistry metallurgical experiments and liquid

waste resulting mainly from laboratory operations in the 200 Areas that supported the major chemical processing facilities and equipment decontamination at T Plant. A work plan (DOE/RL-2001-66), was approved in 2002 that requires remedial investigation activities at four representative waste sites (216-T-28 crib, 216-B-58 trench, 216-S-20 crib, and 216-Z-7 crib) in the 200-LW-1 and 200-LW-2 Operable Units and includes borehole drilling, soil sampling, and geophysical logging. During late 2003, two 30.4-meter- (100-foot-) deep boreholes were drilled in the 216-B-58 trench in anticipation of the transfer of four 200-LW-1 Operable Unit waste sites in the BC cribs and trenches area into the 200-TW-1 Operable Unit. In May 2004, the transfer of these sites was completed. Field activities at the 216-T-28 and 216-S-20 cribs were completed in the fall of 2004. Activities at the 216-Z-7 crib were scheduled to occur in the spring of 2005.

200-MW-1 Operable Unit. The waste sites in the 200-MW-1 Operable Unit consist mainly of cribs, French drains, and trenches that received moderate to low volume equipment decontamination waste and ventilation system waste plus small volume waste streams commonly disposed to French drains. A work plan (DOE/RL-2001-65) was approved during 2002, which requires remedial investigation activities at five representative waste sites (216-A-4 crib, 216-T-33 crib, 216-T-13 trench, 216-U-3 French drain, and 200-E-4 French drain) in the 200-MW-1 Operable Unit. The investigative work includes installing vadose zone boreholes and test pits to collect soil samples and do geophysical logging. In 2004, pre-job planning activities were completed and a borehole was begun at the 216-A-4 crib. Work on this borehole was temporarily halted because of unexpected high levels of radioactive contamination. A re-assessment of the plan for this borehole is being conducted. In parallel with this activity in late 2004, a borehole at the 216-U-3 French drain was initiated and completed in January 2005. A borehole at the 216-T-33 crib is planned during 2005, followed by completion of a test pit at the 216-T-13 trench and an auger hole at the 200-E-4 French drain.

200-PW-2 and 200-PW-4 Operable Units. Waste sites in the 200-PW-2 Operable Unit received uranium-rich condensate and process waste, primarily from waste streams generated at the U Plant, Reduction-Oxidation (REDOX) Plant, Plutonium-Uranium Extraction (PUREX) Plant, B Plant, and semi-works facilities. Waste sites in the 200-PW-4 Operable Unit received mostly process drainage, process distillate discharge, and miscellaneous condensates from the same facilities including condensates from S and A Tank Farms and the 242-A evaporator. The original draft work plan (DOE/RL-2000-60) was prepared and submitted to the regulatory agencies for review in December 2000. The revised work plan, which received regulatory agency approval in February 2003 to proceed with field work, proposed remedial investigation activities at six representative waste sites (216-A-19 trench, 216-B-12 crib, 216-A-10 crib, 216-A-36B crib, 216-A-37-1 crib, and 207-A south retention basin) and consolidated the 200-PW-4 Operable Unit into the work scope associated with the 200-PW-2 Operable Unit. Field work was completed in October 2003 and included installing vadose zone boreholes to collect soil samples and conducting geophysical logging. In addition, five drive casings (steel tubes driven into the ground) were installed and geophysically logged at the 216-A-10 crib to determine the optimum location for the characterization borehole that was installed in 2003. Evaluation of the data was initiated in conjunction with preparation of the remedial investigation report for these operable units. This report (DOE/RL-2004-25) was provided to the regulatory agencies in June 2004 for review, fulfilling Tri-Party Agreement Milestone M-15-43B. Investigation of an additional waste site, the 216-S-7 crib, was added to the scope of this operable unit in early 2004 and included in Revision 1 of the work plan, which was approved in July 2004. Field work at this site took place in late 2004 following completion of pre-job planning activities. Results of the investigation of this site will be included in the feasibility study scheduled to be prepared during 2005.

