WASHINGTON STATE DEPARTMENT OF ECOLOGY

EPA

Considerations for Cleanup of the Hanford 200 Area National Priorities List Site

December 2007

Purpose

This white paper expands upon the one-page principles paper on Central Plateau cleanup and closure planning jointly produced by the Washington State Department of Ecology (Ecology) and the U.S. Environmental Protection Agency (EPA) Hanford Project Office. The principles and statutory preferences discussed in the principles paper ("Central Plateau Remediation/Closure Planning Principles," discussion draft by Nicholas Ceto, 10/17/2003*) guided the development of the various detailed aspects presented in this white paper that should be considered for cleanup decision-making. This white paper focuses on non-tank farm areas. Planning for tank farms and integration with the cleanup of nearby waste sites is being performed initially through the C200 demonstration project.

By jointly providing this white paper of cleanup considerations, it is our hope that it will help lead to constructive dialogue with the U.S. Department of Energy (DOE), the Tribes, the State of Oregon, the Hanford Advisory Board and Natural Resource Trustees, and the public. Individual cleanup decisions should be made with an understanding of the integration needs of cleaning up and closing the entire 200 Area National Priorities List (NPL) site. Our hope is that this document will ensure that individual decisions are not made in a vacuum and will reflect a broader understanding of the 200 Area cleanup effort. Certain factors should be considered in cleanup approaches used throughout the NPL site. Actions such as continued identification and detection of sources of contaminant release to the environment, technology development for remediation, and development of better understanding of groundwater and vadose zone contaminant fate and transport will be needed to support determination of cleanup approaches. Both the Resource Conservation and Recovery Act (RCRA) and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) cleanup decision processes will be used in the Central Plateau.

This white paper does not have any regulatory standing, is not intended in any way to substitute for the remedy selection process, and does not change, substitute, or replace established laws, regulations, permit or other legal requirements. As indicated by the use of non-mandatory language such as "may," "should," "it is expected," and "can," it provides recommendations and does not impose any legally binding requirements. EPA and Ecology

* included as Attachment A

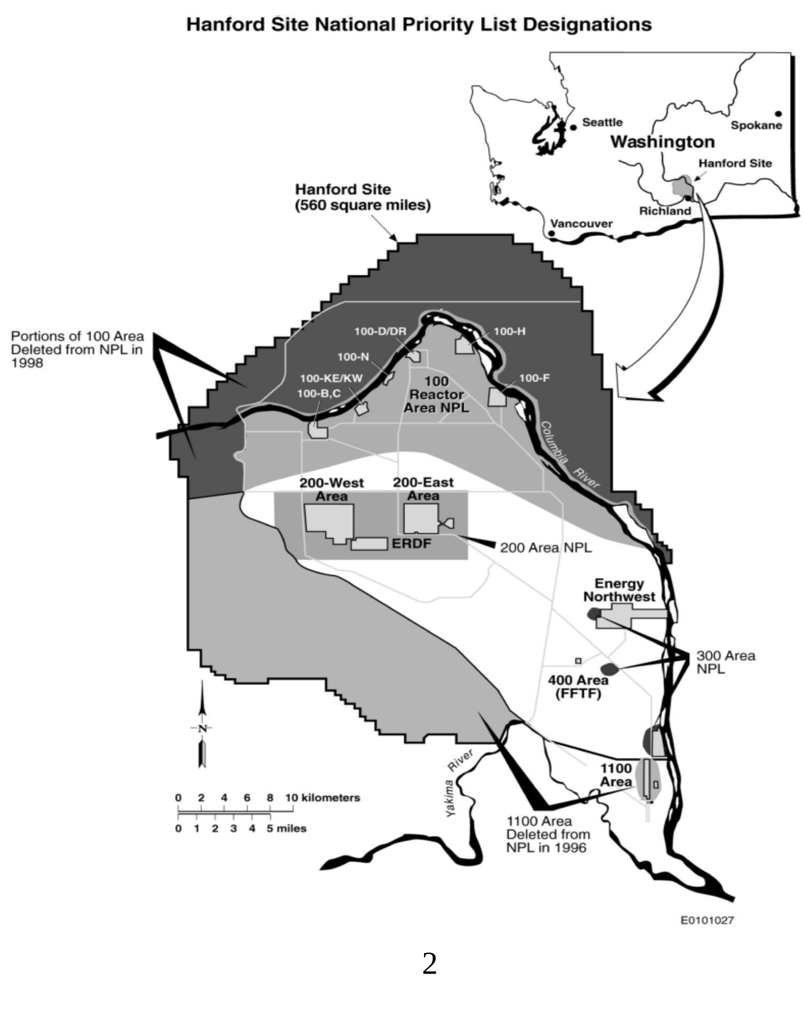
emphasize our intent to make CERCLA decisions in accordance with CERCLA requirements and RCRA decisions in accordance with RCRA requirements.

A brief background of this complex federal facility Superfund site is provided below.

