U Plant Geographic Zone Cleanup Prototype

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ABSTRACT

The U Plant geographic zone (UPZ) occupies 0.83 square kilometers on the Hanford Site Central Plateau (200 Area). It encompasses the U Plant canyon (221-U Facility), ancillary facilities that supported the canyon, soil waste sites, and underground pipelines. The UPZ cleanup initiative coordinates the cleanup of the major facilities, ancillary facilities, waste sites, and contaminated pipelines (collectively identified as "cleanup items") within the geographic zone. The UPZ was selected as a geographic cleanup zone prototype for resolving regulatory, technical, and stakeholder issues and demonstrating cleanup methods for several reasons: most of the area is inactive, sufficient characterization information is available to support decisions, cleanup of the high-risk waste sites will help protect the groundwater, and the zone contains a representative cross-section of the types of cleanup actions that will be required in other geographic zones. The UPZ cleanup demonstrates the first of 22 integrated zone cleanup actions on the Hanford Site Central Plateau to address threats to groundwater, the environment, and human health.

The UPZ contains more than 100 individual cleanup items. Cleanup actions in the zone will be undertaken using multiple regulatory processes and decision documents. Cleanup actions will include building demolition, waste site and pipeline excavation, and the construction of multiple, large engineered barriers. In some cases, different cleanup actions may be taken at item locations that are immediately adjacent to each other. The cleanup planning and field activities for each cleanup item must be undertaken in a coordinated and cohesive manner to ensure effective execution of the UPZ cleanup initiative. The UPZ zone cleanup implementation plan (ZCIP) [1] was developed to address the need for a fundamental integration tool for UPZ cleanup. As UPZ cleanup planning and implementation moves forward, the ZCIP is intended to be a living document that will provide a focal point for integrating UPZ actions, including field cleanup activities, waste staging and handling, and post-cleanup monitoring and institutional controls.

INTRODUCTION

The Hanford Site, managed by the U.S. Department of Energy (DOE), is a 1,518 square-kilometer federal facility located in southeastern Washington State. From 1943 to 1989, the primary mission of the Hanford Site was the production of nuclear materials for national defense. The Central Plateau, occupying about 194 square kilometers at the heart of the site, served as a

center for plutonium separations and finishing activities. The production mission resulted in the construction, use, and contamination of hundreds of processing and support facilities, along with the generation and disposal of large volumes of liquid and solid wastes. In July 1989, portions of the Central Plateau were placed on the National Priorities List pursuant to the *Comprehensive Environmental Response, Compensation and Liability Act of 1980* (CERCLA) [2]. Since then, the Hanford Site has focused on an environmental restoration mission.

Nearly 4,000 significant individual items remain to be cleaned up within the Central Plateau. The large number of items and the complex nature of the cleanup present a formidable challenge. Large, heavily contaminated processing facilities remain, along with support facilities and liquid and solid waste management facilities that present a potential threat to human health and the environment. A comprehensive planning effort was recently undertaken by DOE and the prime contractor, Fluor Hanford, focusing on the cleanup of the Central Plateau. The results of that effort are documented in *Plan for Central Plateau Closure* [3]. The effort divided the Central Plateau into 22 geographic cleanup zones organized around significant processing or waste management facilities. Within each zone, the cleanup of major facilities, soil waste sites, ancillary structures/equipment, pipelines, and wells is coordinated. Additionally, post-cleanup monitoring will be coordinated with groundwater remediation activities. The UPZ is the first Central Plateau cleanup zone to be addressed under this geographic cleanup approach. As such, the UPZ is serving as a prototype for the geographic cleanup approach.

U PLANT ZONE AS A PROTOTYPE

The UPZ occupies 0.83 square kilometers toward the middle of the Hanford Site Central Plateau (Fig. 1. and Fig. 2.). The UPZ was selected as a geographic cleanup zone prototype for resolving regulatory, technical, and stakeholder issues and demonstrating cleanup methods. Selection of the UPZ was based on the following factors:

- Most of the area was inactive.
- Characterization information was already available prior to the selection of the prototype zone.
- The zone contains several high-risk waste sites – contaminated soil sites suspected of contributing to groundwater contamination and which continue to pose a threat to groundwater; cleanup of these sites will protect groundwater.
- The zone contains a representative cross-section of the types of cleanup actions that will be implemented in other geographic cleanup zones.
- The 221-U building is the least contaminated of the five large canyon structures at the Hanford Site.