200-TW-1, 200-TW-2, and 200-PW-5 Operable Units. The 200-TW-1 Operable Unit consists of waste sites, mostly cribs and trenches, which received waste associated with uranium recovery activities at U Plant. The 200-TW-2 Operable Unit consists of waste sites, mostly cribs and trenches, which received waste from the decontamination processes at B Plant and T Plant. The 200-PW-5 Operable Unit consists of cribs, French drains, and locations of unplanned releases that received similar types of wastes and quantities of effluents as the 200-TW-2 Operable Unit. The work plan for the operable unit (DOE/RL-2000-38) prescribed remedial investigation 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). The field efforts for these operable units were completed in 2001 and consisted of installing three vadose zone boreholes (one each at the 216-T-26 crib, the 216-B-38 trench, and the 216-B-7A crib), collecting soil samples, and geophysical logging. Data from the laboratory analyses were compiled into a remedial investigation report (DOE/RL-2002-42), which was submitted to state and federal regulatory agencies in 2003 under Tri-Party Agreement Milestone M-015-41B. The remedial investigation report included a human health risk assessment and a screening of ecological impacts. In late 2003, following preparation and approval of a sampling and analysis plan, a borehole was drilled in the 216-B-26 trench. (The 216-B-26 trench is located within the BC cribs and trenches area. Because of the waste stream it received, the 216-B-26 trench was designated as a site assigned to the 200-TW-1 Operable Unit.) A feasibility study (DOE/RL-2003-64) and proposed plan (DOE/RL-2004-10) to evaluate remedial alternatives to address the contamination at the waste sites in the combined 200-TW-1, 200-TW-2, and 200-PW-5 Operable Units were submitted in April 2004. Submittal of these documents satisfied the requirements for Tri-Party Agreement Milestone M-15-41C. Comments from the regulatory agencies included a request to separate the documents into smaller segments, with the initial focus on the BC cribs and trenches area waste sites. Work began on a focused feasibility study and associated proposed plan for the BC cribs and trenches area wastes sites in mid-2004.

BC Cribs and Trenches Area. The BC cribs and trenches area was identified for accelerated closure during 2003. Two trenches were identified for further characterization to facilitate an eventual decision regarding remedial action. The 216-B-58 trench, previously selected as a representative site for the 200-LW-1 Operable Unit, was the focus of two boreholes in 2003. The first borehole was located at the point of apparent highest concentration. The second borehole was drilled following the unexpected discovery of low cobalt-60 concentrations at the west end of the trench during geophysical logging of drive casings that were placed to determine the point in the trench having highest contamination. The 216-B-26 trench, in the 200-TW-1 Operable Unit, was also sampled following approval of a sampling and analysis plan (DOE/RL-2003-44). Specific data from waste sites within the BC cribs and trenches area were deemed essential to adequately characterize waste sites in this area. Efforts were also completed to transfer four 200-LW-1 Operable Unit waste sites in the BC cribs and trenches area to the 200-TW-1 Operable Unit. This assembly of waste sites will be included in a focused feasibility study and proposed plan for remediation of the BC cribs and trenches area waste sites that will be submitted for regulatory review in 2005.

200-PW-1, 200-PW-3, and 200-PW-6 Operable Units. The 200-PW-1 Operable Unit contains waste sites that received significant quantities of carbon tetrachloride and plutonium as well as other contaminants associated with process waste from the Plutonium Finishing Plant. This operable unit also includes the carbon tetrachloride plume in the vadose zone that has migrated beyond the boundaries of the waste sites. A remedial investigation/feasibility study work plan for this operable unit was submitted for review during 2001 (DOE/RL-2001-01, Draft A). The work plan included a strategy to reach final decisions for remediation of carbon tetrachloride in the 200-West Area. The work plan was revised to include the 200-PW-3 and 200-PW-6 Operable Units. The 200-PW-3 Operable Unit waste sites received organic-rich process waste from separation facilities such as the Reduction-Oxidation (REDOX) Plant, Plutonium-Uranium Extraction (PUREX) Plant, U Plant, and C Plant. The 200-PW-6 Operable Unit waste sites received plutonium-rich process waste from the Plutonium Finishing Plant. The revised work plan (DOE/RL-2001-01, Rev. 0) was approved during 2004.

