2.3 Current Issues and Actions

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Progress has been made toward achieving full regulatory compliance at the Hanford Site. Ongoing compliance self-assessments, knowledge gained in implementing Tri-Party Agreement milestones, and public meetings continue to identify environmental compliance issues. These issues are discussed openly with the regulatory agencies and with the public to ensure that all environmental compliance issues are addressed.

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

Eighty-nine milestones scheduled for 1995 were completed. Included in these completed milestones were the activities listed in Section 2.2 as well as those below. The following were submitted to the regulators (Washington State Department of Ecology and/or EPA):

- Five closure plans for Hanford treatment, storage, and disposal facilities
- One interim remedial measure report and plan
- One limited field investigation
- Seven focused feasibility study reports
- Five interim remedial measures proposed plans
- The 100-B Area burial ground field work report
- One sitewide data management systems analysis
- Data management plans for each DOE Richland Operations Office program office
- 1100 Area site restoration construction completion notification.

In 1995, the following activities were begun:

- Cross-site transfer system construction for transfer of tank wastes between the 200 Areas
- Interim stabilization of three single-shell tanks
- Operation of the 200 Area Treated Effluent Disposal Facility and the Effluent Treatment Facility.

From 1989 through 1995, a total of 460 enforceable Tri-Party Agreement milestones and 215 unenforceable target dates had been completed on or ahead of schedule. Three enforceable milestones were missed, and two were completed later than scheduled.

Hanford Site cleanup began in 1989 with the signing of the Tri-Party Agreement. The Agreement laid out a blueprint for the cleanup of the Hanford Site over a 30-year period. Over the past 6 years, the Tri-Party Agreement has been changed as additional information has been acquired about the cleanup problems.

A package of new negotiated changes to the Tri-Party Agreement was developed in January 1995. The new requirements establish 65 new enforceable milestones and 32 new unenforceable target dates.

A summary of the significant changes follows.

Facility Transition Approved Changes

When a facility will no longer be used for its original purpose, it will be brought into a safe and secure condition that will minimize maintenance and surveillance expenses. This is facility transition. Transition is the first phase of a three-step process called facility decommissioning. Phase I, transition, will include the deactivation and stabilization of plant equipment and systems. Phase II, surveillance and maintenance, will be the bridge period. Phase III, disposition, will be final closure and disposal of a facility. Any time before disposition, a facility may be transferred to another useful purpose.

Until recently, the Tri-Party Agreement primarily addressed the cleanup of contaminated waste sites. In January 1994, DOE agreed to include in the Tri-Party Agreement the disposition of key production and other large Hanford facilities. The Tri-Party signatories began negotiations in July 1994 to set schedules and milestones for cleanup at the Plutonium-Uranium Extraction Plant, the Uranium-TriOxide Plants, and the Fast Flux Test Facility. The negotiations also addressed the cleanout of the Plutonium Finishing Plant and the 324 Building radiochemical engineering cells and vault tanks.

These negotiations led to the development of Amendment Five, which was approved in July 1995, incorporating facility transition activities into the Tri-Party Agreement.

Amendment Five changes included:

- Establishing a safe and environmentally secure configuration for the Plutonium-Uranium Extraction Plant to achieve necessary preclosure actions and transition the facilities to the surveillance and maintenance phase.

- Establishing a safe and environmentally secure configuration for the Fast Flux Test Facility to achieve necessary preclosure actions and transition the facilities to the surveillance and maintenance phase.

- Stabilizing the previous process areas within the Plutonium Finishing Plant, including the Plutonium Reclamation Facility and Remote Mechanical "C" Line. This will establish a safe and environmentally secure configuration in these areas of the facility.

- Revising the necessary permitting, closure, or preclosure actions related to transition efforts for the Plutonium-Uranium Extraction Plant, Fast Flux Test Facility, and Plutonium Finishing Plant.

Other Modifications Made to the Tri-Party Agreement

Language was added in Section 10 of the Tri-Party Agreement Action Plan that commits DOE to submit key documents to the involved Native American tribes at the same time they are submitted to the Washington State Department of Ecology and EPA. New language was added in Sections 3, 5, 6, 7, and 9 of the Action Plan to support integration of closure, past practice, and facility decommissioning activities. A number of terms also have been added and other definitions have been modified in Appendix A, "Definition of Terms."

A new section, 14, was added to the Action Plan to detail the facility decommissioning process. It includes planning and action paths for all three decommissioning phases and addresses regulatory integration.

Amendment Six to the Tri-Party Agreement

During the spring and summer of 1995, the tri-party signatories met on several occasions to examine methods of fundamentally improving the ways of doing business at the Hanford Site. A number of commitments were made to change the Tri-Party Agreement, with the aim of becoming more efficient and cost-effective within the Agreement's framework. These changes will provide authority and control to the personnel who are most responsible for performing the actual cleanup, so that decisions will be made at lower levels of management and in less time. These efficiencies will be further enhanced by the adoption of a single regulator concept in which only one regulatory agency generally will be involved in the day-to-day oversight and decision making on individual cleanup activities.

Amendment Six changes were implemented in November 1995 and underwent a successful implementation period through the end of 1995. Final approval of Amendment Six occurred in February 1996.