Background on Hanford's 200 Area

The 200 Area rests atop Hanford's Central Plateau, which is approximately 60 square miles in area. Plumes within, or originating from, the 200 Area contaminate nearly 80 square miles of groundwater about 20 miles north of Richland, Washington. The 200 Area is one of four areas at Hanford on EPA's NPL (see Figure 1). The other three are the 100, 300, and 1100 Areas. These areas are part of a 586-square-mile DOE complex that includes buildings, disposal sites, an environmental research park, and open land used for habitat and a buffer zone. Hanford was established in the 1940s to make plutonium for nuclear weapons. The nearby Columbia River provided cooling waters for the reactors producing the nuclear materials. After World War II, plutonium production capacity was greatly expanded as a Cold War activity. The Atomic Energy Commission assumed control of these operations from 1946 until Congress created DOE in 1977. Over the years, Hanford expanded its role to include research and development on uses of nuclear materials.

Figure 1. Hanford Site Map.



The core of the 200 Area contains the former chemical processing plants and waste management facilities. One of the plants discharged massive quantities of carbon tetrachloride to the ground. The 200 Area was used to process, finish, and manage nuclear materials, including plutonium. About 1 billion cubic yards of solid and liquid wastes (radioactive, mixed, and hazardous substances) were disposed in trenches, ditches, and landfills on the site. More than 800 waste disposal locations have been identified in the 200 Area. There are also approximately 1000 contaminated buildings and structures that must be addressed, ranging from large highly contaminated process buildings to mildly contaminated mobile trailers.

200 Area groundwater and soil are contaminated with tritium, uranium, cyanide, carbon tetrachloride, technetium, hexavalent chromium and other contaminants. People may be exposed to hazardous or radioactive substances in the 200 Area through direct contact with or accidental ingestion of contaminated particles. Site access restrictions or institutional controls (ICs) in the 200 Area prevent unacceptable exposure to contaminated groundwater and surface water. Contaminated groundwater, if not addressed, poses a risk to the Columbia River.

The cities of Richland, Pasco, and Kennewick, with a combined population of approximately 170,000, maintain water intakes in the Columbia River for the bulk of their municipal supply system, but occasionally mix it with groundwater from municipal wells. Over half a million people live within 50 miles of the Hanford Site.

In May 1989, EPA, Ecology, and DOE entered into an Interagency Agreement and Consent Order to provide a legal and procedural framework for cleanup and RCRA regulatory compliance at Hanford. EPA, DOE, and Ecology jointly developed an action plan that addresses Superfund and RCRA-related issues at Hanford. The interagency agreement for this federal facility is referred to as the Tri-Party Agreement and the action plan is often called the Tri-Party Agreement Action Plan.

Cleanup Progress

Since 1992, approximately 212,000 pounds of carbon tetrachloride have been extracted from the soil through soil vapor extraction. In a separate action, approximately 29,000 pounds of carbon tetrachloride have been removed from groundwater to date. In addition, another groundwater pump and treat system has removed 545 pounds of uranium and approximately 1/3 pound of technetium-99. Eight hundred soil waste sites have been organized into 27 operable units for characterization and remediation. Remedial Investigation/Feasibility Study (RI/FS) activities for these operable units are ongoing and scheduled to be complete by 2011. Learning from early characterization work in the 200 Area, DOE, Ecology, and EPA have recently agreed to a large supplemental characterization effort (as described in Tri-Party Agreement milestone change requests M-015-06-02 and M-013-06-01) for many of the complex waste sites to provide additional information upon which to base cleanup decisions.

The partial decontamination and safe demolition of a plutonium concentration facility was completed, as well as the demolition of 54 structures including several that were ancillary to two former processing facilities (PFP and U Plant). The Record of Decision (ROD) for remediation of one of the processing facilities (221-U Facility [Canyon Disposition Initiative]) was completed, and remedial design work has begun. Stabilization of product material was completed at the Plutonium Finishing Plant. Approximately 1,750 feet of pipeline leading to waste disposal locations in the western portion of the 200 Area was recently removed along with 400,000 tons of contaminated soil and then disposed of at the Environmental Restoration and Disposal Facility (ERDF), a modern Superfund landfill that meets RCRA technical requirements for a hazardous waste landfill. Over 7,000,000 tons of waste, including building rubble, contaminated soil, and burial ground contents, have been removed from waste sites across Hanford as part of cleanup activities (primarily conducted at river corridor sites in the 100 and 300 Areas) and disposed of at ERDF. Forty-three thousand tons of contaminated soil has been removed from sites in the 200 North Area.

Over 32,100 drum-equivalents (covers both drums and boxes) out of an estimated total of 75,000 drum-equivalents of transuranic and potential transuranic waste have been removed from retrievably stored waste areas in the central plateau. Approximately half those drums contained transuranic waste that is destined for disposal at the Waste Isolation Pilot Plant (WIPP) in New Mexico. So far, 11,400 drums have been shipped to WIPP. The last of the single-shelled tanks has now been interim-stabilized per a consent decree. A waste treatment facility is being constructed to glassify or vitrify waste from the tank farms in the 200 Area. Much of the tank farm waste is high level radioactive waste. The high-level waste glass will be sent offsite to a geologic repository, while the treated low-activity waste will be stored and eventually disposed of in the 200 Area in an approved disposal facility currently being constructed. Construction of the treatment facility is projected to continue through 2019.

Consideration of Aspects of the 200 Area Vision

The primary aspects of our 200 Area vision are discussed further in this section to provide examples of how they might guide cleanup.

