5.0 Discussion of Alternatives

The purpose of this section is to describe how existing Hanford-specific cleanup decisions and strategies may vary from the DOE Policy (455.1, *Use of Risk-Based End States*). This analysis evaluates existing cleanup decisions and planned actions reflected in the *Integrated Hanford Baseline Description* (DOE 2004b), in relation to land-use determinations for Hanford.

Identification of an alternative does not in itself mean that DOE will seek to renegotiate a cleanup decision document. DOE will examine the alternative, consider the views of Tribal Nations, stakeholders, and regulatory agencies, and weigh the pros-and-cons of proposed changes to cleanup agreements. If DOE decides to pursue an alternative that involves activities regulated under RCRA or CERCLA, such changes would be pursued through the appropriate procedures defined in the Tri-Party Agreement (Ecology et al. 1989) which contains further provisions for public involvement. If the Tri-Party Agreement is not applicable or binding, DOE may pursue changes under its independent CERCLA authority.

The building blocks for developing a vision for the Hanford Site have been accumulating since the cleanup mission was initiated. Risk in planning goes back to the development of the Tri-Party Agreement by DOE, EPA, and Ecology. The CLUP (DOE 1999a) and the Presidential order creating the Hanford Reach National Monument (65 FR 37253), which together identifies land uses following site cleanup, provide a catalyst to re-evaluate the current cleanup baseline and Tri-Party Agreement milestones to assure that the baseline will be in agreement with the land-use plans.

The following sections present eight alternatives between the current baseline plans and the cleanup that would result if driven by the Hanford Site End State Vision. Three workshops were held to obtain public input on end uses for the 100, 200, and 300 Areas with the idea that the input provided by participants would shape the alternatives. A workshop on the 100 Areas was held on June 23 and 24, 2004. A workshop on the 200 Areas was held on August 11 and 12, 2004, and a workshop on the 300 Area was held May 19, 2005. The 300 Area workshop was scheduled so that DOE could complete the first phase of its re-evaluation of the 300 Area groundwater remedy and the city of Richland could complete a study of the redevelopment potential for the 300 Area. Information from both studies assisted stakeholders in understanding the issues and allowed a constructive dialogue. DOE-RL and DOE-ORP have revised the alternatives on 100, 200 and 300 Area actions in response to the workshops.

5.1 Background

As discussed in the previous chapters, the end state vision initially assumed that future land uses for Hanford will be the land uses decided upon in the CLUP. The end state workshops provided additional detail on potential uses of the land to be considered in developing the alternatives. These land uses are consistent with the creation of the Hanford Reach National Monument. The end state vision is also aligned with the following EPA guidance about the role of land-use decisions in the CERCLA remedy selection process:

- *Land Use in the CERCLA Remedy Selection Process* (the Superfund Land Use Directive, OSWER 9355.7-04, EPA 1995a)

- *Reuse Assessments: A Tool To Implement The Superfund Land Use Directive* (OSWER 9355.7-06P, EPA 1995b)

A variety of EPA guidance documents provide additional discussions on how land-use decisions are used in the CERCLA process. Published regulatory guidance and DOE Policy 455.1 recognizes that the regulatory agencies do not establish future land use at CERCLA sites; the agencies are to use appropriate determinations by established land-use authorities. Authority to make future use plans at DOE facilities was assigned to the Secretary of Energy by Congress in the *National Defense Authorization Act for Fiscal Year 1997* (Public Law 104-201), requiring the Secretary of Energy to develop a future use plan for Hanford.

The EPA land-use guidance states that, to the extent possible**,** EPA is to use readily available information to assess future land use. At sites where land-use decisions have already been determined and documented, a simple review to confirm the information may be all that is necessary. The Hanford CLUP (DOE 1999a) serves as the basis of Hanford's land-use planning. This Congressionally mandated land-use plan was formally developed using the process established by NEPA. See Chapters 2 and 3 for a detailed discussion about the Hanford lands and the CLUP land-use decisions.

The reasonably anticipated land use is important for determining the types and frequency of exposures that could occur to exposed persons and ecological receptors from any residual contamination and the resulting risks. The degree of cleanup necessary, including any controls or barriers to prevent exposure, is determined in the CERCLA remedy selection process. Cleanup must be adequately protective of humans and ecological resources and also meet (unless waived) applicable or relevant and appropriate requirements imposed under environmental laws. Potential cleanup alternatives that meet the foregoing threshold criteria are further evaluated for long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; and short-term effectiveness, compared to the cost and implementability of the potential remedy. Remedy selection also considers state and community acceptance of potential alternatives.

The Hanford Site End State Vision is not a decision document or a CERCLA remedy selection document, and it does not provide an evaluation of all CERCLA remedy selection criteria. It focuses on anticipated future land use as a primary factor in developing cleanup alternatives that are adequately protective based on risk as a perspective to look at cost-effective means that can be implemented to achieve site closure. The vision also helps in obtaining EPA, state, and community feedback from stakeholders, including Tribal Nations to understand issues that affect the degree of acceptance of a final closure that implements the Hanford Site End State Vision.

5.2 Descriptions of Alternatives

Table 5.1 summarizes the identified alternatives and the impacts, and recommendations for each one. The table also summarizes the stakeholder input obtained on each alternative at the public workshops and the revised vision based on DOE's interpretation of input from the workshops. A number of potential alternatives were considered and Table 5.1 only contains those that DOE believes should be pursued at this time.

In some cases, the current and planned actions identified in the table are clear because they are required by existing cleanup decisions. In other cases, the current and planned actions are more conceptual or reflect what is perhaps ingrained thinking based on the outcome of interactions over the years with the regulatory agencies and stakeholders. Thus, it should be recognized that as discussions continue and planning becomes more certain, the current and planned actions could become more aligned with a risk-based approach and with the end state vision.