Environmental and Molecular Science Laboratory

In 1995, construction of the Environmental and Molecular Science Laboratory continued. When finished, the 18,600 m^2 (200,200 ft^2) facility will accommodate up to 270 permanent staff, visiting scientists, postdoctoral researchers, and students who will work to develop the science and technology needed to clean up environmental problems at government and industrial sites across the country. Research conducted at this facility is also expected to lead to advancements in energy, new materials, health and medicine, and agriculture.

100-K Area Fuel Storage Basins

In February 1994, the Spent Nuclear Fuel Project was established. The project mission is to provide safe, economic, and environmentally sound management of Hanford spent nuclear fuel in a manner that stages it to final disposition.

The Hanford Site spent nuclear fuel inventory constitutes about 80% of the inventory currently stored in the national DOE complex. The majority of Hanford's inventory consists of about 2,100 metric tons (2,300 tons) of irradiated N Reactor fuel stored in the 105-K East and 105-K West Fuel Storage Basins.

In 1995, working closely with stakeholders and local Native American tribes, decisions were made that support acceleration of the strategy for interim storage of the K Basin fuel inventory. This strategy supports removal of the fuel from the K Basins 3 years ahead of the December 2002 target date stipulated in the Tri-Party Agreement. The Spent Nuclear Fuel Project is now in the process of implementing the strategy for acceleration of fuel removal from the K Basins.

A project to install isolation barriers in the basins was completed in 1995. These barriers isolate the spent fuel from a vulnerable construction joint in the discharge chute of the basins. They will prevent shielding water from draining from the basins in the event of a major earthquake and releasing contaminated water to the ground and radioactive contamination to the air.

Plutonium Finishing Plant

The function of the Plutonium Finishing Plant was to extract plutonium from plutonium-bearing chemical solutions and convert it into metal and oxide. The plant was first used in 1951, and the production processes operated until May 1989. Although processing has ended, plutonium-bearing materials remain in the plant.

In July 1993, DOE started discussions with citizen groups about plans to operate the Plutonium Finishing Plant processes. DOE intended to run processes within the plant, the Plutonium Reclamation Facility, and portions of the Remote Mechanical "C" Line to stabilize some plutonium-bearing materials. DOE initiated efforts to prepare an environmental assessment to evaluate the action.

A series of public meetings regarding the proposed environmental assessment resulted in significant public comment, demands for an environmental impact statement, and consideration of alternate methods of plutonium stabilization. Based on these comments, DOE began preparing an environmental impact statement and approved a proposal to initiate several interim actions to reduce safety risks in the facility while waiting for the environmental impact statement. Many of the interim actions already have been completed, including downloading solutions from the Plutonium Reclamation Facility for disposal, decontaminating portions of the Plutonium Finishing Plant, removing plutonium-contaminated ducts and piping from the 232-Z incinerator building, stabilizing plutonium-bearing solutions stored in Plutonium Finishing Plant gloveboxes, and stabilizing and testing solutions stored in 10-L (2.64-gal) containers.

Current facility activities include remediation of plutonium-contaminated ductwork in 234-5Z; continued thermal stabilization of plutonium residues; and preparation for the implementation of the environmental impact statement Record of Decision, which is expected in June 1996.

Waste Vitrification

Approximately 215,000 m^3 (281,000 yd^3) of radioactive and hazardous wastes accumulated from over 40 years of plutonium production operations are stored in 149 underground single-shell tanks and 28 underground double-shell tanks. Current plans are to pretreat the waste and then solidify it into a glass matrix. Pretreatment will separate the waste into a low-radioactivity fraction, and a high-radioactivity and transuranic fraction. The bulk of the radionuclides will then be in the high-radioactivity and transuranic fraction. In separate facilities, both fractions will be vitrified, a process that will destroy or extract organic constituents, neutralize or deactivate dangerous waste characteristics, and immobilize toxic metals. The vitrified low-radioactivity fraction will be disposed of in a near-surface facility on the Hanford Site in a retrievable form. The vitrified high-radioactivity fraction will be stored onsite until a geologic repository is available offsite for permanent disposal. Tri-Party Agreement milestones specify December 2028 for completion of pretreatment and vitrification of the tank wastes. The DOE Richland Operations Office has issued a change request to the Tri-Party Agreement in order to proceed with the planned privatization of the initial pretreatment and immobilization function of the Tank Waste Remediation System program.

Waste Receiving and Processing Facility

During 1994, construction was started on the first major solid waste processing facility associated with cleanup of the Hanford Site. Scheduled to begin operations in March 1997, the Waste Receiving and Processing Facility Module 1 will be staffed to analyze, and prepare for disposal, drums and boxes of waste resulting from plutonium operations at Hanford. The Tri-Party Agreement mandates construction and operation of this module. Wastes destined for this module include Hanford's current inventory of more than 37,000 drums of stored waste, as well as materials generated by future Site cleanup activities. Consisting primarily of clothing, gloves, face masks, small tools, and dirt suspected of being contaminated with plutonium, wastes in the 0.21-m^3 (55-gal) drums may also contain other radioactive materials and hazardous components. Some of the materials processed will qualify as low-level waste suitable for disposal directly at the Hanford Site. The remaining wastes will be certified and packaged for eventual shipment to the Waste Isolation Pilot Plant in New Mexico. Materials requiring further processing to meet disposal criteria will be retained at Hanford pending treatment.