200 Area End State

Portions of the core zone (see Figure 2) are expected to remain waste management areas for the foreseeable future; some areas, such as ERDF, need to be managed or maintained indefinitely. The core zone boundaries shown in Figure 2 are consistent with those developed during the 200 Area Exposure Scenarios Task Force meetings held in 2002. The map with the core zone boundaries was included in the Tri-Party response to Hanford Advisory Board Advice #132. Numerous studies and workshops have been held, and there is general public support for the concept of the core zone being a waste management area for the foreseeable future (Future Site Uses Working Group, HAB advice, Comprehensive Land Use Environmental Impact Statement, Exposure Scenario Task Force, and Risk-Based End State workshops). The concept is that there are places within the core zone that are expected to need maintenance for a very long time to prevent unacceptable exposure to residual contamination (i.e., require land use controls). The potential for exposure can be limited by engineering controls (such as armoring of caps) or by the determination of appropriate waste acceptance criteria in the case of disposal facilities. The engineering controls and waste acceptance criteria are intended to prevent releases to the environment that would contribute to exceedences of groundwater standards and protect against future exposures to human and ecological receptors.

Land use control areas (areas where ICs limit reuse) should only be as large as absolutely necessary. Consideration should be given to the minimization of both the number and size of areas that require such restrictions to support this goal. This is a goal that the Tri-Parties have agreed to (see response to HAB Advice #132) and is important to the public, stakeholders, Tribes and trustees. It should be noted that there is an expectation under CERCLA that engineering controls should be used to address environmental risks and that ICs are appropriate to supplement, not supplant clean up. This concept is consistent with the expectation that institutional controls may be needed to protect certain aspects of the remedial actions (i.e., caps or barriers) in order to protect public health and the environment, and that in some instances ICs may be the only viable way to control exposure when engineering solutions prove technically impracticable."

Residual groundwater contamination should be limited to the smallest possible area, and contaminant migration should be controlled within the Central Plateau. As provided in the National Contingency Plan at 40 CFR 300.430(a)(iii)(F), "EPA expects to return usable ground waters to their beneficial uses wherever practicable, within a timeframe that is reasonable given the particular circumstances of the site. When restoration of ground water to beneficial uses is not practicable, EPA expects to prevent further migration of the plume, prevent exposure to the contaminated ground water, and evaluate further risk reduction." It is a clear expectation of that every effort be made to restore groundwater, and that the CERCLA 5-year review process be used to evaluate the potential for cleanup of groundwater contamination that may have

