

## **Developing a Remediation Strategy for Hanford's Central Plateau Long-Term Waste Management Area - 16545**

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### **ABSTRACT**

The cleanup of the Hanford site, a Department of Energy (DOE) facility in eastern Washington state, has been underway for over two decades. Cleanup of the river corridor, a portion of the site adjacent to the Columbia River, has been one of Hanford's top priorities since the early 1990s and the majority of waste sites within this area have been remediated, and associated groundwater contamination has been, or is in the process of being remediated. As cleanup of the river corridor has progressed, attention has begun to shift towards addressing the waste sites located within the "Inner Area," a 26Km<sup>2</sup> (10mi<sup>2</sup>) area within centrally located within the site where the majority of the site's burial grounds and landfills are located. In recognition of the differences in expected future land use between the river corridor and the Inner Area, the DOE, the United States Environmental Protection Agency (EPA) and the Washington State Department of Ecology (Ecology) developed a set of Inner Area cleanup principles to: 1) promote consistency in site assessments and alternative evaluations; and 2) support regulatory strategies that will optimize analytical resources and streamline documentation. This paper provides an overview of the Inner Area cleanup principles, how their application is expected to influence the development of remedial investigations and feasibility studies, and ultimately the selection of risk-informed decisions.

### **INTRODUCTION**

The cleanup of the Hanford site, a Department of Energy (DOE) facility in eastern Washington state, consists primarily of two geographical components: 1) the river corridor; approximately 570Km<sup>2</sup> (220 mi<sup>2</sup>) along the shore of the Columbia River containing nine retired plutonium production reactors and associated support facilities and solid/liquid waste disposal sites; and 2) the central plateau; approximately 194Km<sup>2</sup> (75mi<sup>2</sup>) consisting of a highly developed/industrialized inner area 26Km<sup>2</sup> (10 mi<sup>2</sup>) containing the major fuel processing, waste management and disposal facilities; and an outer area 168Km<sup>2</sup> (65 mi<sup>2</sup>) consisting of a few large cooling water pond sites, miscellaneous waste sites and structures scattered throughout largely undisturbed shrub steppe habitat (see Figure 1).