ELEMENTS OF THE U PLANT ZONE

Within the Central Plateau cleanup zones, there are multiple processing and support facilities, tank systems, liquid and solid waste handling, storage, and disposal facilities, utility systems (e.g., buried pipelines), and wells. Each of these is identified as a separate cleanup item in the *Plan for Central Plateau Closure*. To enable systematic zone cleanup planning, the *Plan for Central Plateau Closure* organized these cleanup items into five closure elements: canyons,

tanks (i.e., large single shell or double shell tanks associated with DOE Office of River

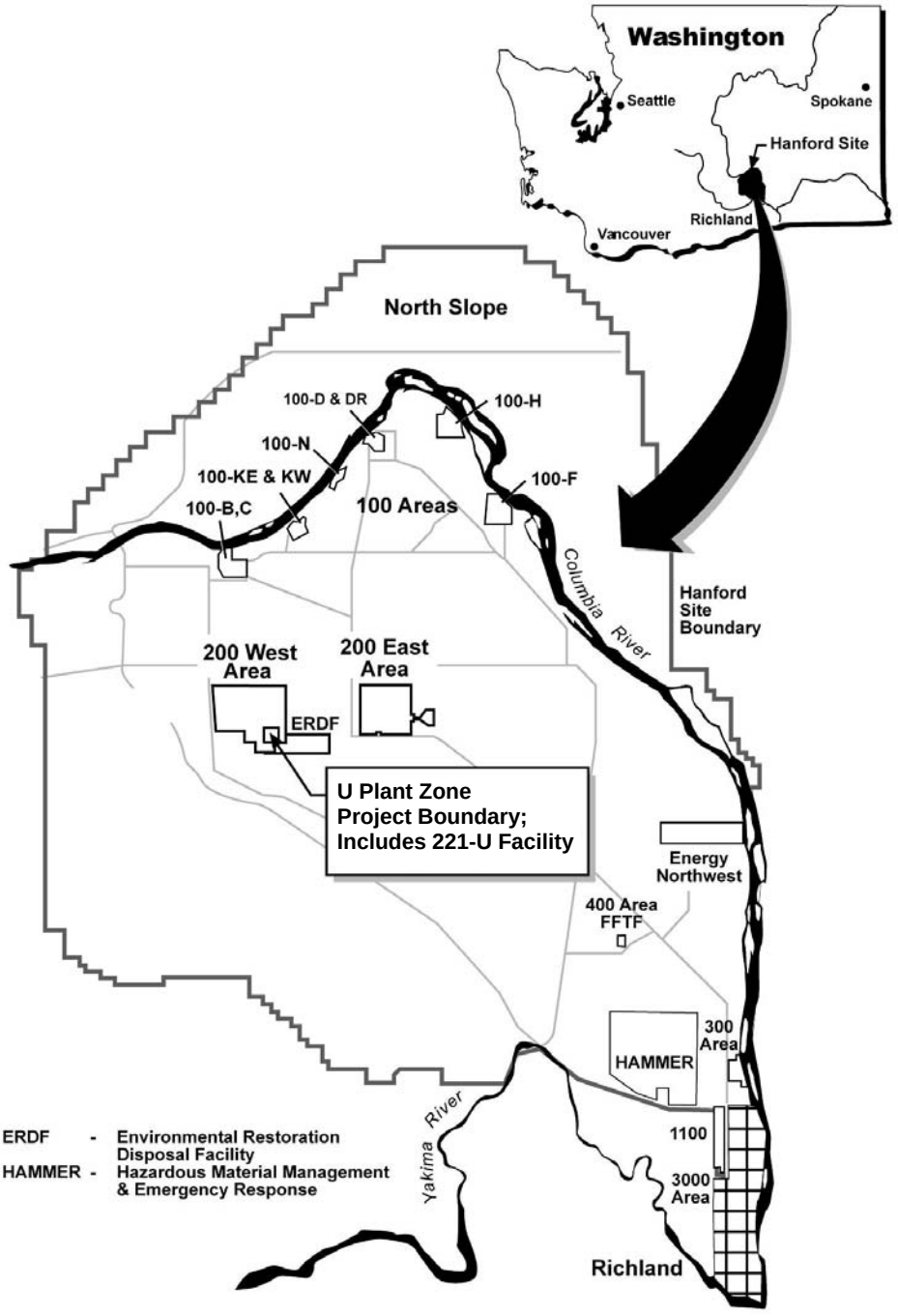

Fig. 1. Location of Hanford Site and U Plant Zone.