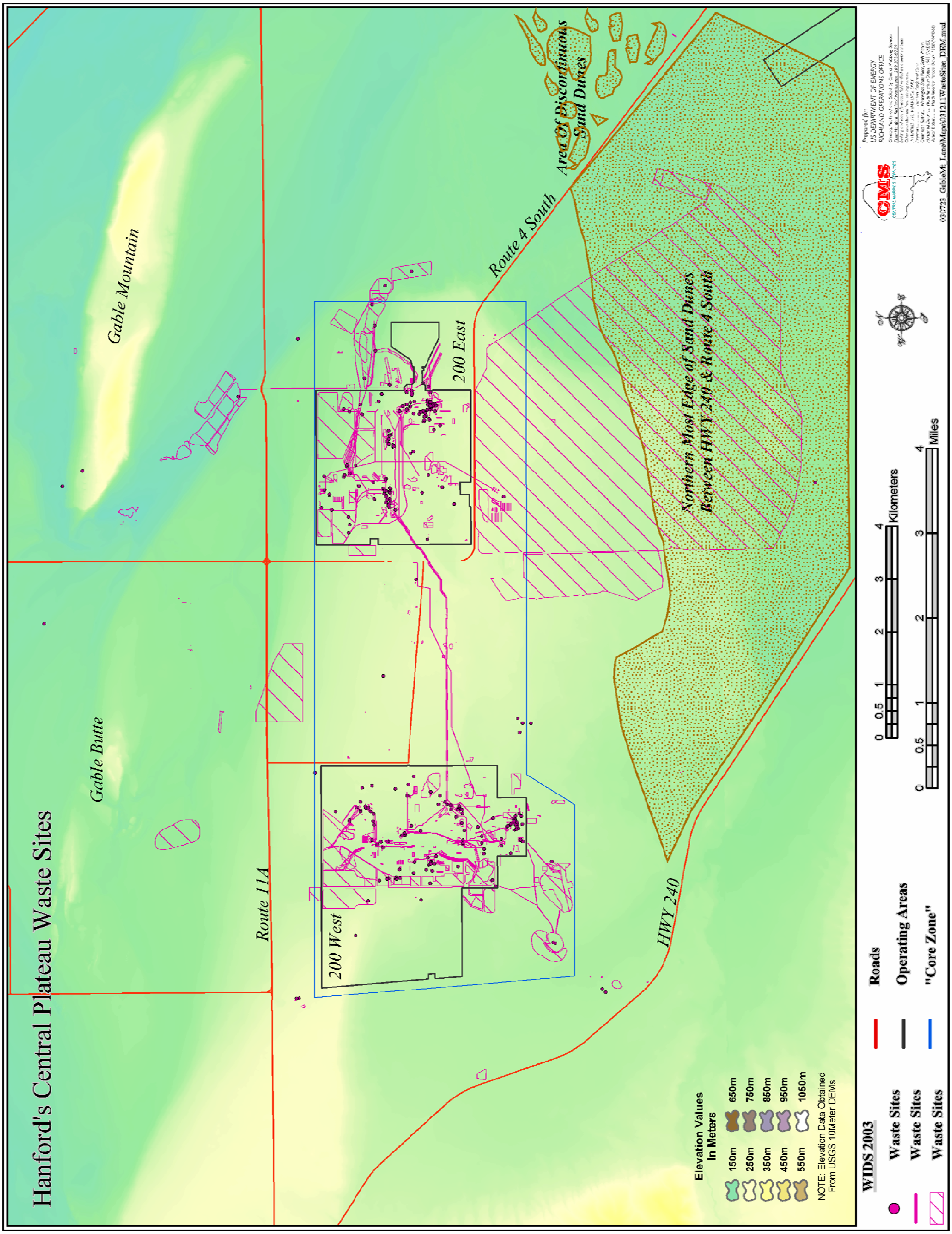


Figure 2. Hanford's Central Plateau Waste Sites (with core zone boundary).

previously been limited by technological constraints. The groundwater strategy[1] developed by the Tri-Parties in 2004 is consistent with these important expectations.

There should be an extensive groundwater monitoring network in place to meet RCRA and CERCLA requirements. CERCLA and RCRA regulations allow for flexibility when coordinating the groundwater monitoring of waste sites and units that are located near each other or exist as part of a group.

Institutional Controls/Reliance on Monitored Natural Attenuation

Areas relying on the maintenance of institutional controls (ICs) beyond 100 years after construction completion (following a period of roughly 50 years of active waste management) to achieve protectiveness should be minimized through more robust cleanup or engineered controls as required by CERCLA and the NCP (and by RCRA for sites being addressed under RCRA authority). This number (100 years) is based on the history of the effectiveness of ICs (including access controls over the decades for Hanford's 200 Area). It is believed to be the best balance between stakeholder and Tribal concerns (accounted for through the CERCLA criterion of Community Acceptance) about the long-term effectiveness of ICs and the federal government's continued ownership and control of the reservation. Further support for the 100-year time frame is provided by U.S. Nuclear Regulatory Commission regulations in 10 CFR 61.59 that limit reliance upon ICs to 100 years after transfer of radioactive disposal facility property to a new owner.

The areas where RODs or permits have been issued that rely on ICs for the long term to supplement engineering controls include ERDF, Integrated Disposal Facility (IDF), U.S. Ecology commercial low-level waste disposal facility, and the 221-U Facility (U Plant and connected structures). Other areas that are likely to have to rely on long-term active ICs include the tank farms, the other canyon buildings, and groundwater that cannot be restored to beneficial use. An intruder scenario was developed for the 221-U Facility RI/FS. The scenario accounted for groundwater usage beginning 100 years after construction completion because as time passes there is an increased risk that ICs will not be effectively maintained. However, it should be noted that ICs are legally required to be maintained as long as is necessary.

Sites that have radionuclide concentrations that will decay to meet final cleanup levels established in RODs (including accounting for shorter-term ecological risk) within 100 years after active waste management may be candidates for monitored natural attenuation. Allowing for 100 years of radioactive decay and attenuation can, in many cases, provide cost-effective remediation given effective ICs and monitoring and limited opportunities for effective treatment of radioactive contaminants.

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[1] *Hanford Site Groundwater Strategy – Protection, Monitoring, and Remediation* (DOE/RL-2002-59), February 2004.

Risk and Exposure Scenarios

Ecological risk and Tribal uses are important to consider when establishing cleanup requirements for shallow soils (generally from the ground surface to 15 feet below the ground surface). When developing Tribal exposure scenarios, the potential for groundwater usage and for groundwater contamination to impact surface water and resources should be considered. In some instances, ecological risk is more of a driver for cleanup than the risk resulting from human industrial exposure. These instances would likely be limited to cases where contamination resides in the upper 15 feet of the soil and the risks are primarily from contamination in the top few feet of the soil profile (although other portions of the profile could contribute to groundwater contamination which could reach surface water at the river). Potential Tribal exposure scenarios will be important in looking at issues of contaminant transfer from soil to food and may help guide the selection of a remedy as analyzed through the CERCLA evaluation criteria.

During the period from initiation of remedial action through 100 years after construction completion (until approximately 150 years from present), inadvertent intruder scenarios should meet the 100 mrem/year chronic and 500 mrem/year acute standards provided in DOE Order 435.1. ICs would aid in the attainment of the CERCLA risk range of 10^{-6} to 10^{-4}. EPA considers the 15 mrem/year dose rate limit to meet the CERCLA risk range. Exposure would be prevented by ICs both before and after construction of the remedies (and through implementation of the active portions of the remedies). After approximately 150 years, there may be a higher probability that ICs will not be maintained effectively (although monitoring and five-year reviews should greatly reduce this). Therefore, the CERCLA risk range may be attained for the inadvertent intruder during this latter period by ensuring every site can meet the 15 mrem/year limit for potential chronic exposures.