Similarly, in some alternatives, costs and other impacts are possible to categorize and estimate. In others, cost estimates or other factors may only be known to an order of magnitude or qualitatively and, therefore, the impact from the alternative is also fairly conceptual and qualitative.

The recommendations serve to identify tasks that DOE believes should be implemented in pursuit of the end state vision reflected in the alternative. These are tasks that DOE believes will help better quantify impacts and address barriers, and will also help focus ongoing planning and regulatory and community consultation on risk-based decision making tied to anticipated future land uses.

Any alternatives that are pursued by DOE will be done through the existing decision-making processes that involve regulatory agencies, stakeholders, and Tribal Nations, as appropriate.

Alternative 1. Clean up the 100 Area waste sites to achieve remedial action objectives that are based on CLUP (DOE 1999a) conservation and preservation land-use exposure scenarios.

Current Baseline	End State Vision – April 2004 Draft Document	Impacts (scope, cost, schedule, risk) – April 2004 Draft Document	Input from End State Workshops and Other Issues for Alternative Implementation	DOE Revised End State Vision Based on Input from End State Workshops	Recommendations for Implementing Alternative
• Unrestricted surface use. • Exposure scenario based on rural residential use – Farming with 36.5 inches of annual irrigation and precipitation • Future groundwater used for drinking. • Achieves 15 mrem/yr (approximately $3x10^{-4}$ risk based on EPA guidance) and $1x10^{-6}$ risk from other contaminants; hazard index less than 1 for non-carcinogenic toxic constituents. • Assumed to be protective of ecological resources. • No decay of radionuclides. • Excavate waste sites to at least 4.6-m (15-ft) depth and to bottom of burial grounds and dispose at ERDF. • Return groundwater to beneficial drinking water use, based on 4 mrem/yr (MCL) for radionuclides, if practicable. • Transfer post remediation land to other federal agency to manage as part of the National Monument.	• Cleanup based on conservation and preservation land use exposure scenarios for recreational, non-resident park ranger and tribal activities, including fishing. • No groundwater use for drinking water or irrigation until reach MCLs (4mrem/yr). • Meet CERCLA risk range (10^{-4} to 10^{-6} risk) for radionuclides and other contaminants and protect ecological resources for CLUP land uses. • Radionuclide decay assumed. • Containment and/or monitoring of some waste sites instead of excavation. • No further degradation of groundwater. • Restore groundwater to beneficial drinking water use if practicable. • Transfer post remediation land to other federal agency to manage as part of the National Monument or Wildlife Refuge.	• 550 waste sites including 45 solid waste burial grounds in 100 Area. • 217 waste sites including 7 burial grounds excavated so far under interim action Records of Decision. • Over 4.2 million metric tons (4.7 million U.S. tons) excavated. • More than 247,750 truckloads of waste have been disposed at ERDF. • Transportation risk calculated to be 2×10^{-2} fatalities – for 100 and 300 Area campaigns so far: no fatalities; 1 significant transportation incident involving movement of material and equipment. Under current and planned actions: • 212 more waste sites and 38 burial grounds are expected to require excavation; approximately 120 facilities must be dispositioned. Under End State Vision: • Estimated 14 burial grounds could be closed by containment for about $77 million. 31 other burial grounds are estimated to cost $65M to remove.	100 Area End State Workshop Summary: • For the next 50 years, or so long as federal entity controlling the land activities will be consistent with National Monument designation and CLUP, but include resident ranger. Further out in time broader range of activities envisioned as possible or reasonable for risk and exposure analysis, but are not endorsed. These include residential and agricultural use, hotel, commercial, and industrial use, oil and gas leasing, etc. • Additional characterization data to support the end state Vision containment and/or monitoring remedies decisions could be extensive in order to sufficiently reduce uncertainty to obtain regulatory approvals. • The regulatory agencies will not consider changing the RODs to evaluate capping in place. • Washington State regulations require 10^{-5} cumulative risk and 10^{-6} individual risk for non-radionuclide contaminants.	• Cleanup based on conservation and preservation land use exposure scenarios for recreational, resident park ranger and tribal activities, including fishing for the next 50 years. Beyond 50 years unlimited use is anticipated. • Meet CERCLA excess cancer risk range (10^{-4} to 10^{-6}) for radionuclides and other carcinogens and protect ecological resources. Future land uses listed in the CLUP do not influence the ecological exposure scenarios. • Meet CERCLA hazard indices (HQ<1) for toxic contaminants and be protective of ecological resources. • Implementation of the Interim Action RODs will be adequate as final remedies for the source operable units. • Monitoring will be required whenever waste are left in place to verify robustness of remedial action. • No further degradation of groundwater above drinking water standards and restore groundwater to beneficial drinking	• The recommendation for burial grounds and waste sites is to continue implementing the current RODs for interim action. It is not deemed cost-effective to pursue the end state vision option for waste sites and burial grounds based on the facts presented here and the amount of resistance DOE will receive from regulatory agencies and community. • Expedite final risk assessments and final RODs. Develop pathway analysis and exposure factors for the 100 Area CLUP identified land-use scenarios. In addition, analyze multiple scenarios considering input from the 100 Area End State Workshop.