The 4,831-m^2 (52,000-ft^2) facility is scheduled to begin operations in 1997 near the Central Waste Complex in the 200-West Area. The 200-West Area is located on the central plateau that the public and Tri-Party agencies have designated for waste processing and long-term waste storage. The facility is designed to process 6,800 drums of waste annually for 30 years.

Radioactive Mixed Waste Disposal Facilities

The Radioactive Mixed Waste Disposal Facilities are the first facilities in DOE's national complex for disposal of radioactive mixed wastes. These facilities are located in the Hanford Site Low-Level Burial Ground and are designated as 218-W-5, Trench 31, and Trench 34. Construction was completed on Trench 34, and operational readiness was completed on both trenches in 1995. The facilities consist of rectangular landfills with approximate base dimensions of 76 m by 30 m (250 ft by 100 ft). The bottom of the landfill excavations slope slightly, giving a variable depth of 9 to 12 m (30 to 40 ft).

These facilities are Resource Conservation and Recovery Act compliant, with double liners and leachate collection and removal systems. The bottom and sides of the facilities are covered with a 1-m (3-ft)-deep layer of soil to protect the liner system during fill operations. There is a recessed section at one end of the landfill excavations that houses the sumps for leachate collection. Access to the bottom of the landfills is provided by ramps along the perimeters.

Enhanced Radioactive Mixed Waste Storage Facility, Phase V

Construction was initiated on the Enhanced Radioactive Mixed Waste Storage Facility, Phase V to increase the Site's permitted mixed waste storage capacity and to provide interim storage for the Waste Receiving and Processing Facility planned to begin operations in March 1997. Construction is scheduled for completion in January 1997. This facility comprises three buildings that have a total storage capacity of about 2,800 m^3 (3,700 yd^3).

Thermal Treatment Contract

In an effort to involve the private sector in waste treatment activities on the Site, bids were solicited for processing stored and future generated solid waste that requires thermal treatment per Resource Conservation and Recovery Act regulations. In October 1995, the contract for this work was awarded to Allied Technology Group, Inc. The contract is for 5 years, with five 1-year renewal options. Waste processing is scheduled to begin in fiscal year 2001.

Stabilization Contract

A contract for waste stabilization is in the bid review process. This contract is scheduled to be awarded in June 1996, with treatment scheduled to begin in September

1999. The initial contract is for 5 years, with five 1-year renewal options. This contract will result in the replacement of the treatment capabilities previously planned for the Waste Receiving and Processing 2A facility, which was terminated by DOE in 1995.

Waste Tank Safety Issues

The Waste Tank Safety Program was established in 1990 to address the hazards associated with storage of radioactive mixed waste in the 177 large underground storage tanks at the Hanford Site. The Program serves as the focal point for identification and resolution of selected high-priority waste tank safety issues, with resolutions being completed in priority order. Tanks with the highest risk will be evaluated and mitigated first. The tasks to resolve safety issues are planned and implemented in the following logic sequences: 1) evaluate and define the associated safety issue, 2) identify and close any associated unreviewed safety questions (DOE 1991), 3) mitigate any hazardous conditions to ensure safe storage of the waste, 4) store and monitor waste conditions, and 5) resolve the respective safety issues. Each of these steps has supporting functions of some combination of monitoring, mathematical analyses, laboratory studies, and in-tank sampling or testing. The path that is followed depends on whether the waste requires treatment or can be stored safely by implementation of strict controls.

The Waste Tank Safety Program is currently focusing on resolution of ferrocyanide, flammable gas, organic, high-heat, noxious vapor, and criticality safety issues as described below. The tanks of concern are placed on a Watch List and categorized by safety issue. At the end of 1995, there were 54 tanks on the Watch List: 18 ferrocyanide tanks, 25 flammable gas tanks, 20 organic tanks, and one high-heat tank. Some of the tanks are included under more than one category. These tanks were identified in accordance with Public Law 101-510, Section 3137 (1990), *Safety Measures for Waste Tanks at Hanford Nuclear Reservation* (the Wyden Amendment).

Watch List Tanks

In 1990, all Hanford Site high-level waste tanks were evaluated and organized into the four categories listed above to ensure increased attention and monitoring. Two other safety concerns involving some or all of the tanks' criticality and noxious vapor safety issues have also been addressed.

Ferrocyanide

The ferrocyanide safety issue involves the potential for uncontrolled exothermic reactions of ferrocyanide and nitrate/nitrite mixtures (Postma et al. 1994a). Laboratory studies show that temperatures must exceed 250°C (482°F) for a reaction to propagate. The hottest ferrocyanide tank temperature is 53°C (127°F) and decreasing. In October 1990, an unreviewed safety question was declared because safety was not adequately defined by existing analyses. However, the unreviewed safety question was closed by DOE in March 1994, as a result of significant knowledge gained from simulant studies, conservative theoretical analyses, and analyses of actual waste samples that allowed bounding safety criteria to be defined and applied to each tank (Postma et al. 1994a). Of the original 24 ferrocyanide tanks, 18 are now on the Watch List. Four were removed in 1993 and two were removed in 1994. The remaining tanks will be taken off the Watch List as core samples are obtained and analytical analyses confirm that the ferrocyanide levels have decreased, because of hydrolysis and radiolysis (aging), to acceptable low levels (Lilga et al. 1994).

