PLAN FOR CLOSURE OF HANFORD'S CENTRAL PLATEAU

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ABSTRACT

This paper summarizes an approach to reduce risk to the public and environment through accelerated closure of Hanford's Central Plateau, based on a plan developed by Fluor Hanford and submitted to the Department of Energy (DOE)-Richland Office, for consideration, in September, 2004. This plan provides a framework and starting point for discussions with regulators and further planning for closure activities on the Plateau. The closure strategy and approach required developing a full inventory of items needing closure as well as identifying and defining technical and regulatory approaches that were compatible with current regulatory processes, reduce risks, and met DOE objectives. This effort, and the paper that follows, integrates closure activities among several contractors and two DOE field offices.

INTRODUCTION

This paper presents a summary of a strategic approach developed to close the Central Plateau area of the Hanford Site, a former weapons-production complex managed by the U.S. Department of Energy (DOE). This approach was submitted to the DOE- Richland office by Fluor Hanford to provide a framework and roadmap to integrate ongoing operations with closure of facilities that are no longer actively used–all with a view to closing the Central Plateau by 2035. The plan is currently under consideration by the DOE.

The 580 mi^2 Site, located in southeastern Washington State (Figure 1), produced 60 percent (about 75 tons) of the United States' plutonium from the mid-1940s to the late 1980s to support national defense. Production led to pollution of the environment, and a major effort is under way to clean up the legacy waste from the defense-production mission. The Pacific Northwest's major waterway, the Columbia River, flows through the Site. Remediating the Site and protecting the river from radioactive and hazardous contaminants are priorities of the cleanup effort.