Alternative 1. Clean up the 100 Area waste sites to achieve remedial action objectives that are based on CLUP (DOE 1999a) conservation and preservation land-use exposure scenarios.					
Current Baseline	**End State Vision – April 2004 Draft Document**	**Impacts (scope, cost, schedule, risk) – April 2004 Draft Document**	**Input from End State Workshops and Other Issues for Alternative Implementation**	**DOE Revised End State Vision Based on Input from End State Workshops**	**Recommendations for Implementing Alternative**
		• Lower worker and transportation risks for containment vs. excavation. • Costs could increase for long term monitoring and maintenance and periodic review to determine continuing remedy protectiveness. • Characterization costs could be significantly higher than excavation cost for some sites. • Land where waste left in place may go to Office of Legacy Management if unacceptable to other federal agency.	• How to balance the remediation risks to workers and risks from transportation with the potential long-term environmental impact needs to be better understood. • See Section 3.5.5 for additional Tribal input	water use when practicable. Follow process outlined in state and federal regulations to establish protective limits ARARS cannot be met. • Transfer post remediation unrestricted use land to other federal agency to be managed as part of the National Monument or Wildlife Refuge.	

Alternative 2. Cleanup the 300 Area Waste Sites to achieve remedial action objectives that are based on CLUP (DOE 1999a) industrial land-use exposure scenarios.					
Current Baseline	**End State Vision – April 2004 Draft Document**	**Impacts (scope, cost, schedule, risk) – April 2004 Draft Document**	**Input from End State Workshops and Other Issues for Alternative Implementation**	**DOE Revised End State Vision Based on Input from End State Workshops**	**Recommendations for Implementing Alternative**
• Cleanup based on industrial land use. (The 300-FF-2 scenario assumes the worker spends 1,500 hours a year indoors and 500 hours a year outdoors, corresponding to a 250 day/yr, 8-hour workday.) • Achieves 15 mrem/yr (approximately $3x10^{-4}$ risk based on EPA guidance) and $1x10^{-5}$ risk from other contaminants; hazard index less than 1 for non-carcinogenic toxic constituents. • Assumed to be protective of ecological resources. • No decay of radionuclides. • Excavate waste sites to at least 4.6 m (15 ft) depth based on future industrial excavations - and dispose at ERDF. • Return groundwater to beneficial drinking water use, based on 4 mrem/yr (MCL) for radionuclides, if practicable.	• Cleanup based on industrial land-use exposure scenarios with controlled excavation. • No groundwater use for drinking water or irrigation (the 300 Area is connected to the city of Richland water supply). • Meet CERCLA risk range (10^{-4} to 10^{-6} risk) for radionuclides and other contamination and protect ecological resources for CLUP land uses. • Radionuclide decay assumed. • Containment and/or monitoring of some waste sites/ burial grounds instead of excavation. • No further degradation of groundwater. • Restore groundwater to beneficial drinking water use if practicable	• 195 waste sites including 13 solid waste burial grounds associated with 300 Area. • So far, 69 waste sites and 5 burial grounds excavated under a final and an interim action ROD. • Over 709,000 U.S. tons excavated. • At ERDF, more than 38,160 truckloads of waste have been disposed. • Transportation risk calculated to be 6.6×10^{-3} fatalities – for 100 and 300 Area campaigns so far: no fatalities; 1 significant transportation incident involving movement of material and equipment. Under current and planned actions: • 119 more waste sites and 8 burial grounds are expected to require excavation. Cost estimates of $450M for burial grounds and waste sites. 618-7, 10, and 11 estimated to cost $325M. • Cost estimate does not include onsite disposal costs. • Requires removal of 150 buildings over 40 of the waste sites. A total of approximately 220 facilities must be properly dispositioned. Under the End State Vision:	• 300 Area End State Workshop Summary • A broad range of activities are envisioned for the area currently known as the industrialized 300 Area and the surrounding region. The proximity to the Columbia River and the city of Richland makes this area attractive to many people for a broad range of uses. • Current land use plans identify this region for industrial reuse, but a study recently completed by the city of Richland suggests that industry is not interested in reoccupying this land. • Future land used identified during the workshop included a number of industrial uses, as well as recreational uses and a range of other ideas. • See Section 3.5.5 for additional Tribal input	• Cleanup based on industrial land-use exposure scenarios with controlled excavation. • Remediated sites will be backfilled to support unlimited surface use (irrigation and groundwater use may be restricted, based on success of future groundwater cleanup activities) where practicable. To date, this has been accomplished whenever possible by backfilling the excavated waste sites first with excavated material that is below the standard for industrial use (267pCi/g uranium if there was any) and finishing with clean fill from a borrow site. DOE will continue this practice in the future where practicable. • The outcome of the River Corridor risk assessment, the final remedy for groundwater, the 5-year review of land use decisions and the data gathered during the early stages of cleanup will be considered along with public input before final 300 Area site remedies are identified.	• Continue remediation of waste sites to industrial standards as required under the current interim action Record of Decision. • The risk assessment for the River Corridor will be completed to support final remedial decisions. The outcome of the River Corridor risk assessment, the final remedy for groundwater, the 5-year review of land use decisions and the data gathered during the early stages of cleanup will be considered along with public input before final 300 Area site remedies are identified.

Alternative 2. Cleanup the 300 Area Waste Sites to achieve remedial action objectives that are based on CLUP (DOE 1999a) industrial land-use exposure scenarios.					
Current Baseline	**End State Vision – April 2004 Draft Document**	**Impacts (scope, cost, schedule, risk) – April 2004 Draft Document**	**Input from End State Workshops and Other Issues for Alternative Implementation**	**DOE Revised End State Vision Based on Input from End State Workshops**	**Recommendations for Implementing Alternative**
		• Lower worker and transportation risks for containment vs. excavation. • Costs could increase for long-term monitoring and maintenance and periodic review to determine continuing remedy protectiveness. • Characterization costs could be significantly higher than excavation cost for some sites. • The buildings over waste sites are still anticipated to be demolished in the end state vision, but complete removal may not be needed.		Re-evaluate the natural attenuation decision for the uranium plume at the 300 Area and develop a proposed plan/focused feasibility study to determine if other more effective groundwater remedial alternatives are available to meet cleanup goals. Work to meet the goals of no further degradation of groundwater above drinking water standards and restore groundwater to beneficial drinking water use when practicable. Follow process outlined in state and federal regulations to establish protective clean up goals if groundwater cannot be restored in a reasonable time frame	

Alternative 3. Cleanup the Central Plateau waste sites to achieve remedial action objectives that are based on CLUP (DOE 1999a) industrial exclusive and conservation/preservation land-use exposure scenarios.

