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Hanford Site Central Plateau Cleanup Completion Strategy

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

U.S. DEPARTMENT OF ENERGY | Richland Operations Office

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Hanford Site Central Plateau Cleanup Completion Strategy
"Mapping the Path to Efficient and Effective Cleanup"

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ABSTRACT

Cleanup of the Hanford Site is a complex and challenging undertaking. The U.S. Department of Energy (DOE) has developed a comprehensive vision for completing Hanford's cleanup mission including transition to post-cleanup activities. This vision includes 3 principle components of cleanup: the ~200 square miles of land adjacent to the Columbia River, known as the River Corridor; the 75 square miles of land in the center of the Hanford Site, where the majority of the reprocessing and waste management activities have occurred, known as the Central Plateau; and the stored reprocessing wastes in the Central Plateau, the Tank Wastes. Cleanup of the River Corridor is well underway and is progressing towards completion of most cleanup actions by 2015. Tank waste cleanup is progressing on a longer schedule due to the complexity of the mission, with construction of the largest nuclear construction project in the United States, the Waste Treatment Plant, over 50% complete. With the progress on the River Corridor and Tank Waste, it is time to place increased emphasis on moving forward with cleanup of the Central Plateau.

Cleanup of the Hanford Site has been proceeding under a framework defined in the Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement). In early 2009, the DOE, the State of Washington Department of Ecology, and the U.S. Environmental Protection Agency signed an Agreement in Principle in which the parties recognized the need to develop a more comprehensive strategy for cleanup of the Central Plateau. DOE agreed to develop a Central Plateau Cleanup Completion Strategy as a starting point for discussions. This DOE Strategy was the basis for negotiations between the Parties, discussions with the State of Oregon, the Hanford Advisory Board, and other Stakeholder groups (including open public meetings), and consultation with the Tribal Nations. The change packages to incorporate the Central Plateau Cleanup Completion Strategy were signed by the Parties on October 26, 2010, and are now in the process of being implemented.

DEVELOPMENT OF A HANFORD CLEANUP STRATEGY

The initial framework for cleanup of the Hanford Site was established when DOE, EPA, and Ecology signed the *Hanford Federal Facilities Agreement and Consent Order* (Tri-Party Agreement) in 1989. In 1992, the Tri-Parties actively engaged stakeholders and the public on Hanford Site cleanup with the Hanford Future Site Uses Working Group. Three key recommendations of the group have framed much of the direction of cleanup since that time.

- ***"Protect the Columbia River"*** *– Stop actual and possible future contamination of the Columbia River. Protection of the Columbia River and its uses is viewed as a high priority.*
- ***"Deal Realistically and Forcefully with Groundwater Contamination"*** *– Return groundwater to unrestricted use where possible. Restrict groundwater use where necessary, but apply treatment technologies and source removal to enable future use.*
- ***"Use the Central Plateau Wisely for Waste Management"*** *– To facilitate cleanup of the rest of the site, wastes from throughout the Hanford Site should be concentrated in the Central Plateau. Minimize the amount of land devoted to, or contaminated by, waste management activities.*

The first two recommendations have appropriately been the focus of cleanup efforts in the last 15 years for the three major components for Hanford Site cleanup – the River Corridor, Tank Waste, and Central Plateau. Specific activities have been further shaped by discussions with Tribal Nations, interactions with the public, and advice from the Hanford Advisory Board. Cleanup of waste sites and facilities in the River Corridor will essentially be complete by 2015, with substantial progress made on groundwater remediation. Closure of tanks and tank farms is being evaluated in the forthcoming *Tank Closure and Waste Management Environmental Impact Statement* (EIS).

In August 2009, DOE issued a draft *Hanford Site Cleanup Completion Framework* document for public comment to define a comprehensive and efficient path forward for completing cleanup at the Hanford site that began in the 1980s. The draft Framework document defined the two main geographic components of cleanup – the River Corridor and the Central Plateau (Figure 1). The River Corridor includes the former fuel fabrication and reactor operations areas. This region is adjacent to the Columbia River and cleanup must deal with the threats to that valuable resource. The Central Plateau includes the former fuel processing facilities and numerous waste disposal facilities and is located in the center of the site. Included within the Central Plateau area is Hanford's most significant challenge – Tank Waste cleanup, which forms the third main component of Hanford Site cleanup.

The goals for cleanup, as identified in the *Hanford Site Cleanup Completion Framework* document, are:

Goal 1: Protect the Columbia River.