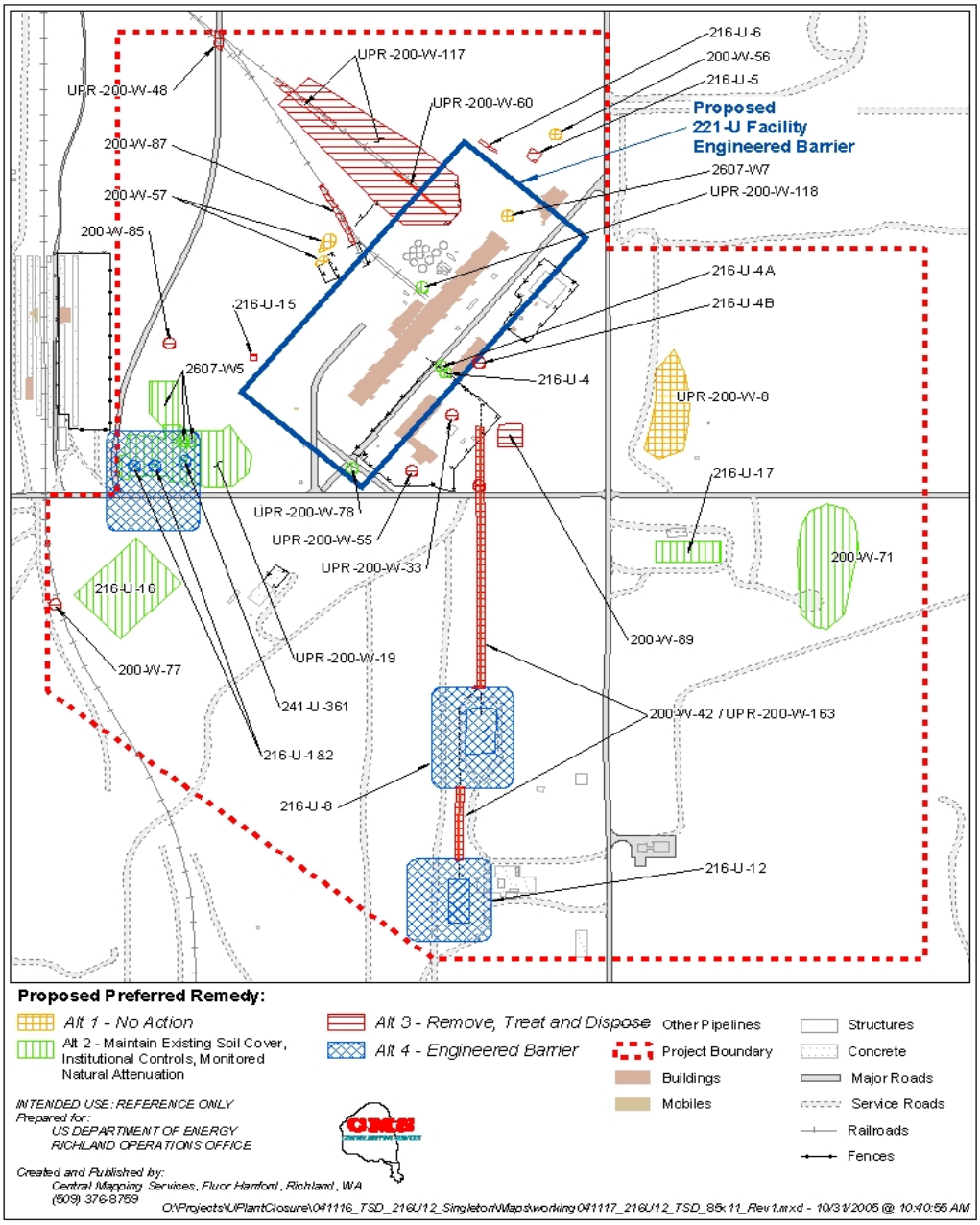

Fig. 2. Enlargement of U Plant Zone.

Protection), waste sites, structures, and wells. The UPZ encompasses four of these five elements; the UPZ does not contain any of the single-shell or double-shell underground waste tanks that comprise the tanks element.

Cleanup items within the UPZ include the U Plant canyon (221-U building), soil waste sites, ancillary structures, underground pipelines, and wells. The contaminated soil consists

predominantly of liquid waste disposal sites associated with U Plant operations and a few solid waste sites (debris piles and burial trenches). A few structures and wastes sites in the UPZ are not directly associated with U Plant operations (i.e., Tank Farm operations support structures or cross-site utilities). The groundwater underlying the zone is contaminated. Contamination in the groundwater includes elevated levels of nitrates, technetium-99, and uranium due to past liquid discharges from Central Plateau production facilities, including those within the UPZ. Groundwater cleanup actions are outside the scope of zone cleanup because contamination plumes extend beyond the geographic zone boundaries. However, UPZ monitoring actions will be coordinated with groundwater cleanup.

Canyons

The UPZ contains one canyon building: the 221-U building. The 221-U building is one of five large Hanford Site chemical separations plants constructed to process irradiated fuel at the Hanford Site. U Plant did not process irradiated fuel as originally intended; it was instead used for training, equipment repair, and decontamination (1945-1951), and later it was modified to recover uranium from process wastes (1952-1957). The 221-U building is a reinforced concrete structure approximately 244 meters long, 21.3 meters wide, and 24.4 meters high, with about 9.14 meters of the height below grade. A cinder block annex building (271-U) and a solvent treatment annex (276-U) are attached to the 221-U building. These three components together comprise the 221-U Facility.

Waste Sites

The UPZ contains 52 known waste sites, including pipelines. A number of contaminated and noncontaminated pipelines (e.g., potable water lines) traverse the UPZ and need to be addressed as part of the UPZ cleanup. In the UPZ, liquid wastes were discharged to the soil column via several types of near-surface underground structures designed to receive and allow liquid waste to percolate directly into the soil including cribs, French drains, a reverse well, trenches, and a septic system. Additional waste sites were created from spills or other types of discharges.