Current Baseline	End State Vision – April 2004 Draft Document	Impacts (scope, cost, schedule, risk) – April 2004 Draft Document	Input from End State Workshops and Other Issues for Alternative Implementation	DOE Revised End State Vision Based on Input from End State Workshops	Recommendations for Implementing Alternative
• Industrial land use and conservation/preservation land use for the Central Plateau inside/outside Core Zone, respectively. • Possible animal intruder and human intruder after 150 years. • No groundwater use for drinking water or industrial use - incidental contact only. • Protect ecological resources for this land use. • 15 mrem/yr from radionuclides ($3x10^{-4}$ risk based on EPA guidance). • $1x10^{-4}$ to $1x10^{-6}$ risk from other contaminants. • Meet DOE performance assessment criteria - 100 mrem/yr in unrestricted areas (near boundary of waste disposal site). • Radionuclide decay assumed. • Remove treat and dispose for some wastes sites, others receive cover only to achieve regulatory compliance or a combination of remove treat and dispose along with a cover. • TRU waste in retrievable storage will be retrieved, treated and shipped to WIPP.	• Core Zone Industrial Exclusive land use for radiation workers, industrial workers, and authorized visitors. • Outside Core Zone, same as 100 Area conservation/ preservation land-use exposure scenarios - excluding fishing and adding mining for borrow soil. • No groundwater use for drinking water or irrigation. • Meet CERCLA risk range of 10^{-4} to 10^{-6} risk for radionuclides and other contaminants. Protect ecological resources for CLUP land uses. • Radionuclide decay assumed. • Small isolated waste sites may be removed and consolidated to optimize placement of surface barriers. • Containment and/or monitoring of some waste sites instead of excavation. • TRU waste in retrievable storage will be retrieved, treated and shipped to WIPP. • Groundwater degradation is adequately controlled to protect the river and to return to beneficial drinking water use if practicable.	• Central Plateau is ~194 km^2 (75 mi^2). • 64.7 km^2 (25 mi^2) Core Zone contains the 200 Area - reserved for waste management and disposal. • Approximately 1,000 waste sites including 132 burial grounds/landfills/dumps within the Central Plateau; 69 waste sites including 29 landfills/ dumps are outside the Core Zone. • 15,000 m^3 (19,619 ft^3) of suspect transuranic waste stored in retrievable trenches. About 8,600 m^3 (11,248 yd^3) of TRU/M and MLLW stored at CWC. • One waste site remediated within the Core Zone and no interim action or final RODs for the Central Plateau waste sites. Under current and planned actions: • Assumes 32% of the waste sites will have surface barriers (Modified RCRA C or Hanford Barrier) • 40% of the waste sites removed and disposed. • 28% under natural attenuation or no action. • Cost estimate of these actions is over $1.5 billion.	Central Plateau End State Workshop Summary Significant common themes for burial sites: • First and foremost is protecting the groundwater. Address the high risks first. • There should be an aggressive plan to develop technology for remediation for the contamination that could get to the groundwater (particularly the Tc-99). • We should allow for "nature doing its job" over reducing the footprint in certain cases (Gable Mountain as an example where there is an active and healthy ecosystem there. Also there is low risk if there is a failure in institutional controls). This includes maintaining the appropriate institutional controls during a predetermined time period. Emphasis on "certain". Need good data and characterization. Need to consider human and ecological risk, and look holistically.	• Central Plateau cleanup activities and use of Core Zone to support cleanup of other areas will be ongoing for next 50 years. • A Central Plateau Core Zone will be a permanent waste management area and will remain under federal control for Industrial Exclusive land use (radiation workers, industrial workers, and authorized visitors) for the next 150 years or as long thereafter as federal government retains control of Central Plateau. • Outside Core Zone consider establishing buffer area between Core Zone and remainder of Central Plateau to adequately protect human health and the environment from Core Zone industrial uses. Buffer area could also have industrial uses compatible with Core Zone uses. • After cleanup is complete the buffer area will shrink and land use will be similar to the 100 Area. • Outside the buffer area cleanup will be consistent with the 100 Area conservation/preservation land-use exposure scenarios - excluding fishing, but adding mining for	• Finalize integration strategy, such as the 200 Area zone approaches currently being developed, to expedite development of overall Central Plateau regulatory and ROD strategy. • Only pursue interim actions based on current, not future, ecological or human health risks and river water quality protection. • Implement February 2004 "Hanford Site Groundwater Strategy" for the groundwater protection, monitoring and remediation aspects of this alternative. • Expedite development of the risk assessment methodology and sampling and analysis plans for the development of the final RODs. • Explore future industrial uses for Core Zone and potential Buffer Area around Core Zone compatible with DOE industrial exclusive as means to assure effectiveness and duration of institutional controls through human presence.