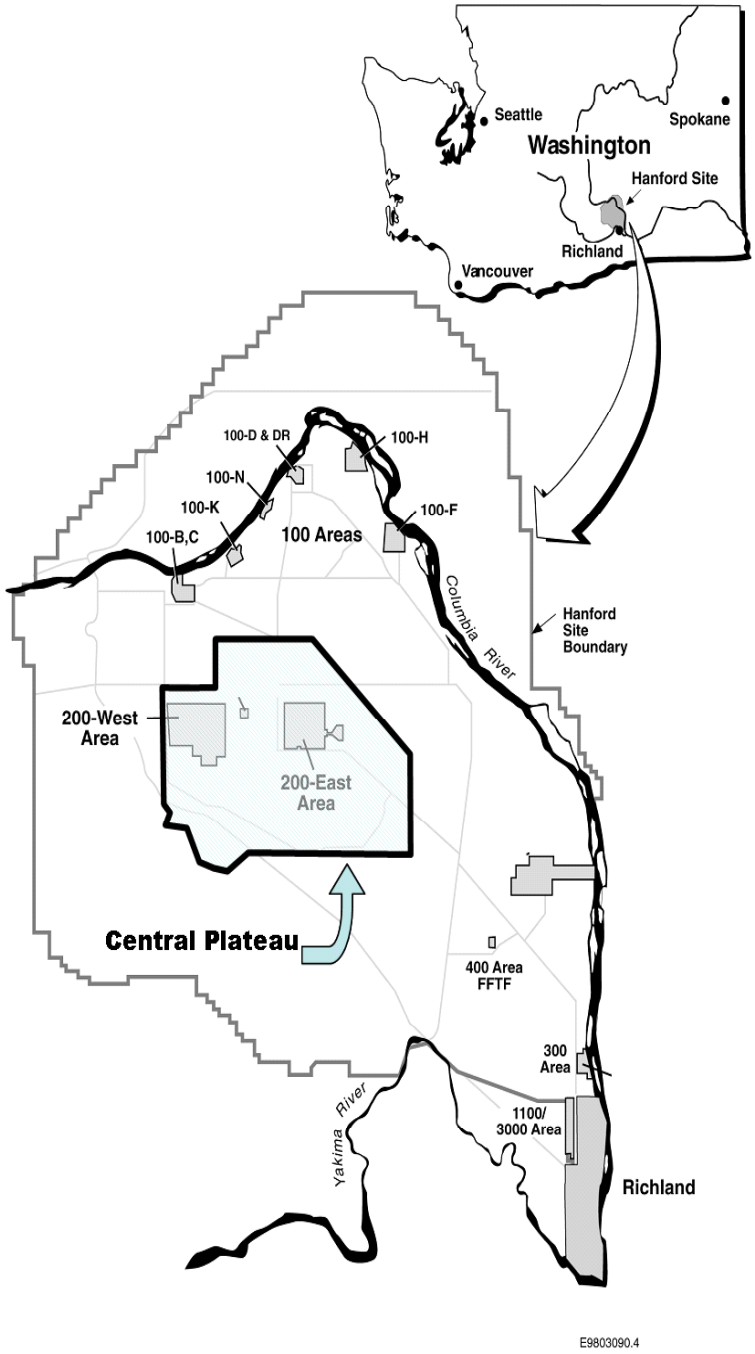

Fig. 1. The Hanford Site.

The Central Plateau encompasses about 75 mi^2 near the center of the Hanford Site. As the site of processing and waste management activities since 1945, the Central Plateau has accumulated a large inventory of processing and support facilities, tank systems, liquid and solid-waste disposal and storage facilities, utility systems, and wells.

The legacy waste and contaminated materials from the defense-production mission remain on the Central Plateau in canyons, underground tanks, waste sites, and structures. More than

450 billion gallons of liquid waste, some containing radionuclides and hazardous chemicals, have been discharged to the ground. Much of this contamination remains above the water table, but some has reached the groundwater. The closure planning summarized in this paper provides an integrated approach, and schedule for transforming the Central Plateau of today from a collection of active and inactive operations to a closure state where most structures are gone, contamination is either removed or placed under a barrier, and long term stewardship has been initiated. This approach for closure addresses the source of the contamination in the canyons, underground tanks, waste sites, structures and wells, on the Central Plateau.

The objectives of the closure planning are to demolish structures, remove and/or stabilize contaminants, and establish institutional controls, such as postclosure groundwater monitoring, for long-term stewardship. The ultimate goals are to minimize the risk to the groundwater, protect the public and environment, and to return the Central Plateau to a state that supports the ecosystem.

REGULATORY APPROACH

The regulatory approach to closure recognizes that the ultimate remedial action closure decisions and plans will be made using the existing federal and state regulatory framework established by the *Hanford Federal Facility Agreement and Consent Order* (Tri Party Agreement) [1] and other governing DOE orders and environmental regulations. A number of different regulatory and decision processes exist that will affect work within an individual zone. All Central Plateau zones have some combination of Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Resource Conservation and Recovery Act (RCRA), National Environmental Policy Act (NEPA), and other processes that will determine final disposition actions within the zone. The regulatory approach developed brings these processes together in a streamlined manner to ensure that closure requirements are met, that closure elements within a zone are addressed, and that final closure of the Central Plateau supporting the completion of DOE's EM mission is verified and documented.

As the regulatory approach for Central Plateau closure was developed, it became apparent that most zones were affected by multiple regulatory processes and decision documents and that decision documents crossed multiple zones. A fundamental integration tool is critical to successful implementation of the closure program. The concept of zone closure implementation plans (ZCIP) was developed to address that need. A ZCIP, to be prepared for each of the Central Plateau zones, will serve as the foundation for integrating closure activities within a zone. The ZCIP would be structured to capture all regulatory requirements related to activities within the zone, provide project execution details and ultimately become a data package that documents the history and completion of zone closure activities. The ZCIP and subsequent zone closure completion package would be the source of data for documenting closure verification requirements.

CLOSURE APPROACH

The approach for closing the Central Plateau divides the area into 22 geographically based zones (Figure 2).