Goal 2: Restore groundwater to its beneficial use to protect human health, the environment, and the Columbia River.

Goal 3: Clean up River Corridor waste sites and facilities to:

- Protect groundwater and the Columbia River.
- Shrink the active cleanup footprint to the Central Plateau.
- Support anticipated future land uses.

Goal 4: Clean up Central Plateau waste sites, tank farms, and facilities to:

- Protect groundwater.
- Minimize the footprint of areas requiring long-term waste management activities.
- Support anticipated future land uses.

Goal 5: Safely manage and transfer legacy materials schedule for off-site disposition including special nuclear material (including plutonium), spent nuclear fuel, transuranic waste, and immobilized high-level waste.

Goal 6: Consolidate waste treatment, storage, and disposal operations on the Central Plateau.

Goal 7: Develop and implement institutional controls and long-term stewardship activities that protect human health, the environment, and Hanford's unique cultural, historical and ecological resources after cleanup activities are completed.

Also in 2009, the DOE, the State of Washington Department of Ecology, and the U.S. Environmental Protection Agency recognized the need to develop a more comprehensive and detailed strategy for cleanup of the Central Plateau portion of the Hanford Site, to facilitate the same type of progress that had been made on the River Corridor cleanup and in groundwater remediation. DOE agreed to develop *a Central Plateau Cleanup Completion Strategy* document as a starting point for developing a final Tri-Party agreement on Central Plateau cleanup path forward. This DOE Strategy, consistent with the goals from the Framework document, was the basis for negotiations between the Parties, discussions with the State of Oregon, the Hanford Advisory Board, and other Stakeholder groups (including open public meetings), and consultation with the Tribal Nations. The change packages to incorporate the agreed-upon Central Plateau Cleanup Completion Strategy were signed by the Parties on October 26, 2010.

CENTRAL PLATEAU CLEANUP

General Cleanup Approach

The Central Plateau is a 75square mile region near the center of the Hanford Site. The Central Plateau includes the area designated in the *Hanford Comprehensive Land Use Plan Environmental Impact Statement* and *Record of Decision* as the "Industrial Exclusive Area", a rectangular area of about 20 square miles in the center of the Central Plateau.

The Central Plateau has been the site of processing and waste management activities since 1945. It has a large inventory of chemical processing and support facilities, tank systems, liquid and solid waste storage and disposal facilities, utility systems, administrative facilities, and groundwater monitoring wells. The Central Plateau has also been utilized to support cleanup of the rest of the Hanford Site, as waste materials have been brought to centrally-located disposal facilities, including the disposal of contaminated soils and debris from remediation activities at the Environmental Restoration Disposal Facility (ERDF).