Alternative 3. Cleanup the Central Plateau waste sites to achieve remedial action objectives that are based on CLUP (DOE 1999a) industrial exclusive and conservation/preservation land-use exposure scenarios.					
Current Baseline	**End State Vision – April 2004 Draft Document**	**Impacts (scope, cost, schedule, risk) – April 2004 Draft Document**	**Input from End State Workshops and Other Issues for Alternative Implementation**	**DOE Revised End State Vision Based on Input from End State Workshops**	**Recommendations for Implementing Alternative**
• Prevent groundwater degradation, protect the river and return to beneficial drinking water use if practicable. • Central Plateau Core Zone remain under DOE control for waste management activities for the foreseeable future.	• Use integration strategy to optimize and prioritize cleanup activities within discreet 200 Area zones (e.g., Canyon Zones). • Groundwater points of compliance set at points where groundwater treatment and restoration is determined to be practicable and to monitor progress towards protection and restoration goals of CERCLA, RCRA, and AEA. • Institutional controls to prevent intrusion or modification to caps. • Central Plateau Core Zone remain under DOE control for waste management activities for the foreseeable future.	Under the End State Vision: • Use evaporative transport barriers for 32% of waste sites with expected cost savings of 25% or more. • Fewer waste sites will require remove, treat, and dispose, and more sites will apply natural attenuation or no action. • Lower worker and transportation risks for containment vs. excavation. • Costs for long-term monitoring and maintenance and periodic review to determine continuing remedy protectiveness could increase. • Characterization costs could be significantly higher than excavation cost for some sites. • Risk to future Hanford Site workers and visitors not expected to change. • Source removal actions taken only if action will significantly improve groundwater quality or the practicability of treatment. • Contaminants are not expected to significantly impact river water quality or pose an unacceptable risk in the 100 or 300 Areas.	Land use and timeline considerations for exposure scenarios: • Active Remediation until about 2050 for waste management and facility cleanup, tank waste vitrification, ERDF, US Ecology, Facilities/ Tanks decommissioning. • Should consider shrinking a Core Zone especially into smaller sub-zones that would release areas such as between the 200-East and 200-West Areas. • Need to better define area outside Core Zone – what is needed to supplement Core Zone as buffer or for institutional controls enhancement? • Active management of engineering controls and institutional controls expected for 100 years thereafter – probably can control land uses. • Institution(s)/handoffs must be determined. • Tribes recognize need for Federal jurisdiction in Core Zone. • ICs will fail at undefined time beyond that, so any use possible (Same as 100 Area).	borrow soil for caps. • No groundwater use for drinking water or irrigation in Core Zone and buffer area for at least 150 years of active controls. • Meet CERCLA risk range of 10^{-4} to 10^{-6} risk for radionuclides and other contaminants. • Meet CERCLA hazard indices (HQ<1) for radionuclides and other toxic contaminants and be protective of ecological resources. • Radioactive decay will occur and should be accounted for in the risk estimation process. • Remove and consolidate small waste sites to optimize placement and minimize the number of surface barriers. • Monitoring will be required whenever waste are left in place to verify robustness of remedial action. • Strive to meet the goals of no further degradation of groundwater above drinking water standards and restore groundwater to beneficial drinking water use when practicable. Follow process outlined in state and federal	• Implement this alternative and Alternatives 5 and 6 consistent with an integration strategy, such as the 200 Area zone approach for Central Plateau.

Alternative 3. Cleanup the Central Plateau waste sites to achieve remedial action objectives that are based on CLUP (DOE 1999a) industrial exclusive and conservation/preservation land-use exposure scenarios.					
Current Baseline	**End State Vision – April 2004 Draft Document**	**Impacts (scope, cost, schedule, risk) – April 2004 Draft Document**	**Input from End State Workshops and Other Issues for Alternative Implementation**	**DOE Revised End State Vision Based on Input from End State Workshops**	**Recommendations for Implementing Alternative**
			• Remedies should be sufficiently robust as to prevent intrusion by "realistic" future intruders (i.e., if ICs fail). • The area outside of the Core Zone should be used to establish a buffer zone around Core Zone. It is expected that this buffer zone will shrink and be eliminated over time. <u>Conflicting input for exposure scenarios:</u> • Need for robust remedies versus reversible remedies. • ICs that prevent access versus encourage access. <u>General considerations for exposure scenarios:</u> • Population will continue to increase – will increase value and demand for land for productive uses. • Configuration after facility and tank clean up, e.g., cap size/location affects Core Zone size. • Continue to characterize source and risk. • Groundwater should be cleaned for future resource. • Mineral exploration possible – drilling. • Buried waste a future resource? • US Ecology closes – 2064	regulations to establish protective clean up goals if groundwater cannot be restored in a reasonable time frame • Retrievably stored suspect TRU waste will be retrieved, treated, and the TRU portion shipped to the WIPP. The low level portion of the retrieved waste will be treated and disposed of on-site. Wastes containing transuranic materials buried pre-1970 will be managed per CERCLA decisions • Groundwater degradation is adequately controlled to protect the river and to return to beneficial drinking water use if practicable. • Use integration strategy to optimize and prioritize cleanup activities within discrete 200 Area zones (e.g., Canyon Zones). • Groundwater points of compliance set at points where groundwater treatment and restoration is determined to be practicable and to monitor progress towards protection and restoration goals of CERCLA, RCRA, and AEA. • Institutional controls to prevent intrusion or modification to caps.	