Releases to four high-risk waste sites are suspected to have contributed to groundwater contamination. These waste sites, the 216-U-1, 216-U-2, 216-U-8, and 216-U-12 cribs, require near-term cleanup.

Structures

Until recently, the UPZ contained 32 ancillary buildings and other miscellaneous items identified as structures in the cleanup item database. In the past year, 11 of these have been removed for disposal outside the UPZ. The 21 remaining items include above-ground and below-ground support (e.g., administrative, warehousing) and processing facilities and/or buildings; stacks, underground ducts and filters, and other exhaust system components; and tanks that are not in a facility or building.

Wells

The UPZ contains 16 wells requiring decommissioning to meet Washington State regulations.

ZONE CLEANUP OBJECTIVES AND APPROACH

The objectives of cleaning up the UPZ using the geographic cleanup concept are as follows:

- Demonstrate the zone cleanup concept of grouping work for optimum use of resources, increased efficiency, and cost-effectiveness;
- Eliminate potential sources of groundwater contamination;
- Identify facility, waste site, and pipeline characterization methodologies and disposition alternatives that are cost-effective, protective of human health and the environment, and acceptable to regulators and stakeholders;
- Accelerate U Plant ancillary facilities decontamination and decommissioning;
- Place the UPZ in a condition for long-term stewardship, integrating post-cleanup monitoring and institutional control requirements as appropriate;
- Capture lessons learned for application during implementation of future Hanford Site cleanup actions, as well as share information across the DOE complex where other large nuclear processing facilities will be remediated in the future.

These objectives can only be met if the UPZ cleanup is undertaken in a coordinated and cohesive manner. As the regulatory approach for Central Plateau cleanup was developed, it became apparent that most zones were affected by multiple regulatory processes and decision documents. The *Plan for Central Plateau Closure* envisioned the development of a fundamental integration tool as critical to the successful implementation of the cleanup program. The concept of a ZCIP [1] was developed to address that need. Fluor Hanford has recently prepared a ZCIP for the UPZ that will serve as the foundation for integrating cleanup activities within the UPZ. The ZCIP is intended as a focal point for integrating the following activities within the UPZ:

- Field activities from multiple decision documents and paths,
- Work performed and managed by multiple field offices and contractors,
- Barrier design and installation covering multiple cleanup elements,
- Work performed in adjacent zones,
- Air and groundwater monitoring,
- Waste staging and handling,
- Infrastructure
- Post-cleanup monitoring and institutional controls.

The ZCIP will function as part of the project execution plan for DOE- and contractor-level cleanup implementation. The UPZ ZCIP includes a complete list of the cleanup items within the UPZ, identifies the decision documents that will guide the cleanup of each cleanup item, and provides a logic-tied sequence for cleaning up each item. The ZCIP can monitor the completeness and consistency of cleanup actions within the zone and can also be used to coordinate implementation of activities in adjacent cleanup zones. The ZCIP integrates the planning, execution, and history of UPZ cleanup.

Development of the UPZ ZCIP began with a review of existing databases to develop a complete inventory of UPZ cleanup items. This base inventory was cross-walked against cleanup items identified in regulatory documents. The inventory was then verified by field walkdowns of the UPZ; a team walked the entire zone to visually validate the current inventory, identify any cleanup items assigned to the wrong zone, and identify additional items that are not currently in the database but may require cleanup or further investigation.

The ZCIP provides a summary of regulatory documentation (e.g., CERCLA cleanup decisions) issued or in preparation for each of the UPZ cleanup items. Further, it identifies cleanup items that are not presently associated with a cleanup decision document and proposes a regulatory path forward for those items. Finally, the ZCIP integrates actions required for the cleanup of each item so that cleanup and post-cleanup activities can be carried out in an integrated, projectized fashion. The proposed cleanup sequence takes into consideration the following factors:

- Groundwater Risk – the likelihood that the site has contributed to groundwater contamination (i.e., 216-U-1, 216-U-2, 216-U-8, and 216-U-12 liquid disposal cribs were sequenced first);
- Technical Feasibility – the level of information known about the site and the waste to support decisions regarding waste retrieval, handling, and disposal (e.g., the contents of tank 241-U-361 need to be characterized before establishing a waste disposal pathway that influences when associated cleanup items can be sequenced).
- Logical Relationships – cleanup action predecessors and successors (e.g., physical interferences, such as the need to remove ancillary facilities prior to removing the 221-U building, or the possible need to remediate the 241-U-361 tank before constructing a barrier over the 216-U-1 and 216-U-2 liquid disposal cribs).
- Multiple Cleanup Actions – interfaces and constraints associated with performing multiple cleanup actions in one zone.
- Funding Constraints – integration of cleanup cost estimates and annual funding profiles.

SPECIFIC CLEANUP ACTIONS

Deactivation, decontamination, decommissioning, demolition, waste site removal/remediation, barrier construction, well decommissioning, and other activities associated with UPZ cleanup will be performed in accordance with the applicable provisions of DOE's contract with Fluor Hanford [4].