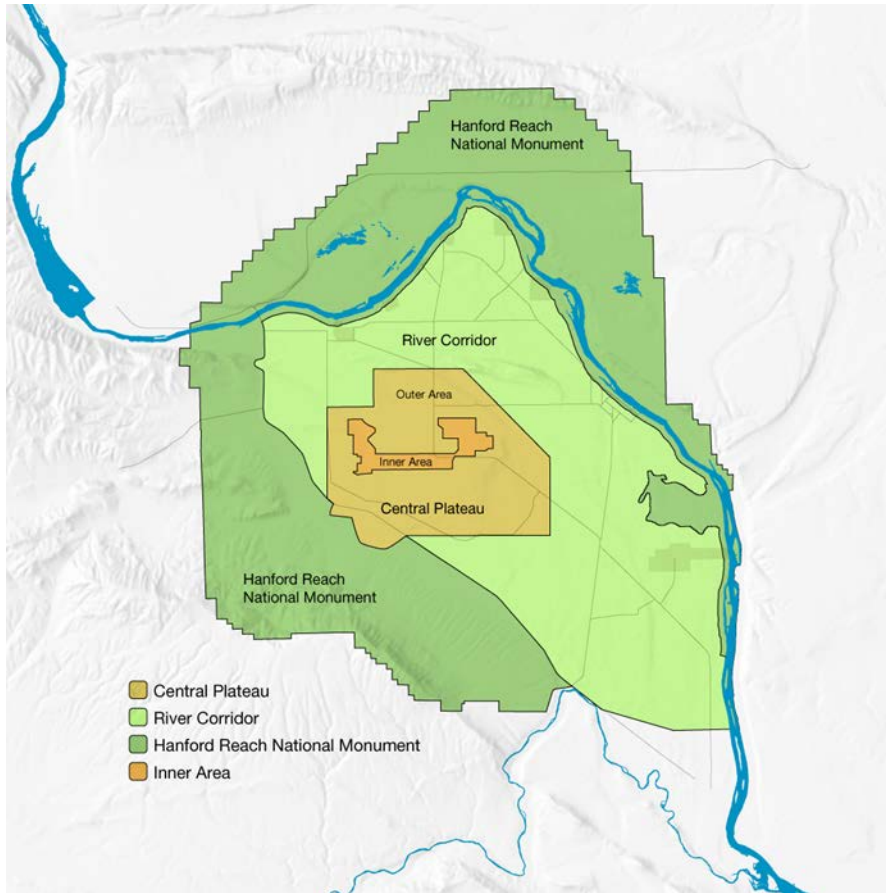


Figure 1. The Hanford Site

The inner area has been segmented into an “East Area and a West Area, and a total of nine operable unit groupings have been defined (see Figure 2).

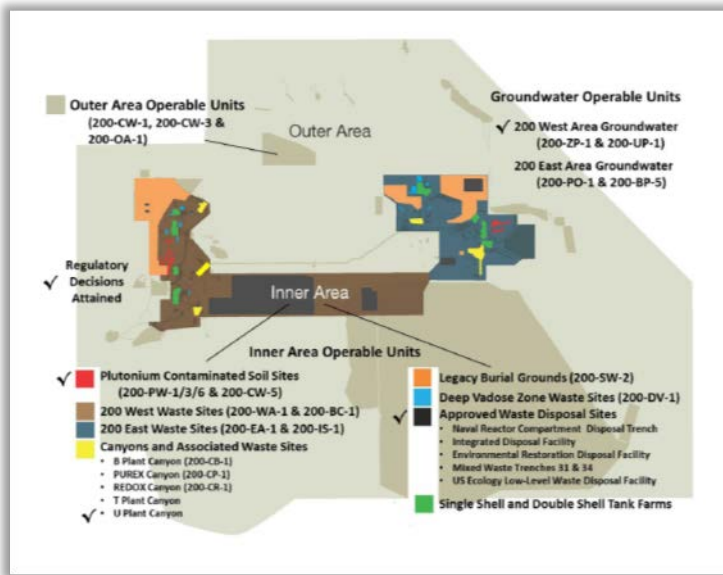


Figure 2. The Central Plateau's Inner Area

Cleanup of the river corridor has been one of Hanford's top priorities since the early 1990s and the majority of waste sites within this area have been remediated and associated groundwater contamination has been remediated or is in the process of being remediated. Although the river corridor cleanup was conservatively set using residential-based cleanup standards, future site use of the inner area will be based on industrial land use and dedicated to the long-term management and containment of residual waste. In recognition of these future land use differences between the river corridor and the inner area, the DOE, the United States Environmental Protection Agency (EPA) and the state Department of Ecology (Ecology) developed a set of Inner Area Cleanup Principles to promote: 1) consistency in site assessments and response action evaluations; and 2) regulatory strategies that will optimize resources, streamline documentation, and result in risk-informed decisions.

As a result, DOE, EPA and Ecology (Tri-Party) decision makers will be able to provide clear direction to the cleanup project managers and technical staff from each of the three agencies on the specific assumptions, methods, and parameters to be applied in the assessment of risks, the evaluation of response alternatives, and the selection of remedies for each of the operable units (OU) within the Inner Area. This up-front agreement is intended to: 1) ensure all cleanup decisions are fully protective and cost-effective; 2) minimize potential delays in documentation and implementation caused by inconsistencies and inefficiencies that are likely to arise when multiple OUs that are in close proximity and intermixed are being processed simultaneously; and 3) promote consistent and expeditious remedial decisions.

Although the Tri-Parties have reached general agreement on these principles, their application will initially be reflected in the individual OU remedial investigation/feasibility study (RI/FS) workplans currently being developed, and ultimately codified in cleanup decision documents, e.g., Records of Decision. The Tri-Parties also are concurrently working to clarify the specific parameters and assumptions that will be used to model potential impacts to ground water from source areas, and the fate and transport of contaminants already present in ground water. Accordingly, the following discussion, although reflective of the agreements and discussions amongst the Tri-parties to date, represents the views and perspectives of the authors, and readers should not presume the EPA or Ecology share identical views in all aspects of the following discussion.