Alternative 3. Cleanup the Central Plateau waste sites to achieve remedial action objectives that are based on CLUP (DOE 1999a) industrial exclusive and conservation/preservation land-use exposure scenarios.					
Current Baseline	**End State Vision – April 2004 Draft Document**	**Impacts (scope, cost, schedule, risk) – April 2004 Draft Document**	**Input from End State Workshops and Other Issues for Alternative Implementation**	**DOE Revised End State Vision Based on Input from End State Workshops**	**Recommendations for Implementing Alternative**
			• 5-year reviews needed – do not preclude further cleanup. • New technologies will come in 50 years, 100 years, etc., horizons. Other issues: • Additional characterization data to support the end state vision containment and/or monitoring remedies decisions could be extensive in order to sufficiently reduce uncertainty to obtain regulatory approvals. • The regulatory agencies will not consider changing the RODs to evaluate capping in place. • Washington State regulations require 10^{-5} cumulative risk and 10^{-6} individual risk for other contaminants. • How to balance the remediation risks to workers and risks from transportation with the potential long-term environmental impact needs to be better understood. • See Section 3.5.5 for additional Tribal input		

Alternative 4. Stabilize high radioactivity material in the 200 Area onsite and allow radioactive decay prior to final disposition.					
Current Baseline	**End State Vision – April 2004 Draft Document**	**Impacts (scope, cost, schedule, risk) – April 2004 Draft Document**	**Input from End State Workshops and Other Issues for Alternative Implementation**	**DOE Revised End State Vision Based on Input from End State Workshops**	**Recommendations for Implementing Alternative**
• Land use, exposure scenarios and risk goals same as Alternative 3. • Ship ~2000 metal capsules of cesium-137 and strontium-90 to a geologic repository by 2020. • Continued capsule storage under water until disposition. • Central Plateau Core Zone remains under DOE control for waste management activities for the foreseeable future. • Store estimated 50 cubic meters of K Basin radioactive sludge in special containers in 200 Area until shipped to WIPP for disposal. • Decontaminate the K-Basin as necessary to coincide with cocooning of reactors in 2012. • Transfer post remediation 100 Area land to U.S. Fish and Wildlife Service to manage as part of the National Monument.	• Land use, exposure scenarios and risk goals same as Alternative 3. • Place cesium and strontium capsules in dry storage in the 200 Area. • After 50 years of decay, a final disposition pathway will be made. • Strontium capsules are anticipated to meet onsite disposal criteria prior to the end of the EM cleanup mission. • Cesium capsule activity is expected to exceed onsite disposal WAC - disposition decision will be made prior to the end of the EM mission. • Central Plateau Core Zone remain under DOE control for waste management activities for the foreseeable future. • After removal of spent fuel from K-Basin, less than 0.5 m^3 (0.65 yd^3) of fuel pieces will be removed from the sludge, stabilized and stored similar to the fuel. • Stabilize remaining ~50 m^3 (65 yd^3) of sludge using in-container solidification processes similar to those used in commercial nuclear power plant waste management operations. • Directly dispose sludge	• Approximately 2,000 cesium-137 and strontium-90 capsules stored in a Central Plateau pool. • Capsules have high radiation levels making near term disposition uncertain. • K-Basin sludge is highly radioactive because it contains less than 0.5 m^3 (0.65 yd^3) of fuel pieces in the sludge. • 2,300 tons of K-Basin highly contaminated fuel packaged and stored in 200 Area. Under current and planned actions: • Current pool storage of capsules runs about $5M per year. • Sludge disposal at WIPP is estimated to require 1,000 containers. • Decontaminating K-Basin and removal of equipment will not occur for 5 or more years. • Decontaminating K-Basin poses significant worker exposure potential. Under End State Vision: • Capsule storage in 200 Area is consistent with the CLUP exclusive industrial land use. • Placing capsules in interim dry storage costs about $50M. • Dry storage maintenance	• Central Plateau End State Workshop Summary • The land use and timeline considerations listed above for Alternative 3 are relevant to the vision for the cesium and strontium capsule storage and disposition. They are also relevant to the management of removed K-Basin sludge in an Industrial Exclusive 200 Area Core Zone. • The 100 Area End State Workshop input for the Vision for Reactor Cores in Alternative 7 is relevant to K-Reactor after removal of sludge and decontamination of K-Basins. • There are regulatory issues and Ecology has serious concerns with on-site disposal of strontium capsules. Other issues: • How to balance the remediation risk to workers and risk from transportation with the potential long-term environmental impact needs to be better understood. • Capsule disposal at Yucca Mountain repository requires a license application or license amendment. • Cesium/strontium inventory is regulated under RCRA and is stored in a RCRA facility. Mutual	• Land use, exposure scenarios and risk goals same as Alternative 3. • Continue storage of cesium and strontium capsules in wet storage in the WESF in the 200 Area in the near term (up to 5 years). • Place cesium and strontium capsules in dry storage in the 200 Area until the cesium capsules can be sent to a geological repository and strontium capsules can be disposed of in the Central Plateau in accordance with waste acceptance criteria and CERCLA decision documents • Final disposition pathway for capsules may be made beyond 50 years, depending on future Industrial Exclusive land use and institutional controls for the Core Zone that would be effective for at least 150 years, per Alternative 3. • There are regulatory issues and Ecology has serious concerns with this on-site disposal alternative • Central Plateau Core Zone remains under DOE control for waste management activities for the foreseeable future.	• Factor this alternative into the current Tri-Party discussions related to these decisions. • Discussions must include consideration of final disposal for capsules in the 200 Area Core Zone. • Discussions should consider CLUP identified land-use scenarios for the 100 Areas and 200 Areas affected, as appropriate, and consider short-term risks to workers and risks involved in transportation and disposal activities in addition to long term costs. • Evaluate the waste regulatory requirements that apply to capsules. • Develop permit application for dry storage of capsules.