Risk from deep vadose zone contaminants predicted to impact groundwater (barring the unforeseen or unpredictable development of more effective remedial technologies) should be accounted for in groundwater risk assessments and remediation planning. This is an acknowledgement that some of the contaminants in the deep vadose zone may impact groundwater and that currently there are few remedial technologies that are available to effectively prevent this. Therefore, the flux to groundwater should be accounted for in the design and implementation of groundwater remedial actions. Technology development is necessary to be able to remediate deep contamination effectively.

Remedies

Transuranic materials (both pre- and post-1970) should be treated the same when they pose similar risks and should be removed for burial in a deep geologic repository unless there can be a determination made that the materials can be safely managed in near surface disposal. There are pre-1970 TRU waste sites that contain concentrations that are significantly higher than TRU waste being sent to WIPP from remediation of post-1970 waste sites. TRU material should be treated the same based on risk as a CERCLA hazardous substance regardless of the date of disposal.

There should be a presumption of Remove-Treat-Dispose (RTD) for shallow, long-lived contaminants. Long-lived contaminants in this case may include uranium and transuranics, high concentrations of fission products where 100 years after active waste management activities have ceased is not sufficient for decay, as well as organics and metals. Caps may be used without RTD in limited circumstances, such as for waste sites in the vicinity of canyons or tank farms where the waste sites are limited in size and easily covered by the caps for those facilities. However, the specific circumstances must be fully evaluated through the RI/FS or RFI/CMS process. Waste sites that do not attenuate within 100 years post-construction completion, reside in the shallow zone, and result in unacceptable exposure under any reasonably anticipated land use should be considered for RTD. Waste from these sites should be managed in approved waste disposal facilities employing engineering controls, centralized ICs and conservative waste acceptance criteria.

As part of CERCLA and RCRA decision-making process, individual waste site characteristics should be considered in deciding the appropriate depth break between what is removed and what is left behind (e.g., don't default to 15 feet). Consideration should be given to the practicability and implementability of deep excavation, especially where necessary infrastructure is affected by the large layback areas necessary to perform such excavation. Applicable regulatory requirements must be satisfied, including ARAR requirements for CERCLA response actions. The 15-foot below ground surface boundary of the shallow zone should be a consideration, not a limit to excavation. Removing the mass of contamination may be more appropriate where site conditions and uncertainty warrant excavation below 15 feet. It is understood that excavation below 40 to 60 feet is less practicable and less implementable. It should be noted that an excavation for a Pacific Northwest National Laboratory building in the triangle area (between the laboratory campus and the 300 Area) was dug to 40 feet below ground surface. The triangle area is on the Hanford Site and this example illustrates that industrial exposure can occur below 15 feet; either through construction or occupation of the facility.

Containment remedies should be considered for waste sites where removal and/or treatment is impracticable or for wastes that pose relatively low long-term risks. Such containment remedies must prevent unacceptable exposure to humans and biota including, among others, inadvertent intruders. Examples might consist of engineering controls for residual contamination, such as armoring of caps to prevent or severely curtail drilling through contamination. Containment remedies can protect human health and the environment by isolating contaminants and greatly reducing the potential for completion of contaminant pathways and unacceptable exposure. For waste sites with radionuclide concentrations that would range within the Class C levels, the regulations in 10 CFR 61.52 provide some guidance for remedial decision making. The regulations state that, "*Wastes designated as Class C pursuant to Sec. 61.55, must be disposed of so that the top of the waste is a minimum of 5 meters below the top surface of the cover or must be disposed of with intruder barriers that are designed to protect against an inadvertent intrusion for at least 500 years.*" This is instructive in that it supports removal of contamination above 15 feet and indicates that if capping is to be employed that barrier performance and ICs would have to be designed to meet the performance objective of preventing inadvertent intrusion for a period much longer than 100 years.

Decisions on remediation of waste sites should include considerations for source control to limit the spread of contaminants in the vadose zone and prevent further degradation of groundwater. This is a basic concept that cannot be stressed enough.

Contamination in the vadose zone below high-level waste tanks has many attributes in common with releases from nearby past-practice waste sites. In some cases a common remedy may be applied to both releases. This consideration touches on the importance of integrating 200 Area cleanup across regulatory and program boundaries, which may result in common remedies being selected that address all requirements adequately and cost-effectively. Integration and coordination of RCRA and CERCLA activities are also required under Article IV of the Tri-Party Agreement.

Remedy Considerations for Each Conceptual Model Group or Category of Waste Site

Model Group 1

The waste sites in this model group have contamination in the shallow vadose zone and are not considered a threat to groundwater quality. The radionuclide inventory for this conceptual model group does not include transuranic isotopes to the level of 100 nCi/g. Examples of Model Group 1 waste sites may include unplanned releases, shallow leaks from pipelines or tanks, and contamination spread by burrowing wildlife.

The range of remedial alternatives that might apply to Model Group 1 sites includes remove-treat-dispose (RTD), monitored natural attenuation, and no-action. If RTD is the choice upon completion of the RI/FS, the observational approach may be applied during excavation. However, verification sampling may be needed to complete remediation at the sites.

Confirmatory sampling would be needed to assure that monitored natural attenuation or no-action remedies are appropriate. Sites with the potential for groundwater impacts may need a more robust monitoring scheme and/or may require a minimal cap. However, this would probably mean that the waste sites would no longer be considered Model Group 1 sites. If confirmation sampling or the observational approach shows that a site is more than a shallow contamination problem, the site may need to be reevaluated and other alternatives reconsidered.