The remedial investigation at the 200-PW-1 Operable Unit is expected to focus on one representative waste site, the 216-Z-9 trench, and on other potential sources of carbon tetrachloride contamination. The first step in the carbon tetrachloride vadose zone investigation began during 2002 and was completed in 2003 (CP-13514). Soil-vapor sampling and analysis were used to explore the shallow vadose zone in the vicinity of the Plutonium Finishing Plant. The sampling was conducted at engineered structures that had the potential to release carbon tetrachloride to the vadose zone. The engineered structures included liquid waste discharge sites, pipelines that conveyed liquid waste to those discharge sites, and solid waste burial ground trenches. The second step in the carbon tetrachloride investigation will extend deeper in the vadose zone and to locations beyond the study area

investigated during the first step. The representative waste site investigation includes soil sampling, soil-vapor sampling, and geophysical logging during drilling of a slant borehole beneath the 216-Z-9 trench. The representative waste site investigation and initiation of the second step in the carbon tetrachloride vadose zone investigation are scheduled for 2005.

The remedial investigation at the 200-PW-3 Operable Unit is expected to focus on one representative waste site, the 216-A-8 crib. The representative waste site investigation, which includes soil sampling and geophysical logging, is scheduled for 2005. Through the process of consolidating these three operable units, it was determined that no specific investigation of waste sites in the 200-PW-6 Operable Unit was required.

200-SW-1 and 200-SW-2 Operable Units. The 200-SW-1 Operable Unit includes a number of non-radioactive landfills and dump sites that were created during the construction and operation of the 200 Areas facilities. Although a few sites were excavated engineered structures that were operated in a manner to contain waste releases, most sites were accumulation points for materials not regarded at the time to be potentially hazardous. The 200-SW-2 Operable Unit includes engineered burial grounds that were constructed to receive radioactive waste. The dry waste burial grounds received all types of miscellaneous radioactive waste and the industrial burial grounds received large pieces of failed or obsolete equipment from the chemical processing facilities. A remedial investigation/feasibility study work plan for these operable units was submitted for regulatory review during 2004 (DOE/RL-2004-60), fulfilling Tri-Party Agreement Milestone M-13-00O.

200-IS-1 and 200-ST-1 Operable Units. The 200-IS-1 Operable Unit consists primarily of pipelines, diversion boxes, catch tanks, and related structures used to transfer single-shell tank waste within and between the 200 Areas. These facilities are the responsibility of the tank farms (groupings of underground waste-storage tanks) contractor, CH2M HILL Hanford Group, Inc. Also included in this operable unit are five RCRA treatment, storage, and disposal unit tanks belonging to Fluor Hanford, Inc., the 241-CX-70, 241-CX-71, and 241-CX-72 tanks, and the 276-S-141 and 276-S-142 tanks. The 200-ST-1 Operable Unit consists of septic tanks and tile fields that are thought to have potentially received minor quantities of radioactively contaminated liquid waste from showers, floor drains, and janitor sinks. Work on the 200-IS-1 and 200-ST-1 Operable Units was resumed in 2004 with the preparation and release of Revision 1, Draft A of the work plan (DOE/RL-2002-14). This revision of the work plan addressed a series of comments and requirements submitted by the Washington State Department of Ecology following their review of Revision 0 of the work plan in 2002. Through a series of technical meetings, a strategy for the work plan was developed to address the comments, acceptable to both Fluor Hanford, Inc. and CH2M HILL Hanford Group, Inc. Sixteen site profiles were identified for the 200-IS-1 Operable Unit pipelines that provided a basis from which to develop a remediation strategy during the remedial investigation/feasibility study process. The work plan was submitted to the Washington State Department of Ecology in December 2004 for their review.