Alternative 4. Stabilize high radioactivity material in the 200 Area onsite and allow radioactive decay prior to final disposition.					
Current Baseline	**End State Vision – April 2004 Draft Document**	**Impacts (scope, cost, schedule, risk) – April 2004 Draft Document**	**Input from End State Workshops and Other Issues for Alternative Implementation**	**DOE Revised End State Vision Based on Input from End State Workshops**	**Recommendations for Implementing Alternative**
	after stabilization at WIPP or onsite if waste acceptance criteria met. • Grout remaining equipment and material in place and then cut up and moved to a disposal facility in the 200 Areas. • Transfer post remediation 100 Area land to U.S. Fish and Wildlife Service to manage as part of the National Monument.	costs estimated at less than $1M per year. • Long-term safe dry storage of the capsules will facilitate future disposition. • K Basin sludge would not have to be stored in T Plant in special containers for over 10years. • Grouting sludge will result in much of the sludge and K Basin equipment being acceptable for either WIPP or onsite disposal. • Grouting significantly reduces worker risk posed by removing, handling and storing the debris and untreated sludge. It also lowers transportation risks. • Stabilized product provides safer handling. • Avoids extensive deactivation of K Basin. • K Basin removal could occur earlier than the cocooning of K Reactors. • Consistent with industrial exclusive land use for the 200 Area. • Risk to future Hanford Site workers and visitors and potential groundwater impacts are not expected to change.	agreement on the conditions of a long-term storage permit is not achieved. • See Section 3.5.5 for additional Tribal input	• After removal of spent fuel from K Basin, less than 0.5 m^3 (0.65 yd^3) of fuel pieces will be removed from the sludge, stabilized and stored similar to the fuel. • Stabilize K-Basin sludge and dispose at WIPP or in a 200 Area Core Zone (if less than 100 nCi/g) in accordance with waste acceptance criteria and CERCLA decision documents • Grout remaining equipment and material in place and then cut up and move to a disposal facility in the 200 Area.	

Alternative 5. In-place disposal via CERCLA of contaminated materials within the Central Plateau Core Zone.					
Current Baseline	**End State Vision – April 2004 Draft Document**	**Impacts (scope, cost, schedule, risk) – April 2004 Draft Document**	**Input from End State Workshops and Other Issues for Alternative Implementation**	**DOE Revised End State Vision Based on Input from End State Workshops**	**Recommendations for Implementing Alternative**
• Inside Core Zone is industrial land use and outside the Core Zone is conservation/preservation land use. • Partial demolition of canyon buildings to canyon deck. Existing contaminated equipment size reduced, placed in canyon cells and grouted or removed to other disposal location. • PFP removed to slab and equipment, debris, and plutonium holdup packaged and disposed at WIPP or onsite if meets WAC. Potential subsurface contamination remediated under same approach as adjacent waste sites. • PUREX tunnels filled with grout. • Soil surface barrier placed over demolished canyons to limit infiltration and to prevent human and animal intrusion. • Large portions of underground piping removed for disposal on site or at WIPP. • No groundwater use for drinking water or industrial use - incidental contact only. • 15 mrem/yr from radionuclides ($3x10^{-4}$ risk based on EPA guidance). • $1x10^{-4}$ to $1x10^{-6}$ risk from	• Core Zone industrial exclusive land use for radiation workers, industrial workers, and authorized visitors. • Outside Core Zone, meet same objectives as 100 Area for conservation/ preservation land-use exposure scenarios - excluding fishing, and with mining for borrow soil. • Contaminated equipment from the Canyon/PFP and additional waste and adjacent facility demolition debris as well as small isolated waste sites disposed within or near the Canyon/PFP facilities to the extent practicable. Grout to fill void spaces. • Demolish PFP to concrete structures surrounding RMC/RMA glovebox lines and PRF to lower canyon structure. Leave in place PFP equipment and structure. • Remove ~0.1 metric tons (0.11 tons) of plutonium hold-up material from PFP. • Grout contaminated equipment in PUREX tunnel and leave in place. • Strategically place surface	• About 900 excess facilities inside and outside Core Zone, including 5 canyons and PFP must be properly dispositioned. • Approximately 17 metric tons (18 tons) of bulk plutonium-bearing material from PFP packaged into ~2,200 Specification 3013 containers and ~2,400 pipe overpack containers. Under current and planned actions: • Long-term institutional controls may be needed for capped areas and for wastes disposed onsite. Under End State Vision: • Less demolition of key facility structures and more contaminated material disposed onsite. • Leave in place PFP equipment and structure lowering costs and shortening schedule. Savings could approach $500M. • If the canyon footprint is not covered by a surface barrier, 2.3 million m^3 (3 million yd^3) of borrow source material or ~200,000 truck trips eliminated and avoiding associated ecological and worker risks. • Up to 35,000 m^3	Central Plateau End State Workshop Summary Common themes: • Maintain a Core Zone in the 200 Area where site-wide contamination is consolidated. • Minimize the size of the Core Zone. • Deal with the highest-risk facilities first, and make decisions regarding whether to leave or demolish facilities based on risk. • Leave "robust" facilities (e.g., the canyons) in place if the contamination is contained to a similar degree as it would be in an engineered waste disposal facility. • It makes little sense to demolish facilities and move them to ERDF if they can be made safe where they are. • Demolish less robust facilities that cannot be placed in a configuration that would be protective of the environment. Since PFP is a high-risk facility and its construction makes demolition relatively easy, then get rid of the building and the equipment inside it now. Recent success and lessons learned with 233-S demolition could be utilized.	• Land use in and outside a Core Zone, activity timelines, exposure scenarios and risk goals same as Alternative 3. • Use canyon facilities that are robust as engineered waste disposal facilities. • Dispose small waste sites within or near the canyon/PFP facilities to optimize barriers and or cap sizes. Grout to fill void spaces. • Grout in place contaminated equipment in PUREX tunnels. • Disposition buried pipelines in place in the Central Plateau using the RCRA and CERCLA processes, by remove-treat-dispose, or stabilize in place. • Demolish PFP to slab-on-grade. Remove equipment, debris and plutonium hold-up material from PFP and dispose at WIPP or onsite in accordance with waste acceptance criteria and CERCLA decision documents. • Remove ~0.1 metric tons (0.11 tons) of plutonium hold-up material from PFP. • For canyon facilities that will be demolished rather	• Finalize integration strategy, such as the 200 Area zone approaches currently being developed, to expedite development of overall Central Plateau regulatory and ROD strategy. • Implement this alternative and Alternatives 3 and 6 consistent with integration strategy for Central Plateau. • Determine whether any existing canyon facilities could serve as robust, engineered waste disposal facilities. • Develop waste acceptance criteria for waste to be left inside or placed in canyons for disposal. • Develop criteria for characterizing pipelines and for determining which pipelines may be safely left in place. • U Plant regional closure project could serve as a prototype to address this approach. Some alignment may be needed to fully incorporate recent risk based opportunities. • Use lessons learned from the decision process and field work to improve remediation approaches on the remaining canyon facilities. • Develop sampling