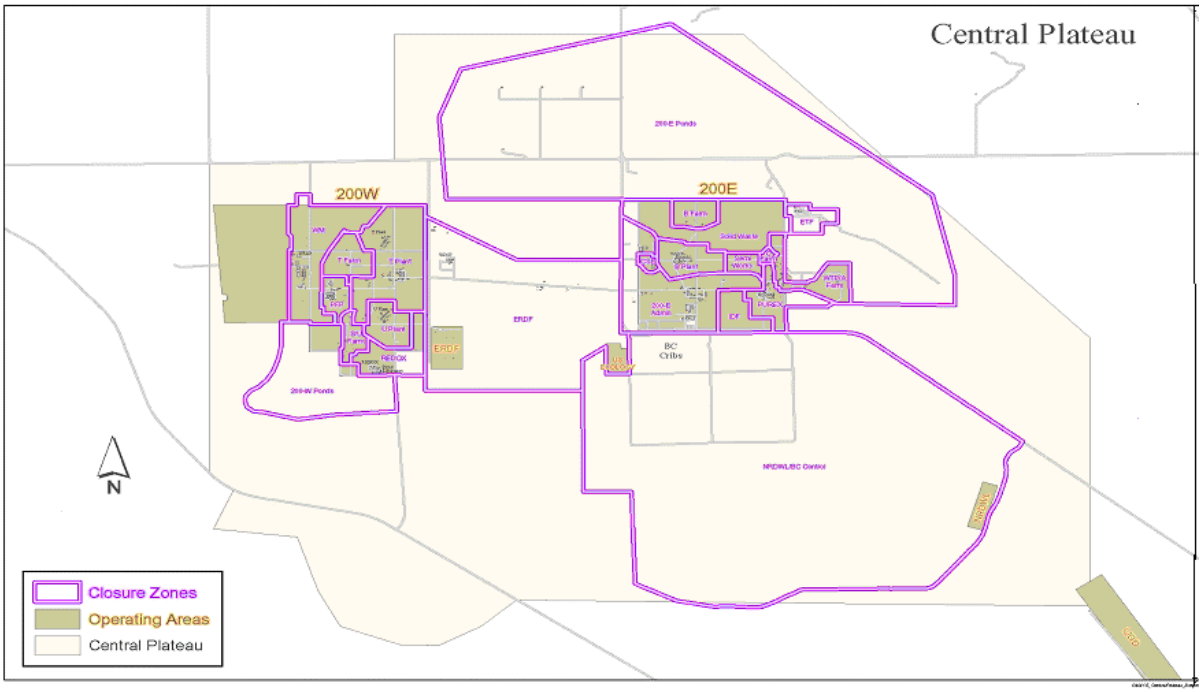

Fig. 2. Central Plateau 22 Closure Zones.

The zones are comprised of nearly 4,000 items requiring closure action. The major constituents of those zones are organized into five closure elements: canyons, underground tanks, waste sites, structures, and wells. Work is divided into these common, manageable elements to facilitate the planning necessary to meet regulatory requirements, obtain timely public reviews and regulatory approval, and stage work for optimum efficiency and cost-effectiveness. To ensure that the full set of actions for each of the closure elements is identified, standard process steps were developed and are discussed later in this paper. Each closure zone is planned as a separate project to control and track the work as part of an integrated program.

CLOSURE ELEMENTS

The approaches outlined above have been tailored for each of the five closure elements to balance contaminant removal and placement of barriers to limit migration of contaminants to the groundwater and protect contaminants remaining in place from bio-intrusion. The approach for each of the closure elements is described in the following paragraphs.

Canyons

The canyon closure element consists of five major defense production facilities originally designed for fuel reprocessing operations. Four of the five; U Plant, B Plant, the PUREX Plant, and the REDOX Canyon, are currently in surveillance and maintenance. The fifth, T Plant, is being used for Waste Management Project operations. The closure approach for the canyons is as follows:

- Remove material and equipment requiring disposal at a different location
- Place contaminated equipment and materials in cells, below-ground galleries, or other below-ground portions of the building
- Demolish the upper structure of the canyon leaving demolition debris in place
- Place a protective barrier over the demolished building and adjacent waste sites and demolished structures.