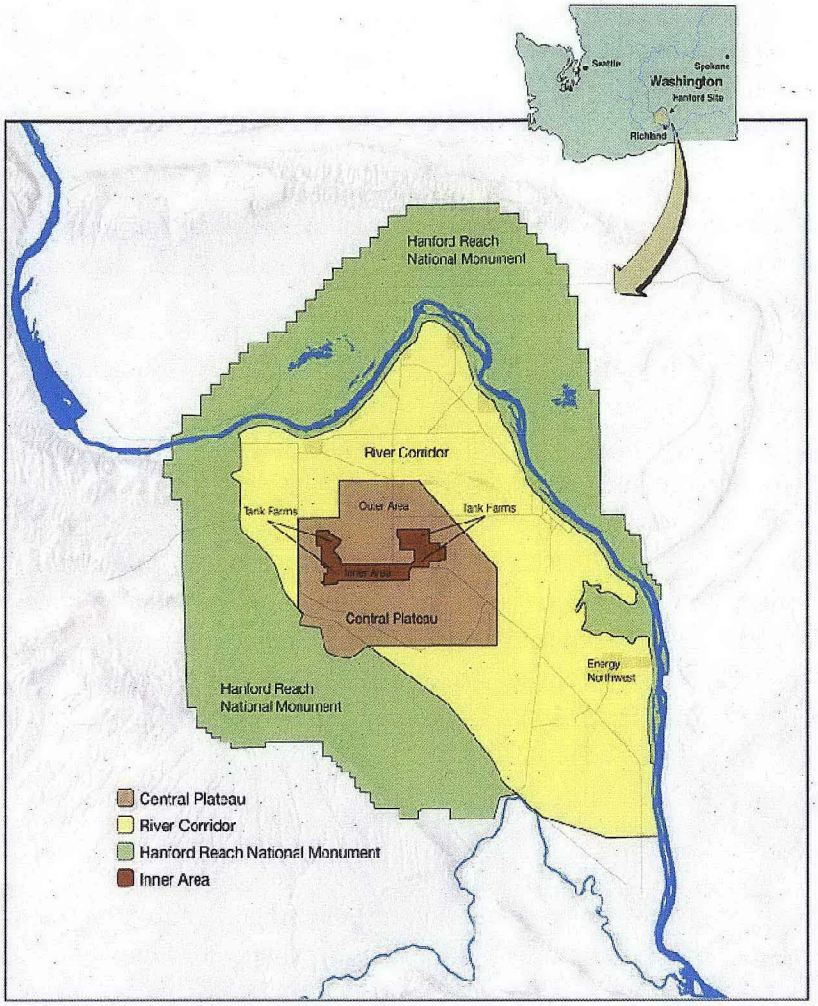

Figure 1. River Corridor and Central Plateau Areas of the Hanford Site

The DOE is committed to aggressively move forward to complete the cleanup of the Hanford Site and to shrink the size of the "final footprint" that will require long-term management of wastes and residual contamination. This final footprint, hereafter referred to as the "Inner Area", will be located in the Central Plateau, within the Industrial-Exclusive Area, where residual contamination is likely to remain after cleanup remedies have been implemented and where commitments to management and disposal of wastes have already been made. DOE does have an object to minimize the size of this final footprint to the smallest practical land area, and envisions an area comprising less than 2% of the original Hanford Site land area. Outside of the Inner Area, the remainder of the Central Plateau is referred to as the "Outer Area", which will be made available for other uses consistent with the *Hanford Comprehensive Land Use Plan*.

The Inner Area boundary is defined by waste disposal decisions already in place and anticipated future decisions that will result in the requirement for continued waste management and containment of residual contamination. In developing the proposed boundary, DOE considered:

- Waste disposal decisions already in place, such as the Environmental Restoration Disposal Facility (ERDF), the Integrated Disposal Facility (IDF), the Naval Reactor Compartment Disposal trench, the Mixed Waste Landfills, the U Plant canyon record of decision, and the US Ecology Washington Low-Level Radioactive Waste facility.
- Areas where post-closure and cleanup actions would likely result in engineered surface barriers, even if removal decisions were pursued as part of cleanup, such as the remaining canyons, tank farms, and the existing low-level waste landfills.
- Areas where deep vadose zone contamination exists below the effective range of surface remedies, and therefore will likely require long-term surface controls.

The boundary of the Inner Area is not static, and will be subject to refinement as necessary as cleanup decisions are made and implementation progresses. The locations of these sites were key considerations in development of DOE's initial boundary of the Inner Area as shown in the Figure 2. DOE's goal is that the Inner Area footprint be as small as practical.