Model Group 2

These waste sites have contamination starting below 15 feet and pose a known or potential hazard to groundwater. These waste sites do not include transuranics above 100 nCi/g. An example of a waste site in this group might be a crib constructed at depth where contamination begins below 15 feet. Some of the waste sites may be known contributors to groundwater contamination while others may have the potential for impacts but may require further characterization to estimate this potential.

Potential remedies for these sites may range from capping to “cut-and-cap” if there is a need to remove the bulk of contamination down to the limits of standard excavation (40 to 60 feet below the ground surface) to protect groundwater or address inadvertent intrusion risk.

Remediation technologies for deep contamination may be required to protect groundwater. However, there are limited options at this time to deal with very deep contamination. Sites in this category will be evaluated on a regular basis through the 5-year review process to determine if remedies are protective.

Model Group 3

This group is limited to the Z-Ditches. They are a series of ditches that in total run 0.8 miles from the Z Plant area to the U Pond. Portions of the shallow zone contain concentrations of transuranics above 100 nCi/g. The cribs have minimal contamination below 20 feet.

The remedial action alternatives that may meet CERCLA threshold criteria include RTD and capping with a robust engineered barrier that minimizes long-term migration of liquids into the concentrated contamination zone. RTD could be performed in a way that may limit the amount of transuranic waste generated. ICs and a cap without intrusion protection features may not suffice because the contamination will not decay to acceptable protective levels for thousands of years. Creating and maintaining a robust cap almost a mile long may be more onerous (especially considering the long-term effectiveness) than removing the contamination down to 20 or 25 feet and disposing of it in a safe way that is compliant with regulations and minimizes the amount of transuranic waste that has to be packaged and sent to WIPP.

Model Group 4

These sites are the small to medium-sized transuranic sites. Examples of these may include the Z-Cribs like Z-9, Z-1A, etc. and the A-4 crib. These sites generally have shallow and deep contamination and are, or potentially could be, a threat to the groundwater due to their entire inventory of contaminants. Smaller sites that are next to canyon buildings like the A-4 crib might be remediated by being capped by the large barrier for the canyon. However, the Z-Cribs with their carbon tetrachloride and highly concentrated transuranic content may be a serious threat to industrial users, intruders, and groundwater. Source removal may be necessary prior to capping. Carbon tetrachloride releases to the groundwater could impact the Columbia River if current pump and treat actions are not continued and possibly intensified. There may also be an ecological risk to burrowing animals due to inhalation of vapors within their burrows.

Model Group 5

These are the ponds that are generally large in area, have shallow and deep contamination, and have contributed to groundwater contamination or have a potential to do so in the future. Depending on how long-lived the contaminants are, there may be several options. Remediation options have not yet been determined. One option may be to leave the former pond areas undisturbed to allow contamination to decay while preserving existing healthy plant communities that provide habitat to animals (e.g., Gable Mountain Pond). Whereas for other sites such as the U Pond, the large inventory of uranium may make leaving waste in place and/or capping inadequate to address the continued threat to groundwater. A cut-and-cap alternative might be the alternative best suited to prevent unacceptable risk to human and ecological receptors. In some instances, an engineered barrier could be emplaced over the pond and this might protect groundwater by spreading out the flux of water infiltrating to the aquifer over time so that groundwater protection standards are not exceeded.

Extensive characterization, design work, and monitoring may be necessary if barriers are going to be relied upon. RTD may be an appropriate long-term solution for sites in this group. After RTD, these sites could be restored through backfilling and planting native vegetation.

Model Group 6

Waste sites in this group have contamination problems in both the shallow and deep parts of the vadose zone. An example of some waste sites in this group would be the BC Cribs and Trenches. They have fission products in high concentrations in the upper 15 feet and also have contaminant plumes that go over half of the way to groundwater. Technetium-99 has a long half-life and is fairly mobile. It moves with the water and appears to be concentrated in some deep layers of fine silt material where the water content is elevated.

The remedial alternatives that might be effectively applied to sites in this group include capping, cut-and-cap, and either capping or cut and cap combined with a deep vadose zone remediation technology. So far, only drying of the deep vadose zone layers has been proposed (in concert with a surface remedy expressed on the surface like cut-and-cap or capping) as a potential remedy for dealing with this deep technetium-99. Drying deep and extensive layers of the vadose zone would require installing many closely-spaced boreholes and running air through the pore spaces of the sediments. The effectiveness of this technology may be evaluated in the upcoming deep vadose zone treatability test. Alternative technologies may be developed that would provide the potential to address deep contamination and should be considered in developing cleanup decisions.

The highly concentrated cesium and strontium near the surface should be removed and disposed of in ERDF. These sites are near the edge of the core zone and may encounter pressures from outside groups interested in reusing the land before areas deep within the core zone. The radionuclides would not decay to safe levels within 150 years, which is the extent that many in the public and stakeholder groups believe is the longest that active ICs can be relied upon for waste sites at Hanford. Also, some areas of highly elevated cesium and strontium have been shown to exceed ecological screening criteria that include DOE's biological concentration guidelines according to findings from the Central Plateau ecological risk assessment effort.