In addition to the contract requirements, the final remedy for cleanup items in the UPZ is determined in large part by various regulatory and decision processes. It is primarily a combination of CERCLA, the *Resource Conservation and Recovery Act of 1976* (RCRA) [5], and the *National Environmental Policy Act of 1969* (NEPA) [6] that will determine the final disposition actions for the canyon, structures, wastes sites, and wells within the UPZ. Under CERCLA, it is anticipated that records of decision (RODs) will determine the final disposition actions for the 221-U Facility and the UPZ contaminated soil sites. The final signature on the *Record of Decision, 221-U Facility (Canyon Disposition Initiative), Hanford Site, Washington* [7] was obtained on October 3, 2005. A separate ROD for soil contamination sites contained in

the 200-UW-1 Operable Unit is being prepared for issuance. Non-time-critical engineering evaluations/cost analyses (EE/CAs) and action memoranda will determine the final disposition actions of contaminated ancillary facilities and pipelines in accordance with the joint DOE-EPA *Policy on Decommissioning DOE Facilities Under CERCLA* [8]. The action memorandum for the U Plant ancillary buildings has been released [9], and demolition of ancillary facilities is underway. An EE/CA for pipeline remediation is under preparation. The CERCLA remedial action document process has incorporated the necessary elements from the RCRA corrective action process and, as such, no further RCRA corrective action activities are needed in the UPZ. Disposition of noncontaminated facilities will be reviewed using NEPA processes. The principal documents and cleanup actions required to complete UPZ cleanup are as follows.

221-U Facility/Canyon Disposition Initiative Record of Decision

The *Hanford Federal Facility Agreement and Consent Order* [10], known as the Tri–Party Agreement, governs cleanup of the Hanford Site. Section 8.0 of the Tri–Party Agreement identifies the 221–U Facility as a key facility subject to a process by which facilities are taken from operational status to their final end state condition. In 1996, the DOE, the U.S. Environmental Protection Agency, and the Washington State Department of Ecology (collectively identified as the Tri-Party Agencies) determined in an agreement in principle [11] that the CERCLA process would be followed to evaluate potential cleanup remedies and identify the final end state for the 221–U Facility as a pilot project for the disposition of all of the Hanford Site's five canyon facilities. (Disposition planning for the 221-U Facility is also viewed as a pilot for planning the future disposition of canyon facilities at DOE-Idaho and DOE-Savannah River.) The canyon disposition initiative addressed by the 1996 agreement in principle was intended to investigate the potential for using the canyon buildings as disposal sites for Hanford Site remediation waste, rather than demolishing the structures and transferring the resulting waste to another disposal facility.

The *Final Feasibility Study for the Canyon Disposition Initiative (221–U Facility)* [12] evaluated five disposition alternatives against nine CERCLA evaluation criteria. These alternatives included the no action alternative, complete removal of the structure, leaving the structure (including contaminated equipment) in place and importing waste into the structure for final disposal, and partially demolishing the structure and leaving the remaining portion (including contaminated equipment) in place. In the 221-U Facility ROD, EPA selected the Close in Place – Partially Demolish alternative as the final disposition for the 221-U Facility (Fig. 3.).

The key components of the remedy can be summarized as follows:

- Remove wastes that, if stabilized in place, would contain levels of transuranic isotopes greater than 100 nanocuries per gram,
- Consolidate contaminated equipment on the canyon deck into below-grade process cells,[1]
- Grout fill void spaces, operating galleries, and process cells,[2]

[1] To date, no waste stream has been identified for disposal in the 221-U Facility. However, as stated in the *Proposed Plan for Remediation of the 221-U Facility (Canyon Disposition Initiative)* [13], if in the future a viable waste stream were identified for disposal in the facility, the ROD would be amended as appropriate. Further studies addressing the disposal of waste in the canyon are anticipated in the near future.

- Demolish the superstructure to the canyon deck level,
- Construct an engineered evapotranspiration (ET) barrier,
- Remove contaminated debris from ancillary structures to a nearby Hanford Site disposal facility and possibly use clean rubble as barrier fill,
- Conduct groundwater monitoring and performance monitoring of the ET barrier,
- Maintain institutional controls around barrier perimeter, and
- Conduct five-year remedy reviews as required by CERCLA.