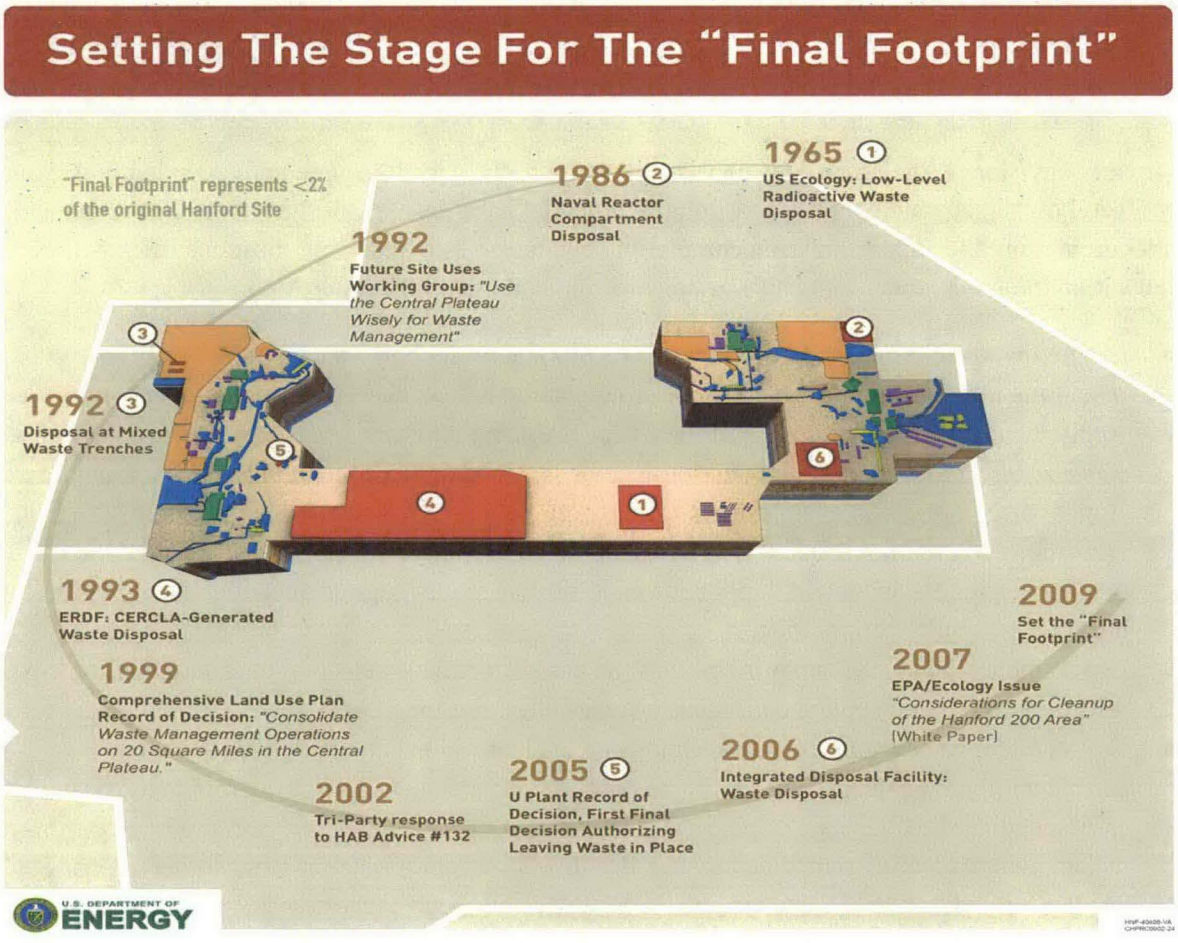

Figure 2. Inner Area Boundary

Objectives of the Strategy

DOE developed the Central Plateau strategy to improve the ongoing remedy decision making process and structure. The previous structure of 23 process-based operable units has served well for the characterization phase of the cleanup, however, as the effort moves into the remedial alternative evaluation, remedy selection and remedy implementation phase, a more comprehensive, structures, and defensible approach is needed to ensure the right remedy decision choices are made. Multiple independent decision units created a redundancy in decision-making, causing many of the same difficult issues to be revisited multiple times by multiple decision-makers. This has led to disagreements on decision processes and outcomes, inconsistencies in the process, and has contributed to delays in getting Central Plateau decision documents approved.

A more structured, holistic approach will provide consistency, take into consideration the scale of cleanup needed on the Central Plateau, account for the geographic proximity of wastes sites, facilities and landfills to integrate remedies, and enable efficient, effective remedies to be developed. A decision process more oriented toward geographic areas of closure will also improve efficiency of implementation and cleanup field work.

Inner Area Cleanup

As currently envisioned, the Inner Area consists of an approximately 10 square mile area that will remain under federal ownership and control for as long as potential hazards exist. If future waste management facilities are required to support mission completion, e.g. tank waste treatment, those facilities will be located within the Inner Area. The DOE strategy for remediation of the Inner Area is to:

- Ensure that the configuration of the waste disposal facilities and residual contamination remaining after cleanup is protective of groundwater, human health and ecological receptors.
- Apply the decision-making steps of the CERCLA process for the Inner Area's excess facilities, waste sites, burial grounds, and tank farm environmental media contaminated by radionuclides. Apply corrective action and closure requirements from RCRA and Washington State's *Hazardous Waste Management Act*, where applicable. Wherever possible, streamline the regulatory process and avoid duplication of effort where the requirements of each regulation can be met by a single work product.
- Use sound technical cleanup principles as the basis for remedy selection to ensure that remedy selection criteria are applied consistently across the entire Inner Area.
- Use a comprehensive approach to develop and evaluate remedial alternatives to 1) improve DOE's ability to evaluate each site in the contexts of "area cleanup", 2) to provide the best assurance that the full scope of potential risks and impacts are taken into account by decision-makers when selecting remedies for specific sites, 3) to appropriately balance other criteria such as long-term effectiveness and cost, and consider public acceptance across the entire Inner Area, rather than on a waste site by waste site basis, and 4) drive consistency in decision making.
- Integrate groundwater and soil remediation using a defense-in-depth approach that applies a combination of actions including infiltration barriers, vadose zone monitoring, groundwater monitoring, and readiness to implement groundwater treatment, when necessary.