Simultaneously, an operable-unit-based pipeline mapping activity was restarted in 2004, picking up from work previously performed in 2002. Mapping is a process by which historical drawings are reviewed, coordinates and other key attributes are documented, and detailed location maps are generated. In the 2002 effort, an estimated 40% of the pipelines leading to waste disposal sites were mapped, including pipelines in six operable units. Another 49 lines were identified for mapping in 2004, nearly completing work for another four operable units. These 49 pipelines will be mapped during 2005. The need to coordinate pipeline mapping activities between the tank farms contractor and Fluor Hanford, Inc. has been recognized as an integral part of remediation activities, and efforts are being made to track pipeline mapping activities in a centralized mapping system.

200-UR-1 Waste Group Operable Unit. The 200-UR-1 Waste Group Operable Unit includes unplanned release sites that generally consisted of small volume spills to the ground surface or subsurface or windblown radioactive particulates, plant materials, and/or animal feces. Many of the unplanned release sites in the 200 Areas resulted from loss of control of radioactive materials during waste transfer or loss of containment in areas with process facilities, roads, railroad lines, or tank farms. A small number of unplanned release sites were associated with burial grounds, trenches, and cribs. Causes for the releases were attributed to administrative failures, equipment failures,

and operator error as well as to vegetation and animal intrusion. In fall 2003, a work plan and data quality objectives process were initiated. The data quality objectives process grouped the 147 unplanned release sites to allow consistent and streamlined remedial decision making. A work plan (DOE/RL-2004-39) was issued to the regulatory agencies in June 2004, fulfilling the requirements of Tri-Party Agreement Milestone M-013-00N. Comments from the Washington State Department of Ecology are being incorporated and the Revision 0 version is expected to be issued in 2005. The Revision 0 version of the data quality objectives summary report (WMP-19920) has been prepared and is also expected to be issued in 2005.

Significant changes to the scope of this work plan that resulted from the Washington State Department of Ecology comments were the addition of the West Lake waste site (216-N-8) to the operable unit and the decision to perform the full remedial investigation/feasibility study process for West Lake and the BC cribs Controlled Area.

200-BP-1 Prototype Barrier. The 200-BP-1 prototype barrier is a surface barrier to reduce the infiltration of water that drives contaminants through the soil to groundwater. Monitoring of the performance of the 200-BP-1 prototype barrier continued during 2004. Activities included water balance monitoring, stability surveys, and biotic surveys. A draft report to document the monitoring results was prepared during 2004.

U Plant Closure Area. The U Plant Closure Area Project is a prototype for area closures that will focus on addressing high-risk sites and associated contiguous areas in a cost-effective and integrated manner. Key components of this strategy include cleanup of waste sites, facilities, and pipelines within a defined geographic area. For this area closure, it is anticipated that separate records of decision will be needed for the high-risk sites, the 221-U facility, and for the 200-UP-1 Groundwater Operable Unit. Also, separate engineering evaluations, cost analyses, and action memoranda will be needed for ancillary facilities and pipelines. These components are being executed separately because they require distinct alternatives and specific responses. A *Focused Feasibility Study for the U Plant Closure Area Waste Sites* (DOE/RL-2003-23) and the *Proposed Plan for the U Plant Closure Area Waste Sites* (DOE/RL-2003-24) was submitted to EPA and the Washington State Department of Ecology on June 27, 2003, which satisfied Tri-Party Agreement Milestone M-015-47. The focused feasibility study and proposed plan continued to undergo regulatory review and comment resolution during 2004. The most recent version of the proposed plan recommends that 4 high-risk cribs (216-U-1, 216-U-2, 216-U-8, and 216-U-12) be modified with barriers or caps; a remove-and-dispose alternative be implemented at 14 waste sites (e.g., trenches, unplanned release sites, French drains, and one pipeline); institutional controls, monitoring of natural attenuation, and maintenance of existing soil cover be implemented at 8 sites (e.g., cribs, reverse injection wells, and septic systems); and no action be taken at 4 sites (e.g., dump sites and septic tanks). The record of decision on the proposed plan is expected to be issued in 2005 and remedial action initiated in 2006. A remedial design report and remedial action work plan for these waste sites are expected to be completed in 2005. To support confirmation of the proposed actions and collect needed remedial design data, the *Data Quality Objectives Summary Report for the U Plant Closure Area Waste Sites* (CP-16244) was completed in 2003.