## **DISCUSSION**

### **Future Land Use within the Inner Area**

The Inner Area of the Central Plateau is incredibly complex with literally hundreds of waste sites, many comingled contaminant releases in the vadose zone, and multiple, sometimes comingled groundwater plumes that originated from decades-long disposal practices of high volumes of liquid waste. Accordingly, the author's believe the most significant principle/agreement was the agencies' decision to not only base the inner area cleanup on an industrial land use - which was the designated land use previously codified in the DOE's National Environmental Policy Act (NEPA) Comprehensive Land Use Plan – but to acknowledge there would be no tangible risk or natural resource benefit in attempting to further reduce the size (footprint) of the Inner Area.<sup>1</sup> Although a 26Km<sup>2</sup> area represents a substantial piece of real estate, taken in the context of the total site acreage, and the nature and extent of contamination across the site at the time the cleanup program was initiated, reducing the future restricted area for waste management purposes to an area of that size in the center of the site constitutes a major accomplishment. In addition, the designation of an industrial land use precipitated several important agreements with respect to risk evaluations and the establishment of cleanup goals as noted below.

### **Risk Assessment and Cleanup Goals Establishment within the Inner Area:**

The key agreements with respect to the planned risk assessments include:

- 1) A separate baseline risk assessment will be conducted for each of the individual operable units within the inner area;

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<sup>1</sup> Although the agencies have yet to agree on a set of principles to guide the cleanup of the outer area of the central plateau, the expected future use, as codified in the NEPA Comprehensive Land Use Plan, is conservation.

- 2) The only assumed institutional control for purposes of conducting the baseline risk assessments will be the assumed industrial land use, i.e., a residential scenario will not be evaluated as was done for the river corridor; and
- 3) The EPA's default industrial scenario (multiple pathways) using a one in 10,000 acceptable risk level will be used to determine the need for action under CERCLA. However, risk will be assessed and documented for chemicals based on Washington state corrective action requirements, and the latter may be used to guide the need for action as well based on a direct contact carcinogenic risk level of one in 100,000 for the industrial worker or a hazard index of 1 for non-carcinogens.
- 4) With respect to ground water, comparisons to federal and state maximum contaminant levels (MCL) and state drinking water standards will be used to guide decisions on the need for action. In situations where ground water may discharge to surface waters, federal ambient water quality criteria and state surface water quality standards will be used to determine the need for action as well.
- 5) The site's previously developed and approved "Graded Approach to Evaluation of Groundwater Protection" will be followed to conduct ground water modeling activities, however models will be based on natural recharge and not irrigation scenarios as was used on the river corridor cleanup.<sup>2</sup>

### **Points of Compliance**

The cleanup of the central Plateau, and in particular the Inner Area, represents one of the most complex challenges the Department faces due to the vast number of waste sites, the areal extent and depth of contamination, which is found throughout the vadose zone to depths of 100m (300 feet). As is the case with all of the DOE's major sites (as well as the large mining and sediment sites on the EPA's National Priority List), full restoration to pre-disturbance conditions is technically and economically impracticable.

Groundwater protection and restoration: Although DOE intends to evaluate all viable remedial alternatives, the DOE believes existing conditions warrant a conditional point of compliance (POC) for groundwater protection, or the establishment of an alternate waste management area (WMA) boundary(ies) - as is allowed under EPA and Ecology regulations/policies.<sup>3</sup> Therefore, DOE is assessing which of the OUs might provide the greatest insights into whether a

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<sup>2</sup> U.S. Department of Energy. 2012. Regulatory Basis and Implementation of a Graded Approach to Evaluation of Groundwater Protection. Revision 1. DOE/RL-2011-50. U.S. Department of Energy. Richland Operations Office. February.