- Establish institutional controls that will complement engineered controls selected for application. Continued federal ownership combined with institutional controls will ensure long-term protection of human health and the environment.
- Consolidate decision documents for the Inner Area into geographic area groupings that are amenable to consistent remedy selection and effective implementation (see Table 1 for decision document structure).
- Implement remedies using a geographic area approach organized around canyon facilities, landfills, tank farms and other discrete areas.
- Develop and apply deep vadose zone treatment technologies to address potential sources of future groundwater contamination.
- As part of the CERCLA five year review process, monitor the Inner Area to ensure cleanup remedies remain protective and enable early action in the event of changing conditions or emerging contaminant plumes that could potentially impact groundwater.

Inner Area	
1. 200-PW-1/3/6 and 200-CW-5	No milestone
2. 200 West Inner Area	
• RI/FS Work Plan	December 31, 2011
• FS/PP	June 2013
3. 200 East Inner Area/Pipelines	
• Pipeline RI/FS Work Plan	June 30, 2011
• RI/FS Work Plan	December 31, 2012
• FS(s)/PP(s)	June 2014
4. Deep Vadose Zone	
• RI/FS Work Plan	September 30, 2012
• FS/PP	September 30, 2015
5. 200-SW-2 (Burial Grounds)	
• RI/FS Work Plan	December 31, 2011
• RI/FS/PP	December 31, 2016
Canyons & associated waste sites	
6. B Plant RI/FS work plan	December 31, 2011
7. PUREX RI/FS work plan	September 30, 2015
8. REDOX RI/FS work plan	December 31, 2017
Outer Area	
1. Outer Area FS/PP	April 30, 2012
Groundwater	
1. 200 West Groundwater combined RI/FS/PP	September 30, 2010
2. 200 East Groundwater consolidated FS/PP	December 31, 2012

Table 1. Central Plateau Decision Document Structure

Outer Area Cleanup

The Outer Area covers approximately 65 square miles. Most of the waste sites in the Outer Area are small near-surface sites that will be removed for treatment as needed for onsite disposal or sampled to confirm that no additional action is required, except for implementation of appropriate institutional controls. The DOE strategy for remediation of the Outer Area is:

- Remediate most of the area to unrestricted surface levels comparable to the adjacent River Corridor to support the future reasonably anticipated land use of conservation/mining (mining refers to quarrying for sand, gravel, basalt, etc. for governmental purposes only).
- Remediate the portions of the Outer Area within the Industrial-Exclusive area designated in the *Comprehensive Land Use Plan* (approximately 10 square miles) to the same unrestricted surface levels, and make them available for uses consistent with that Industrial-Exclusive designation.
- Institutional controls will be required in limited areas, as there may be restrictions on subsurface use in portions of the Outer Area.
- Close the two inactive landfills located in the southeastern portion of the Outer Area under Washington State landfill closure regulations, retain these areas under continued federal ownership and control.

Groundwater Cleanup

A key element of the Central Plateau cleanup strategy is groundwater remediation and protection. Protection of the groundwater and ultimately the Columbia River is essential. The DOE strategy for addressing the Central Plateau groundwater is:

- Address the four groundwater operable units, two for 200 East Area and two for 200West Area. Consider whether the two units in each area can be combined for decision making. (see Figure 3 for existing plume maps.)
- Continue, and enhance as appropriate, ongoing pump and treat system operation.
- Remediate the units with the objective being to achieve drinking water standards, unless determined at some future date to be technically impracticable.
- Where remediation goals are not achievable in a reasonable time frame, strive to contain the plume, prevent exposure to contaminated groundwater, and evaluate further risk reduction opportunities as new technologies become available.
- Take near term actions to control plume migration, as appropriate.