Regulatory agencies continued their review of a sampling and analysis plan (DOE/RL-2003-51) during 2004 based on the data quality objectives. The document is expected to be issued in 2005. Characterization activities conducted in 2004 in the U Plant Closure Area included installation of 30 drive casings to facilitate spectral gamma logging at the 216-U-1, 216-U-2, 216-U-8, and 216-U-12 high-risk cribs.

Central Plateau Ecological Risk Assessment. An ecological risk assessment that includes a data quality objectives process and a field characterization effort was initiated for the Central Plateau in October 2004. This ecological risk assessment is being performed to support remedial decision making for all of the operable units within the Central Plateau area, to determine the health of the ecosystem on and surrounding the Central Plateau, and to provide information that can assist the Hanford Natural Resource Trustee Council (see Section 2.0.3). There are three phases to this effort: Phase I focuses on Central Plateau CERCLA waste sites; Phase II addresses single-shell and double-shell tank farms, the US Ecology, Inc. site, West Lake, and the BC Controlled Area; and Phase III investigates habitat surrounding the 200-East and 200-West Areas as well as the potential for additional characterization in the areas addressed in Phases I and II.

Phase I and II field characterizations will be performed during the spring and summer of 2005. Phase III field characterization is scheduled for the spring and summer of 2006. A final ecological risk assessment will be performed in 2007 to summarize the results of the field characterizations and to assess the risks to the ecological receptors. Results from the risk assessment will feed into remedial decision making for all of the Central Plateau operable units. This phased approach supports Tri-Party Agreement Milestone M-015-00 for completion of the remedial investigation/feasibility study process for all operable units by December 31, 2008.

6.1.3 Cleanup and Remediation Activities in the 100 Areas

This section describes the cleanup and remediation activities occurring within the 100 Areas.

6.1.3.1 K Basins Closure Activities

M. S. Gerber

For 10 years, cleanout of the K Basins was managed by the Spent Nuclear Fuel Project. This project was established in February 1994 to provide safe, economical, and environmentally sound management of Hanford Site spent (irradiated) nuclear fuel and to prepare the fuel for long-term storage leading to final disposal. Most of Hanford's spent nuclear fuel was stored in the K Basins, attached to the now deactivated K-East and K-West Reactors. The K Basins contained 2,100 metric tons (2,300 tons) of Hanford N Reactor spent fuel and a small quantity of irradiated single-pass reactor fuel (fuel from older Hanford reactors).

The Spent Nuclear Fuel Project successfully removed the spent fuel from underwater storage in the K Basins, dried it, and placed it in dry interim storage in the 200-East Area. Fuel in the K-East Basin was transferred into the K-West Basin for processing. In the K-West Basin, the fuel was cleaned (washed) and packaged into containers called multi-canister overpacks. The multi-canister overpacks were then vacuum processed to remove any water and mechanically sealed at the Cold Vacuum Drying Facility located in the 100-K Area. The dried overpacks were then transported to the Canister Storage Building in the 200-East Area where they were placed in storage in below-ground steel tubes.

After an observation period, each multi-canister overpack was brought back to the ground-level operating deck of the Canister Storage Building. In 2003, crews began welding permanent steel caps over the mechanical seals of the multi-canister overpacks. The multi-canister overpacks are being maintained in dry storage pending a federal decision on final disposition. If necessary, the re-packaged spent fuel could remain in dry storage for up to 40 years. Fuel removal from the K Basins was a binding commitment in the Tri-Party Agreement.