The remedial action for each canyon will be evaluated using the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) [2] process.

Underground Tanks

The underground tank closure element consists of 177 single-shell and double-shell tanks used to store high-activity waste generated during reprocessing operations. Closure scope begins after waste retrieval operations are complete.

The closure approach for underground tanks is as follows:

- Close ancillary equipment
- Fill void space in tanks
- Place a protective barrier over the tank farm and adjacent waste sites and demolished structures.

The tank system closure process has been established by the Tri-Party Agreement using *Resource Conservation and Recovery Act of 1976* (RCRA) [3] and "Hazardous Waste Management Act of 1976" [4] closure for double-shell tanks. Waste management area integration studies are being developed for single-shell tank areas to coordinate RCRA closure/corrective measures and CERCLA actions.

Waste Sites
The waste site closure element contains 884 sites consisting of cribs, ponds, ditches, retention basins, burial grounds, pipelines, and unplanned releases where liquid or solid waste contaminated with radioactive materials or hazardous chemicals were disposed of or released. The closure approach for waste sites uses a combination of the following actions:

- Removing, treating, and disposing of contaminated materials, especially soil
- Maintaining existing soil cover
- Taking no action for sites that represent minimal hazard
- Capping with a protective barrier where required to protect groundwater or mitigate intrusion
- Remedial actions for waste sites are being taken under CERCLA in groups of operable units as established by the Tri-Party Agreement.

Structures
The structures closure element consists of 955 varied structures including offices, shops, trailers, and water tanks, as well as large processing, storage, or handling facilities such as the Plutonium Finishing Plant (PFP) and the liquid tank waste evaporators. The closure scope for currently operating facilities begins after completion of deactivation activities by the operating program. The closure approach for structures is as follows:

- Demolish above-ground structures
- Fill voids in below-ground structures
- Stabilize the surface
- Place protective barriers where required to protect groundwater or mitigate intrusion.

The regulatory approach for structures is to use a combination of regulatory paths depending on the extent of radioactive or hazardous chemical contamination present. Disposition of most uncontaminated structures will be managed using a *National Environmental Policy Act of 1969* (NEPA) [5] review. Contaminated structures that are adjacent to canyons generally will be included as part of the canyon CERCLA documents. Other contaminated structures will be dispositioned as CERCLA removal actions.

Wells
The wells closure element includes 1,968 groundwater or vadose zone wells that have been used for monitoring and characterization and are noncompliant with applicable regulations or will not be needed following closure. These wells are closed to eliminate a pathway for contamination to migrate to the groundwater more quickly. The closure approach for wells is to decommission through filling or demolition. The regulatory approach is established and uses a notice of intent to decommission in accordance with *Washington Administrative Code* (WAC) 173-160, "Minimum Standards for Construction and Maintenance of Wells." [6]

PROCESS STEPS, SCHEDULE AND COST

A standard set of process steps (Table I) was developed to ensure consistency and effectiveness in closure actions and to form the basis for building schedules and estimating costs. Each process step was applied as appropriate for each closure element, resulting in a comprehensive list of actions required to complete closure in each zone.

Table I. Standard Process Steps.

Step	Description
Preclosure surveillance and maintenance	Maintaining safe and compliant conditions in deactivated structures and inactive waste sites.
Characterization and investigation	Identifying hazards and constituents of concern. Includes sampling and analysis.
Development and approval of closure decision documents	Obtaining regulatory decisions and developing nuclear safety documentation. Includes preparing implementing plans.
Site preparation	Administrative and physical preparation for closure. Includes development of procedures and specifications and equipment and material removal.
Removal, treatment, and disposal of contamination	Removing, packaging, and disposing of waste. Applied only at waste sites.
Filling voids	Filling below ground voids to stabilize contamination and prevent subsidence.
Demolition	Removing structures and disposing of waste, rubble, and debris.
Barrier installation	Placing barriers and monitoring systems.
Zone completion	Completing closure activities. Includes verification sampling, revegetation, and developing closure documentation.
Postclosure surveillance and maintenance	Maintaining safe and compliant conditions after closure in preparation for transition to long-term stewardship. Includes monitoring and inspecting barriers and maintaining access controls.