Because the ferrocyanide has been shown to age significantly under temperature, pH, and radioactive conditions present in the high-level waste tanks, it is not necessary to sample all 18 of the ferrocyanide tanks. Nine of the tanks have been sampled, and all show that the ferrocyanide has degraded to levels too low to support propagating reactions. The nine tanks that were sampled represent the remaining tanks in terms of the waste parameters that enhance the degradation (aging) process.

Flammable Gas

The flammable gas safety issue involves the generation, retention, and potential release of flammable gases by the waste. Previously, 25 tanks were identified and placed on the Flammable Gas 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.

The worst-case tank, 241-SY-101, was successfully mitigated in 1994 with the installation of a mixing pump. The pump is operated up to three times a week to mix the waste and release gases that are generated and retained in the waste. This mitigation technique has been completely successful, and no episodic releases of gas have occurred since the pump was installed. A spare mixer pump is available in case the original pump should fail.

Hydrogen monitors have been installed on all 25 flammable gas tanks. These monitors, called standard hydrogen monitoring systems, consist of a cabinet equipped with piping and instrumentation that support an on-line hydrogen detector and a "grab sampler." Documentation to close the unreviewed safety question for the SY tank farm was submitted to DOE in 1995 for closure action; approval is expected in 1996.

Additional instrumentation for determining waste properties and tank behavior have been developed for use in the flammable gas tanks. These instruments are the viscometer for measuring the viscosity of the waste in situ in the tanks, a void fraction meter that determines in situ the amount of gas in a given volume of waste by compression, a retained gas sampler that captures a waste sample in a gas tight chamber and allows the gas composition to be measured after the apparatus is brought into a hot cell, and a Gas Characterization System that allows a broad spectrum of domespace gases (including hydrogen, ammonia, and nitrous oxide) to be continuously monitored for selected tanks. All of these devices are scheduled to be operational in 1996.

In November 1995, flammable gas controls were placed on all 177 high-level waste storage tanks after several events occurred where hydrogen gas was found at significant levels in the waste tank undergoing interim stabilization and in another tank being core-sampled. All rotary-mode sampling using the sampling trucks was suspended until a safety assessment covering this method could be approved for tanks that might be retaining pockets of gas within the waste matrix.

The Tri-Party Agreement milestone for resolution of the Flammable Gas Safety Issue is scheduled for September 2001.

High-Heat Tank

This safety issue concerns tank 241-C-106, a single-shell tank that requires water additions and forced ventilation for evaporative cooling. Without the water additions, which would have to be severely restricted in the event of a tank leak, the tank could exceed structural temperature limits, resulting in potential concrete degradation and possible tank collapse. This tank is on an accelerated program for early retrieval, starting the fourth quarter of 1996, and transfer of waste to a double-shell tank. Double-shell tanks are designed to better handle heat-bearing materials than single-shell tanks. As part of the accelerated retrieval program, a refrigerated chiller system is being installed to remove radioactive decay heat and the heat generated by the waste transfer pumps.

The Tri-Party Agreement milestone for resolution of the High-Heat Safety Issue is scheduled for September 2001, with an interim milestone to start sluicing retrieval of the waste in tank 241-C-106 by October 1997.

Organic Tanks

The organic tanks safety issue involves the potential for uncontrolled exothermic reactions of organic chemicals and nitrates/nitrites or organic solvents also present in some of the tanks. During 1995 as part of the vapor sampling program, it was shown that organic vapors in the organic tanks are too low in concentration to exceed even 25% of their lower flammability limits. Criteria to screen tanks for possible organic compounds were also established based on analyses and simulant testing. Tank waste was screened against these criteria using historic and recent sampling data (Webb et al. 1995). Concentrations and temperatures required to support propagating exothermic reactions are comparable to those for ferrocyanide (Fauske et al. 1995). In addition, moisture levels of 20 wt% and less, in some cases, will prevent reactions from propagating regardless of the fuel concentration. To determine if adequate moisture is present in the waste, special surface monitoring instrumentation is being developed, and full-depth core samples of waste in organic tanks is continuing.

Work controls were implemented in 1990 to prevent the introduction of ignition sources into these tanks. In May 1994, vapor sampling and safety analyses were completed that provided the technical basis for closing the unreviewed safety question on the flammability of the floating organic layer in tank 241-C-103 (Postma et al. 1994b). Ten tanks that contained organic complexants were added to the Organic Tanks Watch List following a review of sampling data and waste transfer records (Hanlon 1994).

Other work indicates that aging processes have destroyed or significantly lowered the energy content of the organic tanks (Ashby et al. 1994). In addition, work by Barney (1994) shows that the more energetic complexants and the primary degradation products of tributyl phosphate are water soluble in nitrate-nitrite salt solutions. Thus, a high percentage of reactive organic chemicals were removed from the single-shell tanks when their pumpable liquid supernatant was pumped out as part of the interim stabilization process for the single-shell tanks.