In mid-2004, responsibility for K Basins cleanout passed to the new K Basins Closure Project, and the Spent Nuclear Fuel Project was phased out.

During 2004, the Spent Nuclear Fuel Project, later the K Basins Closure Project, made progress in cleaning out the K Basins as follows:

- Completed all shipments (370 shipments) of fuel from the K-East Basin to the K-West Basin.
- Removed and dried the last 93 multi-canister overpacks of fuel from the K-West Basin, completing a total of 386 shipments to achieve 100% completion, satisfying a major Tri-Party Agreement milestone. Over 1.8 million kilograms (4 million pounds) of fuel, containing over 50 million curies (1,850 million gigabecquerels) of radioactivity, were removed from the K-West Basin.
- Welded 170 multi-canister overpacks with permanent, N-Stamped closure welds (those meeting the highest nuclear quality standards of the American Society of Mechanical Engineers), for a total of 290 multi-canister overpacks welded by year's end. This welding effort remained consistently ahead of schedule.
- Continued the washing and load-out of aged fuel canisters from the K Basins for disposal as low-level nuclear waste. By the end of 2004, 5,830 cans (78% of the total) had been washed and disposed. Also 100% of the contaminated, long-handled pole tools from the K-West Basin (212 tools) were removed, washed, and packaged as waste.

- Began pumping sludge from two locations in the K-East Basin, with two pumping systems, in June and October 2004. By the year's end, nearly 25% of the total sludge volume in the K-East Basin had been transferred to containers.
- Sealed the discharge chute of the K-East Basin permanently closed by filling it with special cement called grout. Putting grout in the discharge chute resolved some key environmental issues because it sealed the construction joint between the K-East Basin and the K-East Reactor structure, a joint that had leaked contaminated water to the environment in the past. Also, placing grout in the discharge chute permanently removed approximately 397,000 liters (105,000 gallons) of contaminated water from the K-East Basin (about 10% of the total water volume).
- Successfully demonstrated an underwater hydrolasing technique that will remove and clean the contaminated outermost surface of the K Basins walls and floor. By the end of 2004, the K Basins Closure Project was actively procuring full-scale hydrolasing equipment, in preparation for beginning to hydrolase the K-East Basin walls in mid-2005.

6.1.3.2 Remediation of Waste Sites in the 100 Areas

J. W. Donnelly and A. K. Smet

Full-scale remediation of waste sites in the 100 Areas began in 1996. Remediation activities in 2004 were performed in multiple areas of the 100 Areas, including 100-B/C, 100-K, and 100-N. Additionally, backfill activities were completed in portions of the 100-F Area and 100-B/C Area. Various records of decision authorized the remediation activities and were issued by DOE, EPA, and the Washington State Department of Ecology. At the 100-N Area, remediation of the treatment, storage, and disposal units is performed in accordance with the Hanford Facility RCRA Permit (Ecology 1994). Figure 1.0.1 shows the former reactor areas along the Columbia River.

A total of 470,060 metric tons (518,006 tons) of contaminated soil from the 100 Areas remediation activities was disposed of at the Environmental Restoration Disposal Facility:

- 104,018 metric tons (114,628 tons) from the 100-B/C Area.
- 318,221 metric tons (350,679 tons) from the 100-K Area.
- 47,821 metric tons (52,699 tons) from the 100-N Area.

Since cleanup activities began in 1996, the primary focus has been on liquid effluent waste sites. After nearly 8 years of work, the number of liquid effluent waste sites requiring remediation is significantly reduced and nearing completion. Cleanup activities now focus on remediation of burial ground waste sites. The volume of contaminated soil in burial grounds is less than that found at liquid effluent sites. Burial grounds are presenting challenges because unknown material has been discovered, requiring additional time to characterize and properly dispose of the waste. Also, unknown material may require revisions to the authorization basis documents including assumptions and inventory data.