<sup>3</sup> DOE initiated a technology development program 15 years ago to determine whether a viable approach to dealing with deep vadose zone contamination exists.

conditional POC may be warranted in light of existing regulatory requirements, and most likely will propose the RI/FS for that OU be conducted first.<sup>4</sup>

Should such an analysis be conducted, and should the results support a conditional POC/alternate WMA boundary, the resulting Record of Decision (ROD) would serve as the underlying basis for the justification of obtaining an alternate POC for the remainder of the Inner Area source and groundwater OUs. However, the EPA and Ecology have clarified that each of the OUs would need to be assessed individually, i.e., similarities and differences to the first OU receiving the conditional POC be evaluated to confirm whether such an alternate POC is justified for each of the OUs within the Inner Area.

Human and ecological exposures: DOE is also assessing whether a conditional soil depth POC for protection of human and ecological receptors as is allowed under Washington state regulations is warranted and can be justified for the Inner Area. The state of Washington regulations identify a potential conditional ecological point of compliance is 1.8m (6 feet) as compared to the standard 4.6m (15 feet) when institutional controls restricting excavations are in place – as will be the case in the Inner Area. However, based on the site-specific bio-intrusion report, DOE believes a minimum of 10 feet would be required to ensure adequate protection of potential ecological receptors.<sup>5</sup> As with the conditional POC for groundwater, DOE believes seeking agreement on a conditional soil depth POC early in the process will provide consistency across OUs, reduce analytical and document complexities, and thereby expedite document approvals/decisions. Therefore, DOE will conduct an analysis in the first Inner Area RI/FS addressing surface soils to determine whether a conditional depth POC is warranted and can be justified. Should the results of that analysis support a conditional depth POC, the resulting Record of Decision (ROD) would serve as the basis for the justification of obtaining a conditional POC for the remainder of the OUs in the Inner Area.

## CONCLUSION

The authors believe the up-front Tri-Party agreements to these principles will significantly improve and expedite the development and approval of the necessary regulatory analyses and documentation to support cleanup decisions in the Inner Area. Application of these principles and consideration of conditional POCs for managing human and ecological exposures to soil and groundwater is necessary to ensure cleanup decisions are truly risk informed and remedial expenditures are

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<sup>4</sup> Given the deep vadose zone (DV-1) OU will address contamination located throughout the Inner Area and represents the greatest challenge in terms of developing technically viable alternatives due to the significant depths at which the contamination is found, DOE will most likely propose this OU be used to conduct such an assessment.

<sup>5</sup> Sample, B.E., J. Lowe, P. Seeley, M. Markin, C McCarthy, J. Hansen, and A.H. Aly. 2015. Depth of the biologically active zone in upland habitats at the Hanford Site, Washington: Implications for remediation and ecological risk management. *Integrated Environmental Assessment and Management*. 11: 150-160.

commensurate with the degree of actual risk reduction being attained. These principles have been developed in recognition of DOE's existing commitment to the long-term management of waste in place associated with engineered disposal facilities within the inner area such as the Environmental Restoration Disposal Facility (ERDF), and previous and ongoing investment in the groundwater pump and treat systems which have removed significant amounts of contaminants from the subsurface, and mitigated the migration of contaminants away from the Inner Area/Central Plateau toward the Columbia River. Thus, once the DOE completes any additional source control actions deemed necessary to protect ground water in the future, even if ultimately it is determined that full restoration of ground water beneath the Inner Area is technically impracticable, the majority of the Hanford site will once again be available for the use and enjoyment of all.<sup>6</sup> Had the agencies failed to recognize previous Inner Area decisions (e.g., previous regulatory closures of landfills, entombment of Canyon facilities, ERDF), and taken into account the associated long-term implications that the inner area will remain restricted indefinitely, they would have run the risk of spending inordinate sums of tax payer dollars on actions that would have generated little to no actual risk reduction or resource benefit.

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<sup>6</sup>A significant portion (approximately 1600 acres) of the site was recently transferred to Hanford's local business development organization to promote economic revitalization to assist in the transition to other employment opportunities for local residents as the cleanup of the Hanford site whines down in the decades ahead.