During 1995, waste samples were obtained from eleven organic tanks, and 16 of the tanks were vapor sampled. Tank characterization reports have been or are being prepared for each of the sampling events. These reports are available to the public. The Tri-Party Agreement milestone for resolution of the Organic Tanks Safety Issue is scheduled for September 2001.

Criticality

The unreviewed safety question on the potential for criticality in the high-level waste tanks was closed in 1994 by completing additional analyses, strengthening tank criticality prevention controls, and improving administrative procedures and training (Braun and Szendre 1994). The analyses showed that criticality is highly unlikely during storage. All of the single- and double-shell tanks at the Hanford Site contain sufficient neutron absorbers to ensure safe storage; however, additional sampling and controls will be required for retrieval and pretreatment-related activities. A potential criticality safety issue still remains for waste transfers required as part of the retrieval and pre-treatment processes. The Tri-Party Agreement milestone for resolution of the Criticality Safety Issue is scheduled for September 1999.

Vapor Sampling Program

Some of the Hanford Site tanks contain chemicals that release noxious vapors to the environment. These vapors pose a potential health risk to Hanford Site employees who work in the tank farms. The safety issue stems from an insufficient understanding of the causes of reported exposures of personnel to unacceptable levels of noxious vapors and the concern that, until the vapors in the tanks are well characterized, the risks to worker health and safety cannot be determined or controlled (Osborne 1994, Huckaby and Babad 1994). In prior years, worker protection controls were instituted to prevent worker exposures, and a program was implemented for routine workspace air monitoring and personnel dosimetry.

In-tank vapor sampling equipment was developed and tested in 1994. Two methods are now used to collect vapor samples from the waste tanks (Huckaby 1994). The primary method involves drawing air, gases, and vapors out of the waste tanks using heated sampling tubes. This method was designed to collect representative samples from warm, moist tanks, even if a fog exists in the tank headspace. A second method employs in situ sampling. Rather than transferring the air, gases, and vapors to be sampled to a remote location, the sampling devices themselves (specifically, sorbent traps) are lowered into the tank headspace. As of December 1995, 38 high-level waste tanks were vapor sampled using heated sampling tubes. The two sampling methods are extremely sensitive and can detect vapors down into the low parts per billion range for certain compounds and consequently a number of organic species are identified in each tank sample. The levels of noxious substances present are normally very low and usually within published guidelines. A separate report is prepared for every tank sampled; each will be available to the public.

Waste Tank Status

The status of the 177 waste tanks as of December 1995 is reported in *Waste Tank Summary for Month Ending December 31, 1995* (Hanlon 1996). This report is published monthly; the December report provided the following:

- Number of waste tanks
  - 149 single-shell tanks
  - 28 double-shell tanks
- Number of tanks listed as “assumed leaker” tanks
  - 67 single-shell tanks
  - 0 double-shell tanks
- Chronology of single-shell tank leaks
  - 1956: First tank reported as suspected of leaking (Tank 241-U-104)
  - 1973: Largest estimated leak reported (Tank 241-T-106; 435,000 L [115,000 gal])
  - 1988: Tanks 241-AX-102, -C-201, -C-202, -C-204, and -SX-104 reported as confirmed leakers
  - 1992: Latest tank (241-T-101) added to assumed leaker list, bringing total to 67 single-shell tanks
  - 1994: Tank 241-T-111 declared an assumed re-leaker

- Number of ferrocyanide tanks on the Watch List
  - 18 single-shell tanks[(a)] (six tanks were removed from the Watch List in 1993 and 1994)
- Number of flammable gas tanks on the Watch List
  - 19 single-shell tanks[(b)]
  - 6 double-shell tanks
- Number of organic tanks on the Watch List
  - 20 single-shell tanks.

So far, 114 single-shell tanks have been stabilized, with the tank stabilization program to be completed in 2000. At the end of 1995, 98 single-shell tanks had intrusion prevention devices completed, and 51 single-shell tanks were disconnected and capped to avoid inadvertent liquid additions to the tanks.

The total estimated volume of radioactive waste leakage from single-shell tanks is 2,300,000 to 3,400,000 L (600,000 to 900,000 gal).

During 1995, pumping occurred in eleven single-shell tanks. Portions of tanks T-107, T-111, BX-106, BX-111, BY-102, BY-103, BY-106, BY-109, C-102, C-107, and C-110 were pumped.

Vadose Zone Characterization

The inactive liquid effluent facilities vadose zone (the vadose zone is the zone between the soil surface and the water table) monitoring program conducted radiological surveys of approximately 70 boreholes or wells during calendar year 1995. The surveys identified gamma emitting radionuclides in the soils that were created by the liquid discharges. These survey data will become the baseline for any further vadose zone monitoring at these facilities.

Wells that are scheduled for decommissioning onsite are also surveyed to assure that no radioactivity exists in the wells before they are filled in. These data add to the geologic data base used for determining moisture in the vadose zone.

The Tank Farms Vadose Zone Characterization Project is being conducted by Rust Geotech, a DOE contractor, to gain a better understanding of contaminated soil beneath Hanford's single-shell tanks. This 4-year effort began in April 1995 with a logging technique called spectral gamma analysis. To date, about 250 dry wells out of a total of about 750 have been logged.