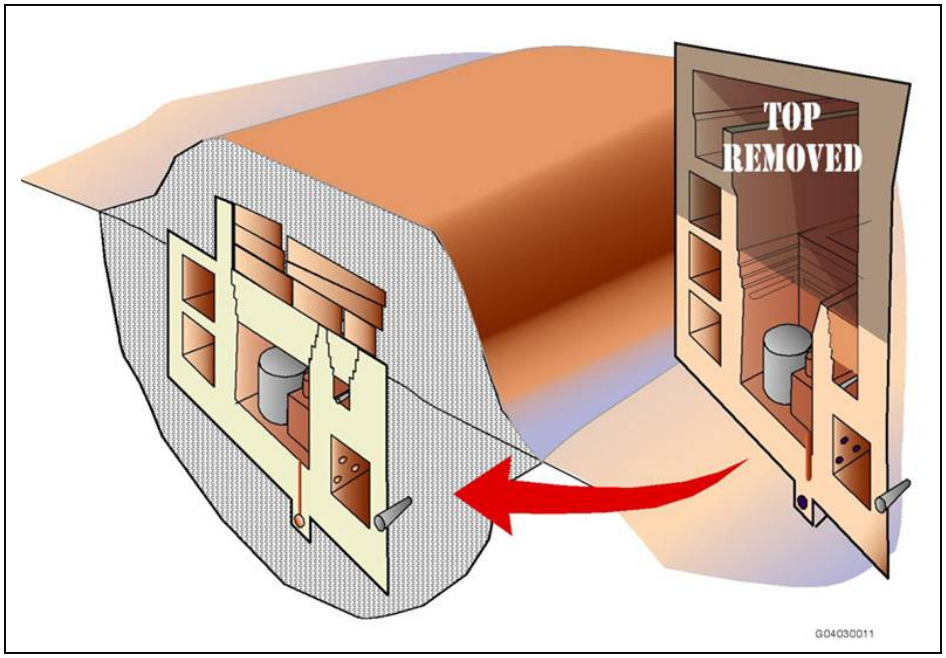

Fig. 3. Illustration of selected 221-U Facility disposition.

Issuance of the 221-U Facility ROD and selection of the Close in Place – Partially Demolish alternative to remediate the 221-U Facility represent significant achievements by the Tri-Party Agencies and Fluor Hanford. This ROD is the first in the nation to address a DOE plutonium production canyon facility, the first to address the remediation of source sites (sites that are potential or actual sources of contamination of the environment) on the Hanford Site Central Plateau, and the first to select isolation of source site waste in place as a final remedial action. By leaving waste in place, the selected 221-U Facility remedy eliminates future worker exposure that would occur if the facility and its contents were instead removed to a nearby CERCLA waste disposal facility. Additionally, the remedy calls for the future deployment of an innovative, cost-effective ET barrier. The decision reached in the 221-U Facility ROD and

[2] A blend of soil may be used to create soil cement for cost reduction. In addition, if waste is imported into the 221-U Facility, the addition of flyash and/or zeolite clay may be considered for enhanced disposal performance.

lessons learned during development and implementation of the decision will be shared across the DOE complex.[3]

200-UW-1 Operable Unit Record of Decision

Within the UPZ, the majority of the contaminated soil waste sites are contained in the 200-UW-1 CERCLA Operable Unit. The cleanup approach for the UPZ wastes sites (excluding pipelines) is based on one of four alternatives as described in the *Proposed Plan for the 200-UW-1 Operable Unit* [14]. (Pipelines will be addressed via a different CERCLA decision process.)

These alternatives are as follows:

- No Action: The waste sites are left in their current state. No legal restrictions, access controls, or active remedial measures are applied.
- Maintain Existing Soil Cover, Institutional Controls, and Monitored Natural Attenuation (MESC/IC/MNA): The existing soil covers are maintained, while radioactivity decays to a level below the cleanup goals, generally achieved in less than 150 years. The institutional controls are maintained to limit human access during that period, and sites are monitored.
- Remove, Treat, and Dispose (RTD): Structures and soils are excavated at sites where contamination levels pose a potential risk to human health and the environment. The removed contaminated material is characterized, separated by waste type, and then shipped to a waste disposal facility. Both during and after excavation, samples of soils/material are analyzed for their contaminant concentrations. The excavation continues until all the contaminated material exceeding the remedial action objectives is removed. The site is backfilled with clean material.
- Engineered Barrier: An engineered surface soil barrier is built over a waste site to cap the contaminants. The engineered soil layer or layers greatly reduce the infiltration of atmospheric water into the contaminated material below, and construction design minimizes or eliminates biological intrusion. Human intrusion is prevented through implementation of institutional controls (e.g., administrative or legal controls on physical access). The barrier protects the groundwater by preventing (or greatly limiting) rain or snow at the surface from percolating down into the underlying contaminated soil. Once the barrier is built, institutional controls are put in place.

Each of these four alternatives is identified as being appropriate for at least one of the 33 waste sites considered in the *Proposed Plan for the 200-UW-1 Operable Unit* (Fig. 2.). Not all of the contaminated soil wastes sites in the UPZ are in the 200-UW-1 Operable Unit, but the same four cleanup alternatives are expected to be appropriate for all UPZ contaminated soil waste sites. A small number of waste sites adjacent to the canyon facility will be remediated by burial beneath the 221-U Facility engineered barrier.