Radiological and Non-Radiological Burial Grounds

An example of a non-radiologically contaminated burial ground is the Solid Waste Landfill (600 CL). An example of a radiologically-contaminated burial ground would be 218-E-2. RTD is a potential remedy for waste areas that reside above 15 feet below the ground surface. Another possible remedy is stabilization and maintenance of shrub steppe vegetation, which could serve to limit infiltration and percolation of atmospheric waters into the waste.

Pre- and Post-1970 Transuranic Contaminated Burial Grounds

Post-1970 transuranic material above 100 nCi/g is automatically considered TRU waste and must be sent to WIPP. Pre-1970 transuranic material, if not excavated and thus generated, is not considered TRU waste by definition. However, if there is an exposure potential to this material that is over the CERCLA risk range of 10^{-6} to 10^{-4} excess cancer incidence, then the transuranic contaminants must be addressed through remedial action. Risk from transuranic materials may not be acceptable for inadvertent intruders and thus may be a driver for removal of transuranic contaminants. Remedies to be considered for these burial grounds include capping, cut-and-cap and RTD.

Pipelines, Diversion Boxes, Vaults and Associated Unplanned Releases

These underground conveyances for contaminated effluent were used to route waste from processing facilities to tank farms or disposal trenches and cribs. The structures are contaminated and in many cases there were leaks or spills that resulted in the surrounding soils being contaminated. An example of a waste site in this category is the unplanned release UPR-200-W97.

Depending on the risk and depth with respect to the shallow zone, the pipelines could be removed, capped, grouted or some combination of these actions over portions of their length. There are a great number and length of pipelines running throughout the Central Plateau and so decisions on these waste sites will have a large impact on resources, funding, and risk management.

Concrete-lined structures like vaults and diversion boxes could be cleaned out and the remaining structures either removed or grouted. They could also be grouted and then excavated and size-reduced for disposal in a deeper portion of a disposal facility such as ERDF. Unplanned releases should undergo RTD at least down to 15 feet and whether or not deeper material is excavated should be made in accordance with CERCLA (RCRA for RCRA sites).

Dialogue on the 200 Area cleanup considerations presented in this paper is welcome as the Tri-Parties grapple with the large and complex federal facility known as Hanford. Please contact John Price of Ecology at 509 372-7921, jpri461@ecy.wa.gov , or Craig Cameron of EPA at 509 376-8665, cameron.craig@epa.gov if you have comments or questions. It should be noted that individual cleanup decisions will be made following the RI/FS (or RFI/CMS) process in accordance with CERCLA (RCRA for RCRA facilities) with opportunity for public review and comment.

GLOSSARY OF TERMS

Aquifer – A geologic formation, group of formations, or part of a formation capable of yielding significant quantities of groundwater to wells, springs, or other points of discharge.

Central Plateau – Broad area in the center of the Hanford site that is elevated above the river corridor and contains the 200 Area.

Class C – Category of low-level radioactive waste. Waste that has radioactive contamination levels (given for specific radionuclides) greater than Class C limits is not permitted for near-surface disposal under 10 CFR 61.55 and must go to a deep geologic repository unless certain exceptions are met. Such waste is referred to as Greater-Than-Class-C waste.

Comprehensive Environmental Response, Compensation, and Liability Act (**CERCLA)**, also known as Superfund – The federal statute enacted in 1980 and reauthorized in 1986, which provides the statutory authority for cleanup of hazardous substances that could endanger public health or welfare or the environment.

Contamination – includes chemical or radioactive material in environmental media (soil, air, surface or groundwater). Chemical contamination in soil is generally given in mg/kg or parts per million (ppm), and as mg/L in water (also ppm). Radioactive contamination (radioactivity from radioactive isotopes within some medium) is usually provided in units of picocuries per gram (pCi/g) in soil and as picocuries per liter (pCi/L) in water. A curie (Ci) is equal to 37 billion disintegrations per second, which is approximately equal to the decay rate of one gram of radium-226. A nanocurie (nCi) is equal to $1X10^{-9}$ Ci and a picocurie is equal to $1X10^{-12}$ curies.

Core Zone – This is the heavily industrialized portion of the Central Plateau (see Figure 2) that includes the 200 East and 200 West areas and the disposal facilities in between (ERDF and U.S. Ecology). Presently, the majority of 200 Area waste sites and decommissioned facilities and all of the tank farms lie within the boundary of the core zone.

Crib – A waste disposal structure similar to a septic system drain field but designed for disposal of liquid effluent derived from low-level radioactive waste operations. The bottom of crib structures are generally deeper than 15 feet below the ground surface.

Dangerous waste – Those solid wastes designated in WAC 173-303-070 through 173-303-103 as dangerous or extremely hazardous wastes.

Deep zone – The portion of the vadose zone that is more than 15 feet below the ground surface.

DOE Order 435.1 – A DOE issued order , the objective of which is to ensure that all Department of Energy (DOE) radioactive waste is managed in a manner that is protective of workers, public health and safety, and the environment.

Hazardous substance – Substances regulated under CERCLA, as defined in CERCLA Section 101(14).

Hazardous waste – Those wastes included in the definitions of RCRA 1004(5) and RCW 70.105.010(15).

Isotopes – Any of two or more forms of a chemical with the same atomic number and nearly identical chemical behavior but different atomic mass and physical (e.g. radioactive) properties.