Preliminary data from some of the wells in the SX Tank Farm in the 200-West Area show at least one radioactive isotope, cesium, exists deeper in the soil than reported earlier. Readings from several of the monitoring dry wells indicate that cesium is at the bottom of some of the shafts, which are up to 38 m (125 ft) deep. Currently, it is not known if cesium has migrated deeper than 38 m (125 ft) or the means by which cesium has reached this depth in the dry wells. A low-permeability confining bed is located at a depth of approximately 38 m (125 ft) below these tanks. The ground water at this tank farm is about 64 m (210 ft) below the surface.

These data will greatly improve our understanding of the contamination from single-shell tanks that are known or suspected to have leaked over the past several decades. This will lead to better management of the waste and is consistent with Hanford's priority of protecting the Columbia River and the environment.

Pollution Prevention Program

The Hanford Site Pollution Prevention Program is an organized, comprehensive, and continual effort to reduce systematically the quantity and toxicity of hazardous, radioactive, mixed, and sanitary wastes; conserve resources and energy; reduce hazardous substance use; and prevent or minimize pollutant releases to all environmental media from all operations and Site cleanup activities.

The program is designed to satisfy DOE requirements, recent presidential executive orders, and other state and federal regulations and requirements. In accordance with sound environmental management, preventing pollution through source reduction is the first priority in the Hanford Site's Pollution Prevention Program, and the second priority is environmentally safe recycling. Waste treatment to reduce quantity, toxicity, or mobility (or a combination of these) will be considered only when prevention

(a) Two ferrocyanide tanks are also listed as organic tanks.
(b) Eight flammable gas tanks are also listed as organic tanks.

or recycling are not possible or practical. Environmentally safe disposal is the last option.

Hanford Site pollution prevention efforts in 1995 helped to prevent the generation of 2,907 m^3 (3,802 yd^3) of radioactive mixed waste, 207 metric tons (228 tons) of Resource Conservation and Recovery Act waste, 30,000 m^3 (39,000 yd^3) of process waste water, and 4,400 metric tons (4,800 tons) of sanitary waste. Total cost savings exceeded $26,000,000.

Numerous generator-specific initiatives were put into place that enabled these waste reductions and cost savings. To celebrate these pollution prevention activities, the "Hanford Pollution Prevention Accomplishments Book" (Betsch 1995) was published in October. The book outlines 63 initiatives that were implemented and are now in use at locations throughout the Hanford Site.

During 1995, the Hanford Site recycled 632 metric tons (695 tons) of office paper, 20 metric tons (22 tons) of cardboard, 3,574 metric tons (3,931 tons) of ferrous metal, 215 metric tons (236 tons) of non-ferrous metal, 57 metric tons (63 tons) of lead, 16 metric tons (18 tons) of solid chemicals, and 78,000 L (20,600 gal) of liquid chemicals.

A new centralized recycling center for used materials and products opened for business in May 1995. It has received more than 2,140 aerosol cans, more than 590 kg (1,300 lb) of fluorescent light ballasts, more than 11,000 linear m (36,000 linear ft) of intact spent fluorescent light tubes, and more than 50,000 kg (110,000 lb) of lead acid/gel cell batteries. The total savings since May 1995 are estimated to be almost $200,000.

Liquid Effluent Activities

242-A Evaporator

Available storage space to support remediation of the tank waste and cleanup of the Hanford Site is limited in the double-shell tanks. The 242-A Evaporator in the 200-East Area of the Hanford Site processes double-shell tank waste into a concentrate that is returned to the tanks and a process condensate stream. The 242-A Evaporator had one processing campaign in 1995. Dilute waste from three double-shell tanks was processed, resulting in an average waste volume reduction of 87.6% while producing 10 million L (2.7 million gal) of process condensate. Future campaigns are scheduled for 1996.

Effluent treatment and disposal capabilities are now available to support the continued operation of the 242-A Evaporator. The 200 Area Effluent Treatment Facility was constructed to treat the process condensate. The process condensate is temporarily stored in the Liquid Effluent Retention Facility while awaiting treatment in the Effluent Treatment Facility.

Liquid Effluent Retention Facility

The Liquid Effluent Retention Facility consists of three Resource Conservation and Recovery Act-compliant surface impoundments for storing process condensate from the 242-A Evaporator. The facility provides equalization of the flow and pH of the feed to the Effluent Treatment Facility. Each basin has a capacity of 24.6 million L (6.5 million gal). Two basins are used for normal operation, and the third is used as contingency in the event a leak develops in an operational basin. The basins are 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 1-m (3.3-ft)-thick soil/bentonite 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 is designed to operate for 20 years. A total of 33 million L (8.7 million gal) of process condensate was stored in the basins at the end of 1995.

200 Area Effluent Treatment Facility

The 200 Area Effluent Treatment Facility provides for 1) collection of liquid effluents, 2) a treatment system to reduce concentrations of radioactive and hazardous waste constituents in the effluent streams to acceptable levels, 3) tanks to allow for verification of treated effluent characteristics before discharge, and 4) a state-approved land disposal structure for effluent disposal. The treatment process constitutes best available technology and includes ultraviolet light/peroxide destruction of organic compounds, reverse osmosis to remove dissolved solids, and ion exchange to remove the last traces of contaminants. Treatment capacity of the facility is 570 L/min (150 gal/min). The Effluent Treatment Facility began hot operation in December 1995 and has a 30-year design life.