Deep Vadose Zone Cleanup

On the Central Plateau, the deep vadose zone is defined as the region below the practical depth of surface remedy influence (e.g. excavation or barrier). Deep vadose zone contamination presents unique characterization and remediation challenges. This type of contamination is not considered to pose environmental or heath risks through direct exposure or uptake by biota. However, it is a primary concern as a potential/ongoing source of groundwater contamination and exposure to human or ecological receptors through the groundwater pathway. DOE's strategy to address the deep vadose zone includes the following elements:

- Implementation of appropriate surface remedies (e.g. barriers, excavation) to mitigate the potential impacts of deep vadose zone contamination.
- Inclusion of an integrated groundwater and vadose zone monitoring system that is designed to provide early warning of significant contaminant movement or impact to groundwater.
- Implementation of groundwater treatment systems that can be expanded to address emerging plumes, if necessary.

- Continued investment in treatability tests to evaluate potential approaches to remediate deep vadose zone contamination.
- Sustained investment in advance science and technology solutions to tackle deep vadose zone challenges including characterization, prediction, remediation, and monitoring.
- Periodically revisit the effectiveness of remedies and possible changes in environmental conditions through the CERCLA five year review process.

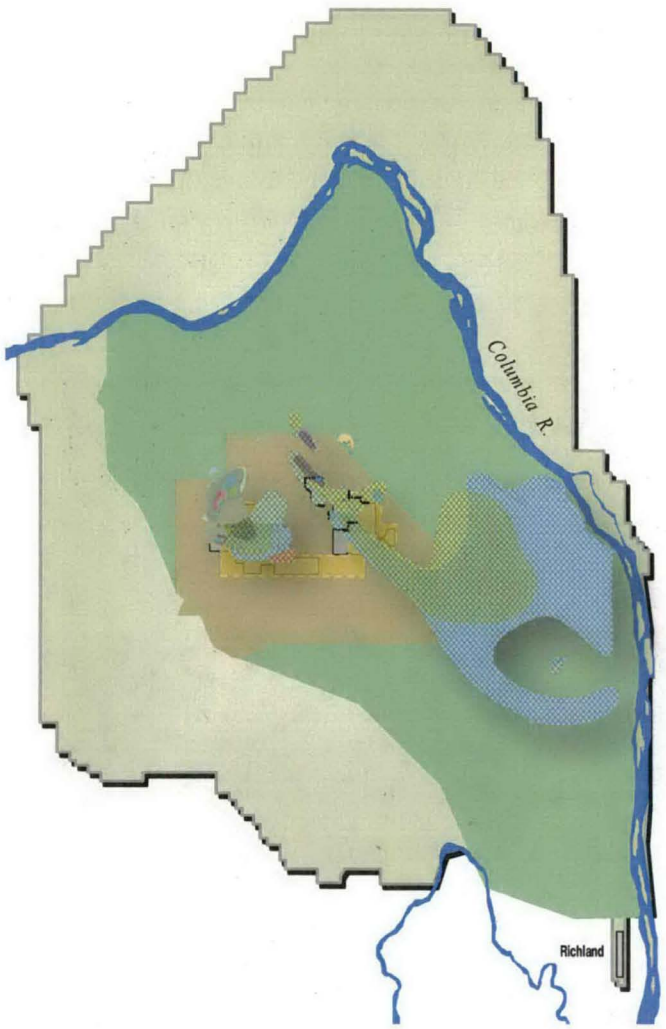

Figure 3. Hanford Site Groundwater Plumes.

CONCLUSIONS

The cleanup of the Hanford Site is a complex and challenging undertaking. The U. S. Department of Energy, the U. S. Environmental Protection Agency, and the Washington State Department of Ecology (Tri-Party Agencies) have agreed upon, and are in the process of implementing, a comprehensive strategy for cleanup of the Hanford Site Central Plateau. This strategy embraces goals that embody more than 20 years of dialogue among the Tri-Party Agencies, Tribal Nations, State of Oregon, stakeholders, and the public. The goals carry forward key values captured in forums such as the Hanford Future Site Uses Working Group, Tank Waste Task Force, Hanford Summits, and Hanford Advisory Board Exposure Scenarios Workshops, as well a many advice letters issued by the Hanford Advisory Board.

Cleanup of the Central Plateau is a highly complex activity because of the large number of waste sites, surplus facilities, active treatment and disposal facilities, and areas of soil contamination. DOE is committed to maintaining the protection of human health and the environment and to meeting its long-cleanup obligations in a safe, protective and cost-effective manner. This Central Plateau strategy will help assure that those obligations can be met (Figure 4.)

Figure 4. Vision of Hanford After Cleanup Completion.