The investigation and evaluation of the 33 waste sites in the 200-UW-1 Operable Unit presented a number of opportunities to streamline the cleanup planning process and increase project efficiency. Three opportunities of particular importance are the use of waste site groupings to

[3] DOE-Richland Operations Office hosted a lessons learned technical exchange in February 2005 with representatives from DOE-Headquarters, DOE-Idaho, and DOE-Savannah River.

characterize sites and identify appropriate remedial actions, the use of a "plug in" approach for determining waste site remedial actions, and the planned construction of an innovative, cost-efficient, and effective ET barrier. These are described in more detail in the remainder of this subsection.

Many of the contaminated soil waste sites within the UPZ possess similarities because they received similar volumes of waste and/or wastes containing similar contaminants. As a result, it is possible to group the waste sites by the process resulting in creation of the waste sites. The 33 waste sites evaluated as a part of the 200-UW-1 Operable Unit were divided into five waste site groupings for the purposes of investigation (characterization) and evaluation (identification of preferred remedial alternative) under CERCLA, thus significantly streamlining the remediation process. Within each grouping, a representative waste site (generally the worst case or "bounding" scenario) was selected for comprehensive investigation. The investigation results were used to describe the contamination of all sites in that group. Cleanup alternatives were evaluated against the contamination description for each representative waste site to identify which alternative would best meet the cleanup goals. More investigation (e.g., sampling) will be conducted during remediation to confirm that the data matches the cleanup description. If the additional investigation changes the contamination description (known as the conceptual model) for any waste sites being represented, those sites can instead be plugged into the selected remedy for a different, more appropriate representative waste site.

The CERCLA evaluations of the four alternatives described in the *Proposed Plan for the 200-UW-1 Operable Unit* provide the basis for future "plug-in" approaches, which would apply when

- Unknown waste sites are discovered in the future
- Known waste sites are reassigned from another operable unit
- The selected alternative for a waste site evaluated as part of the 200-UW-1 Operable Unit is found through the sampling process not to be protective, resulting in a need for selection of a different remedial alternative.

The plug-in approach uses analyses, evaluations, and selection of preferred alternatives identified in feasibility studies and proposed plans to apply cleanup decisions to similar waste sites. The plug-in approach streamlines the decision-making process and reduces administrative paperwork.

The four high-risk waste sites in the 200-UW-1 Operable Unit will be remediated using ET barriers. These barriers are simpler and more cost-effective to build than typical RCRA Subtitle C multi-layer barriers (Fig. 4.), self-healing in a seismic event, and more appropriate in arid environments. The deployment of ET barriers in the UPZ will take advantage of the Hanford Site's arid characteristics of low precipitation and high ET rates. In essence, this innovative barrier will limit or prevent water from percolating into underlying wastes via the collective processes of evaporation and transpiration. During periods of no plant activity (i.e., the winter months), the barrier will be thick enough to act as a sponge; in the springtime, when plant activity commences, the stored water will be released back into the atmosphere. Nearby natural analogue soils have demonstrated that such barriers are capable of long-term performance.

Performance monitoring of the barriers will allow for corrective actions to be implemented long before any type of adverse environmental impacts are realized.