The treated effluent from the Effluent Treatment Facility is sampled to verify that the concentrations of radioactive and hazardous waste constituents have been reduced to acceptable levels and discharged via a dedicated pipeline to a state-approved land disposal structure. The disposal facility consists of an underground drain field. The percolation rates for the field have been established by site testing and evaluation of disposal site soil characteristics. Tritium in the liquid effluent cannot be practically removed, and the location of the disposal facility maximizes the time for migration to the Columbia River to allow for radioactive decay. A delisting petition was approved by the EPA and exempts the treated process condensate from the requirements of hazardous waste regulations under the Resource Conservation and Recovery Act and imposes certain effluent quality restrictions. High concentrations of ammonia in the process condensate also make this stream a dangerous waste subject to Washington Administrative Code (WAC) 173-303, *Dangerous Waste Regulations*. After treatment in the facility, the discharged effluent is not a dangerous waste. The disposal facility was permitted in June 1995 by the Washington State Department of Ecology under the WAC 173-216, *State Waste Discharge Permit Program*. The discharge permit requires monitoring of the effluent ground water to ensure that concentrations for certain constituents are not exceeded.

Secondary waste from treating the process condensate is a low-level mixed waste that will be concentrated, dried, and packaged in 0.21-m^3 (55-gal) drums. The Effluent Treatment Facility is a Resource Conservation and Recovery Act permitted storage facility, and this secondary waste material is temporarily stored until it 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 Trench.

200 Area Treated Effluent Disposal Facility

The 200 Area Treated Effluent Disposal Facility is a collection and disposal system for non-Resource Conservation and Recovery Act permitted waste streams that already meet discharge requirements. Implementation of regulatory required "best available technology/all known and reasonable treatment" is the responsibility of the generating facilities. Facilities that discharge to the 200 Area Treated Effluent Disposal Facility currently include the Plutonium Finishing Plant, 222-S Laboratory, T Plant, 284-W Power Plant, Plutonium-Uranium Extraction Plant, B Plant, and 242-A-81 Water Services Building. Each facility must comply with discharge limits in the WAC 173-216 State Waste Discharge Permit without further treatment.

The 200 Area Treated Effluent Disposal Facility began operation in April 1995 and is designed to operate for 30 years. The design capacity of the facility is 8,700 L/min (2,300 gal/min), although the discharge permit presently limits the average monthly flow to 2,400 L/min (actually specified as 640 gal/min). Approximately 490 million L (130 million gal) of treated effluent was discharged in 1995. The effluent is discharged to two 2 ha (5 acre) disposal ponds located east of the 200-East Area. The discharge permit requires monitoring of the effluent ground water to ensure that concentrations for certain constituents are not exceeded.

300 Area Treated Effluent Disposal Facility

Waste water from laboratories, research facilities, office buildings, and former fuel fabrication facilities in the 300 Area is treated in the 300 Area Treated Effluent Disposal Facility. The waste water consists of once-through cooling water, steam condensate, and other liquid wastes generated in non-contact radioactive processes. The laboratory services are particularly critical to Hanford Site cleanup activities, including tank waste remediation efforts.

The 300 Area Treated Effluent Disposal Facility is designed for continuous receipt of waste waters, with a storage capacity of up to 5 days at the design flow rate of 1,100 L/min (300 gal/min). The facility treats the waste water using best available technology. The treatment process includes iron co-precipitation to remove heavy metals, thiol functional resin ion exchange to remove mercury, and ultraviolet light/hydrogen peroxide oxidation to destroy organics and cyanide. Sludge from the iron co-precipitation process is dewatered and used for backfill in the low-level waste trench. The treated liquid effluent is monitored and discharged through an outfall to the Columbia River under a National Pollutant Discharge Elimination System permit. The permit contains a reopener clause such that the permit conditions can be renegotiated after one year of operation. 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. The 300 Area Treated Effluent Disposal Facility began operating in December 1994 and treated about 310 million L (83 million gal) of waste water in 1995.

340 Waste Handling Facility

The 340 Facility provides receipt, storage, and loadout capability for low-level liquid waste generated during laboratory operations in the 300 Area. The waste is accumulated and stored in two 57,000-L (15,000-gal) tanks located in a covered, below-grade vault in the 340 Building. Six additional 30,000-L (8,000-gal) tanks in the adjacent 340-A building provide backup storage capability. The waste is pumped into rail cars and transported to the 200-East Area 204-AR Unloading Facility for neutralization and transfer to double-shell tanks in the 200 Area for storage. The 340 Facility does not have a Resource Conservation and Recovery Act permit, and wastes cannot be stored for more than 90 days.

The 340 Facility is scheduled to cease operation in about the year 2000. A new waste handling facility with storage and loadout capability will be provided for the 325 Building. This replacement facility will also serve any other generators that are still operating. Once shut down, the 340 Facility will be cleaned out and custody will be transferred to the Transition Projects Program for decontamination and decommissioning.