Closure actions for each zone were merged with logic ties and constraints to produce an integrated schedule for Central Plateau closure. Required resources were incorporated to develop a time-phased schedule and cost profile. The schedule and cost estimate includes rerouting infrastructure and utilities required because of closure activities and logical connections to ongoing operations. The timing of closure actions was reviewed and the schedule adjusted to achieve a reasonable cost profile while meeting a 2035 completion date.

ASSUMPTIONS, RISKS, AND OPPORTUNITIES

The strategy and approach for closure of the Central Plateau is based on a series of overriding programmatic assumptions:

- Barriers over contaminated structures and waste sites will effectively minimize bio-intrusion and reduce the transport rate of contaminants to the groundwater

- Ninety-five percent of the plutonium currently present on the Hanford Site will be removed and shipped off Site
- Contaminated materials and soils will be left in place, unless removal and disposal are more cost effective
- Institutional Controls to ensure long-term stewardship will be necessary.

These assumptions drove the selection of technical approaches and the selection of closure remedies. These assumptions also create programmatic risk.

Programmatic risk is defined as an unplanned event that can affect the cost, schedule, or performance of a project. For Central Plateau closure activities, risks that may affect the project can arise from many different sources. Central Plateau closure includes a number of individual, yet interconnected activities with multiple interfaces. These activities are subject to a diverse set of external regulations and requirements that will occur over an extended period of time. Interfaces, regulations and requirements represent sources of risk, as do constraints and logic ties between the activities. The closure approach and schedule of this plan were qualitatively assessed to identify the key risks, the likelihood that those risks would occur, and the consequence of the event occurring to execution of the closure program. Potential actions and/or opportunities were identified to manage the risks or mitigate the impact.

The primary risks to achieving Central Plateau closure within this schedule and cost estimate relate to 1) regulatory decisions that may differ from planned assumptions, especially related to leaving transuranic-containing materials in place, 2) the logistical challenges inherent in moving significant volumes of fill and barrier material, 3) programmatic delays and limitations such as delay in offsite shipments of plutonium, spent nuclear fuel and vitrified tank waste and 4) availability of funding. Opportunities exist to develop and implement alternative approaches and additional capabilities not yet available that will offset some of these risks.

SUMMARY

The planning for Closure of Hanford's Central Plateau provides an integrated closure approach, schedule, and rough-order-of-magnitude cost estimate for transforming the Central Plateau from a collection of active and inactive operations to a closure state where most structures are gone, contamination is either removed or placed under a barrier, risk to the public and environment are greatly reduced and long-term stewardship has been initiated. In the closure state, few of today's operations remain and portions of the Central Plateau are available for other uses, compatible with the presence of contaminated materials under barriers. The approach described represents the first planning effort to identify the full range of actions that must be accomplished. The plan provides the roadmap to close Hanford's Central Plateau by 2035 and positions the DOE to complete its Environmental Management mission.

REFERENCES

[1] Ecology, EPA, 1989a, *Hanford Federal Facility Agreement and Consent Order*, 2 vols., Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington, as amended.

[2] *Comprehensive Environmental Response, Compensation, and Liability Act of 1980,* 42 USC 9601, et seq.

[3] *Resource Conservation and Recovery Act of 1976,* 42 USC 6901, et seq.

[4] RCW 70.105, "State of Washington Hazardous Waste Management Act of 1976," *Revised Code of Washington,* as amended.

[5] *National Environmental Policy Act of 1969,* 42 USC 4321, et seq.

[6] WAC 173-160, "Minimum Standards of Construction and Maintenance of Wells," *Washington Administrative Code,* as amended.