6.1.4 Cleanup and Remediation Activities in the 300 Area

J. A. Lerch

Remediation work at the 300-FF-1 Operable Unit began in the 300 Area in 1997 and was completed in 2003. Backfill and re-grading operations at the remediated 300-FF-1 waste sites began in November 2003 and were completed February 2004. No additional remediation is necessary in this operable unit.

The 300-FF-2 record of decision (EPA 2001) authorizes remediation activities for the 300-FF-2 Operable Unit. Remediation for the 300-FF-2 Operable Unit began in September 2002.

In 2004, 21,640 metric tons (23,800 tons) of contaminated soil resulting from 300 Area remediation activities were removed and disposed of at the Environmental Restoration Disposal Facility.

Revegetation of 300 Area Waste Sites

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Bechtel Hanford Inc.'s Remedial Action Project remediated the 300-FF-1 Operable Unit (as well as several 300-FF-2 Operable Unit waste sites, which were selected based on proximity to waste sites in the 300-FF-1 Operable Unit) waste sites in the 300 Area under the record of decision (EPA 1996b) for the 300-FF-1 Operable Unit. During 2004, the remediated sites were backfilled with fill material from Pit 6, which is located on the west side of Stevens Drive adjacent to the 300 Area complex. Following backfill, the entire area disturbed during remedial actions, approximately 28 hectares (70 acres), was revegetated. Revegetation was performed with guidance provided in the *Hanford Site Biological Resources Management Plan* (DOE/RL-96-32). The plan prescribed industrial areas to be stabilized with crested wheatgrass (*Agropyron cristatum*). To promote a more diverse plant community, the backfilled and recontoured area was broadcast seeded with 11.2 kilograms per hectare (10 pounds per acre) Sandberg's bluegrass (*Poa sandbergii*), 11.2 kilograms per hectare (10 pounds per acre) crested wheatgrass, 5.6 kilograms per hectare (5 pounds per acre) Regreen (Agropyron hybrid), 5.6 kilograms per hectare (5 pounds per acre) Indian ricegrass (*Oryzopsis hymenoides*), 5.6 kilograms per hectare (5 pounds per acre) thickspike wheatgrass (*Agropyron dasytachyum*), 5.6 kilograms per hectare (5 pounds per acre) bluebunch wheatgrass (*Agropyron spicatum*), and 2.45 kilograms per hectare (2.2 pounds per acre) needle-and-thread grass (*Stipa comata*). To help prevent soil erosion and promote successful germination, 16.8 kilograms per hectare (15 pounds per acre) Terra Bond was co-applied during seeding. Straw mulch was distributed across the site and crimped with a serrated disk.

6.1.5 Cleanup and Remediation Activities in the 600 Area

In July 2004, the annual update of the *618-10 and 618-11 Waste Burial Grounds Basis for Interim Operations* (CP-14592) was completed. The basis for interim operations is a type of documented safety analysis that defines the hazards associated with surveillance, characterization, and groundwater monitoring activities within the burial grounds. It is a requirement of 10 CFR 830, *Nuclear Safety Management*, that an annual update be performed and issued. Activities associated with an unreviewed safety question process (a nuclear facilities requirement promoting safe operations) and preliminary remedial design for these burial grounds continued. An update to a 1995 geophysical survey (WMP-21465) was completed at both burial grounds in 2004. To support completion of Tri-Party Agreement Milestone M-016-66, a preliminary design basis and design criteria report (WMP-20394) was issued on September 30, 2004. In addition to this document, other activities conducted in 2004 included the completion of a biological and cultural review; completion of initial engineering site layout drawings detailing the location of proposed roads, facilities, and utilities; generation of a historical-document database; completion of several technical specifications; update of previous waste volume calculations; drafting of an air monitoring plan for monitoring during remediation activities; and the completion of a document (D&D-23840) summarizing the radiological survey records for both burial grounds. In parallel with these design activities, a program to demonstrate technologies for the in situ delineation and excavation of transuranic waste using innovative technologies was continued. As part of this program, contractor teams worked on developing the necessary safety basis documents and conducted initial demonstration tests at facilities near the Hanford Site.