300 Area Process Sewer Upgrades

Until 1995, there were plans to replace the existing 300 Area gravity-draining process sewer system with a new pressure/vacuum system. However, the list of buildings that needed the process sewer was changing, and problems with a mechanical system became apparent. Approval by the regulators was obtained for a proposal to re-line the existing piping. The new approach will result in cost savings of more than $4 million. The process involves camera surveillance and clean-out of the piping, installation of a resin-impregnated polyester felt fiber on the pipe walls, and thermal curing by heating the water. Lateral pipelines were cut using robotics, and new manholes and clean-outs were constructed as needed for access. The work was approximately 60% complete at the end of 1995. Remaining work involves installation of additional process sewer lines and storm water connections, a pumping station to serve buildings in the southeast 300 Area, and disposal of drummed residue from pipe clean-out.

Phase II Liquid Effluent Streams

The DOE Richland Operations Office has committed to implement "best available technology/all known and reasonable treatment" for nine waste-water streams and to permit the streams under the WAC 173-216, *State Waste Discharge Permit Program* by October 1997. This activity is required by the Washington State Department of Ecology Consent Order No. DE 91NM-177 and Tri-Party Agreement milestone M-17-00B, and includes the elimination, minimization, or treatment of effluents being discharged to the 216-B-3 Expansion Ponds. One stream, the 241-AY/AZ Steam Condensate, is returned to the tank farms and is not planned to be discharged. Another stream, the 183-D Filter Backwash, was eliminated. A WAC 173-216 Discharge Permit application was submitted for the 400 Area Secondary Cooling Water stream in December 1992 and a final permit is expected to be issued by the Washington State Department of Ecology in 1996.

The project, "Phase II Effluent Treatment and Disposal," has been identified to provide the necessary construction activity for the following streams: 242-A Evaporator Cooling Water, the 242-A Evaporator Steam Condensate, the 244-AR Vault Cooling Water, the 284-E Powerplant (including 283-E and 282-E) Waste Water, and the B Plant/Waste Encapsulation and Storage Facility Cooling Water. Another stream, the 241-A Tank Farm Cooling Water, is to be connected to the 200 Area Treated Effluent Disposal Facility. Conceptual design for the project was completed in June 1993, advanced conceptual design was completed in January 1995, and definitive design started in February 1995.

In April 1995, the "best available technology/all known and reasonable treatment" determination was revised for the 200 Area Phase II waste-water streams based on additional sampling and better than expected effluent quality. As a result, only the cooling towers at B Plant remain in the construction project scope. The remaining 200 Area Phase II waste-water streams will now be routed to the 200 Area Treated Effluent Disposal Facility, and the existing WAC 173-216 Discharge Permit will be revised; a separate 200 Area Phase II Waste-Water Discharge Permit application submitted in December 1993 will not be acted upon. The 244-AR Vault Cooling Water stream was discontinued.

Miscellaneous Streams

Miscellaneous streams are lower priority waste-water streams that discharge to the soil column throughout the Hanford Site and are subject to requirements in Washington State Department of Ecology Consent Order No. DE 91NM-177. The *Plan and Schedule for*

Disposition and Regulatory Compliance for Miscellaneous Streams, (DOE 1994c), was approved by the Washington State Department of Ecology in February 1995. This document provides a plan and schedule for ensuring that miscellaneous streams will be in compliance with the applicable state regulations (e.g., WAC 173-216 and WAC 173-218). The commitments established in the plan and schedule include annually updating the miscellaneous streams inventory, registering injection wells, submitting four categorical permit applications, and implementing best management practices.

The inventory of miscellaneous streams includes more than 640 streams. Streams that already have discharge permits in place, streams for which permit applications have been submitted, or streams that are covered under a National Pollutant Discharge Elimination System permit are not included. All injection wells were registered under WAC 173-218 in August 1995, including injection wells that were previously registered. This ensured that the registrations were current, complete, and in the same format.

Use of categorical permits provides a vehicle to easily permit miscellaneous streams with similar characteristics. Four categorical permit applications are scheduled to be submitted through September 1998 for

- Hydrotesting, maintenance, and construction discharges (application submitted November 1995)
- Cooling-water discharges and uncontaminated steam condensate
- Surface-water discharges and safety shower discharges
- Storm-water discharges.

A best management practices report due to the Washington State Department of Ecology by August 1996 will include selection of preferred options and an implementation schedule.

Submarine Reactor Compartments

Eleven defueled submarine reactor compartment disposal packages were received and placed in Trench 94 in the 200-East Area during 1995. This brings the total number received to 54.

The reactor compartment disposal packages are being regulated by the Washington State Department of Ecology as dangerous waste because of the presence of lead used as shielding and by EPA because of the presence of small amounts of PCBs bound within the matrix of nonmetallic materials such as thermal insulation, electrical cables, and some synthetic rubber items.

Revegetation

DOE and the Hanford Natural Resource Trustees are working cooperatively to plan and execute effectively necessary restoration and mitigation actions for the proposed remediation sites. Revegetation/mitigation plans will use native plant species (seeds and shrubs) to restore the areas disturbed by remediation activities.

Bechtel Hanford, Inc. and its subcontractors CH2M Hill and IT Corp. are working cooperatively with the Natural Resource Trustees on the Mitigation Action Plan for the 100 Areas. The plan describes the planning and implementation of appropriate mitigation measures for areas disturbed during remediation. Mitigation measures include avoidance, minimization, rectification, or compensation of impacted resources.