Inadvertent intruder – A person who engages in intrusive activities that are not expected as part of the reasonably anticipated land use. This person may complete an exposure pathway to contamination and take on risk associated with that exposure.

Institutional controls (ICs) – Non-engineered instruments, such as administrative or legal controls, that help to minimize the potential for human exposure to contamination and protect the integrity of a remedy.

National Oil and Hazardous Substances Pollution Contingency Plan (NCP) – 40 CFR Part 300. The purpose of , "…the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) is to provide the organizational structure and procedures for preparing for and responding to discharges of oil and releases of hazardous substances, pollutants, and contaminants." 40 CFR 300.1

National Priorities List (NPL) –
As provided at 40 CFR 300.425(b), the NPL is "…the list of priority releases for long-term remedial evaluation and response.

Radioactive decay – The spontaneous transformation of an unstable atom into one or more different nuclides accompanied by either the emission of energy and/or particles from the nucleus, nuclear capture or ejection of orbital electrons, or fission. Unstable atoms decay into a more stable state, eventually reaching a form that does not decay further or has a very long half-life.

Radionuclide – An unstable nuclide that undergoes radioactive decay. A nuclide is a specific type of atom that is characterized by its nuclear properties, such as the number of neutrons and protons and the energy state of its nucleus.

Resource Conservation and Recovery Act (RCRA) – 42 USC Section 6901 et seq., as amended. For purposes of the Tri-Party Agreement, "RCRA" also includes the Hazardous Waste Management Act RCW 70.105. (A federal law enacted in 1976 that regulates the generation, transportation, treatment, storage, and disposal of hazardous wastes).

Record of Decision (ROD) – The CERCLA document used to select the method of remedial action to be implemented at a site after the Feasibility Study/Proposed Plan process has been completed (see Section 7.3 of the Tri-Party Agreement Action Plan).

Shallow zone – The portion of the vadose zone from the ground surface to 15 feet below the ground surface. This zone is important for direct exposure and ecological protection.

Threshold criteria – Overall Protection of Human Health and the Environment and compliance with Applicable or Relevant and Appropriate Requirements (ARARs) (unless a specific ARAR is waived) are threshold requirements that each alternative for remedial action must meet in order to be eligible for selection. 40 CFR § 300.430(f)(1)(i)(A).

Transuranic waste (TRU) – Waste contaminated with long-lived, alpha-emitting transuranic elements in concentrations greater than 100 nCi/g (for transuranic isotopes with half-lives longer than 20 years) as established by DOE, EPA, and the Nuclear Regulatory Commission. Transuranic elements have atomic numbers greater than uranium (appear after uranium on the periodic table of elements). Examples include plutonium, americium, and neptunium.

Vadose zone – Zone of unconsolidated geologic material between the ground surface and the groundwater table that is unsaturated with respect to water content, as compared to groundwater aquifer(s), which contains geologic layers that are saturated.

Waste Isolation Pilot Plant (WIPP) – A deep geologic repository in New Mexico designed to accept transuranic waste for burial.

200 Area – One of three remaining National Priority List sites at Hanford. The 200 Area contains the industrialized core zone which can be divided into the 200 East and 200 West Areas. It also contains the 200 North Area which is slightly off the north end of the Central Plateau near Gable Mountain. The 200 North Area is an isolated area that is being cleaned up to unrestricted land use under the 100/200 Area Remaining Sites ROD.

Attachment A

Discussion Draft (nceto- 10/17/2003)

Central Plateau Remediation/Closure Planning Principles

The United States Environmental Protection Agency (Hanford Project Office) and the Washington Department of Ecology (Nuclear Waste Program Office) have identified a set of planning principles the agencies believe should be used to guide cleanup of the Central Plateau at Hanford. The purpose of identifying these principles is to assist project managers in focusing their individual project management responsibilities on a common set of goals, as well as to provide a framework for establishing a comprehensive vision for long-term management of the Hanford 200 Area.

The Goal:

To plan and implement a cleanup strategy for the Central Plateau that provides for control of continuing sources of contaminant release to the environment, minimizes the impacts of previous releases, provides opportunities for implementation of evolving technology to improve environmental conditions, creates opportunities for long-term restoration of groundwater, establishes institutional controls that will protect environmental management systems, workers and the public, and leaves significant portions of the 200 Area in a condition to support industrial re-use.

The Principles:

Cleanup projects in the 200 Area must focus on those sites and facilities posing the greatest risk to the environment, worker health, public health, and national security.

Waste management strategies must demonstrate a preference for remove, treat (as appropriate) and dispose options in contrast to containment in place.

In those instances where containment in place is determined to be necessary every effort should be made to minimize both the number and size of caps. When consolidation of waste within an existing waste management area is determined to be appropriate treatment and/or stabilization of waste should be an integral component of the cleanup action.

While it is recognized that currently available technologies may limit the feasibility of restoring groundwater quality to support beneficial uses in portions of the Central Plateau in the near term, it should continue to be a long-term goal; therefore cleanup projects and long-term management strategies for the 200 Area should reflect that value, and opportunities to implement groundwater and vadose zone restoration techniques which may be developed in the future should be considered during the CERCLA 5 year review process.

Opportunities to achieve regulatory program efficiencies during the selection and implementation of cleanup actions should be considered an integral part of an effective and successful cleanup program for the Central Plateau.