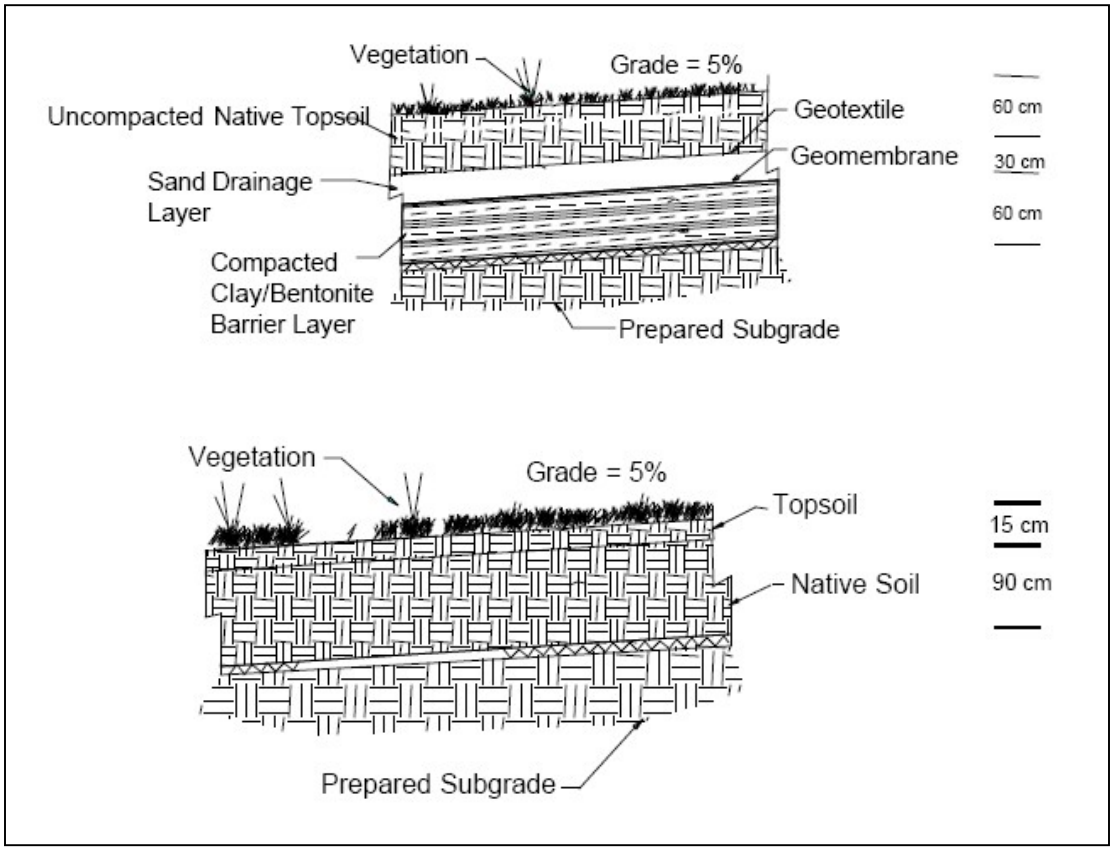

Fig. 4. Comparison of RCRA Subtitle C barrier (top) to evapotranspiration barrier (bottom) [15].

Ancillary Structures

The general approach to cleaning up contaminated ancillary structures is to deactivate, decontaminate as necessary, and demolish, excluding building foundations and underlying soils/structures, as described in *Action Memorandum for the Non-Time-Critical Removal Action for the U Plant Ancillary Facilities* [9]. In general the approach is as follows.

- Contaminated materials requiring treatment or disposal are removed.
- Contaminated equipment is removed from above-ground structures.
- Within basements of structures that will be under the canyon barrier, contaminated material is left in place, and the basements are void-filled with grout or building rubble.
- Structures are demolished to slab on grade or ground level.
- Verification sampling is performed below the surface of remaining slabs to determine if additional actions are required.

To date, DOE and Fluor Hanford have removed 11 U Plant ancillary structures and stabilized the former locations of those structures in accordance with the U Plant ancillary facilities action memorandum. This represents a significant reduction in the number of U Plant ancillary facilities requiring remediation in a time frame significantly accelerated from the overall Hanford Site Central Plateau cleanup baseline.

Pipeline Disposition

A draft EE/CA will be prepared in the near future to address the remediation of the majority of the pipelines in the UPZ. In addition, there are ongoing actions to mitigate and prevent future pipeline leakage that could potentially mobilize deep, vadose zone contaminants to the underlying groundwater. Such actions include mortar-lining pipelines as a methodology for refurbishment and pipeline rerouting.

Well Decommissioning

The UPZ contains 16 wells requiring decommissioning. Wells will be decommissioned in accordance with *Washington Administrative Code*, Chapter 173-160, "Minimum Standards for Construction and Maintenance of Wells" [16].

CONCLUSIONS

The Hanford Site Central Plateau served as a center for defense mission plutonium separations and finishing activities. As a result of these activities nearly 4,000 structures, waste sites, and other items remain to be cleaned up within the Central Plateau. A comprehensive cleanup planning effort, documented in *Plan for Central Plateau Closure*, divided the Central Plateau into 22 geographic cleanup zones organized around significant processing or waste management facilities. The UPZ is the first Central Plateau cleanup zone to be addressed under this geographic cleanup approach. The UPZ contains a representative cross-section of the types of cleanup actions that will be implemented in other geographic cleanup zones (i.e., a canyon, waste sites, ancillary structures, and wells). As a result, it is anticipated that the complexities associated with planning and executing UPZ cleanup will provide many cleanup lessons.

The UPZ ZCIP is intended to be used as a fundamental integration tool for zone cleanup planning and execution. The ZCIP integrates significant components of the planning, execution, and history of UPZ cleanup. The UPZ includes a complete list of the cleanup items within the zone, identifies the decision documents that will guide the cleanup of each cleanup item, and provides a logic-tied sequence for cleaning up each item.

Specific cleanup actions anticipated in the UPZ include the following:

- Final disposition of the partially demolished U Plant canyon in place beneath an ET barrier,
- Remediation of numerous contaminated soil waste sites and pipelines through a variety of actions, including the burial of four high-risk waste sites beneath ET barriers,
- Decontamination and demolition of ancillary structures, excluding building foundations and underlying soils/structures that will be left in place

- Decommissioning wells in accordance with Washington State requirements.

Lessons are already being learned from the UPZ cleanup. For example, the investigation and evaluation of UPZ waste sites presented a number of opportunities to streamline the cleanup planning process and increase project efficiency. Three opportunities of particular importance are the use of waste site groupings to characterize sites and identify appropriate remedial actions, the use of a "plug in" approach for determining waste site remedial actions, and the planned construction of an innovative, cost-efficient, and effective ET barrier. These and other lessons gained from implementing the UPZ cleanup prototype will be captured for application during implementation of future Hanford Site cleanup actions. Lessons learned will also be shared across the DOE complex.

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