Alternative 5. In-place disposal via CERCLA of contaminated materials within the Central Plateau Core Zone.					
Current Baseline	**End State Vision – April 2004 Draft Document**	**Impacts (scope, cost, schedule, risk) – April 2004 Draft Document**	**Input from End State Workshops and Other Issues for Alternative Implementation**	**DOE Revised End State Vision Based on Input from End State Workshops**	**Recommendations for Implementing Alternative**
other contaminants. • Prevent groundwater degradation, protect the river, and return to beneficial drinking water use if practicable. • Protect ecological resources for this land use. • Radionuclide decay assumed. • Central Plateau Core Zone remain under DOE control for waste management activities for the foreseeable future	barriers to provide groundwater protection and prevent human and animal intrusion for a maximum number of facilities/waste sites and most efficient use of raw materials. • Engineer barrier to minimize or eliminate the need for a surface cap. • Stabilization and in place disposal of 643 km (400 mi) of buried pipelines with some sections (hot-spots) removed and disposed onsite as necessary. • No groundwater use for drinking water or -industrial use - incidental contact only. • Meet CERCLA risk range of 10^{-4} to 10^{-6} risk for radionuclides and other contaminants. Protect ecological resources for CLUP land uses. • Radionuclide decay assumed. • Use integration strategy to optimize and prioritize cleanup activities within discreet 200 Area zones (e.g., canyon zones). • Prevent groundwater degradation, protect the river and return to beneficial drinking water use if practicable. • Institutional controls to prevent intrusion or	($45{,}778\ yd^3$) of grout or fill material will be needed to fill the additional void space above the canyon deck for each canyon. • In place disposal of some portions of buried pipelines has significant potential cost and schedule savings. • Significant risk avoidance to the workforce during remediation. • Risk to future Hanford Site workers and visitors and potential groundwater impacts are not expected to change. • Institutional controls, long-term monitoring, maintenance and periodic review to determine continuing remedy protectiveness not expected to change.	• Additional waste can be disposed in the canyon facilities because the general feeling is that they will be as protective as, or even more protective than, ERDF. • Both PUREX tunnels and disposition of buried pipelines was not discussed at the workshops and will require additional public involvement during regulatory decision process. • People had serious doubts about the effectiveness and duration of institutional controls. • Develop Waste Acceptance Criteria (WAC) for any waste left inside or waste imported into the canyon buildings. • Evaluate current worker risks (radiation/chemical exposure, industrial accidents, and maintenance activities) for specific remedial alternatives and compare those risks with the risks that remaining wastes could pose to future generations and the environment. • There is a need for a comprehensive remedial action work plan for the Central Plateau that integrates all	than left as engineered waste disposal facilities, strategically place surface barriers to where and as appropriate based on engineering analysis and ARARs to provide groundwater protection and prevent human and animal intrusion for a maximum number of facilities/waste sites and most efficient use of raw materials. • Radioactive decay will occur and should be accounted for in the risk estimation process. • Monitoring will be required whenever waste are left in place to verify robustness of remedial action. • Strive to meet the goals of no further degradation of groundwater above drinking water standards and restore groundwater to beneficial drinking water use when practicable. Follow process outlined in state and federal regulations to establish protective clean up goals if groundwater cannot be restored in a reasonable time frame.	approach for underground piping targeted to depth, location and type of contaminants carried to identify sections that must be removed.

Alternative 5. In-place disposal via CERCLA of contaminated materials within the Central Plateau Core Zone.					
Current Baseline	**End State Vision – April 2004 Draft Document**	**Impacts (scope, cost, schedule, risk) – April 2004 Draft Document**	**Input from End State Workshops and Other Issues for Alternative Implementation**	**DOE Revised End State Vision Based on Input from End State Workshops**	**Recommendations for Implementing Alternative**
	modification to caps. • Central Plateau Core Zone remains under DOE control for waste management activities for the foreseeable future.		components in a logical, cost-effective, and protective manner and includes life-cycle costs as well as the pros and cons of remedial alternatives. • There is a need to conduct comprehensive interviews of retired workers to take advantage of their vast process knowledge. • There is a need for cap monitoring systems to ensure cap performance and mitigation action plans for potential future problems. Other Issues: • Regulatory agencies have expressed a preference to remove, treat, and dispose of underground piping. • Regulatory agencies, Tribal Nations and stakeholder acceptance of on-site disposal of some types of wastes may be low. • Characterization requirements have not been mutually agreed to. • See Section 3.5.5 for additional Tribal input		

Alternative 6. Retrieve tank waste and close tank farms based on risk consistent with CLUP (DOE 1999a) industrial exclusive land use and integration of RCRA and CERCLA.					
Current Baseline	**End State Vision – April 2004 Draft Document**	**Impacts (scope, cost, schedule, risk) – April 2004 Draft Document**	**Input from End State Workshops and Other Issues for Alternative Implementation**	**DOE Revised End State Vision Based on Input from End State Workshops**	**Recommendations for Implementing Alternative**
• Tanks are considered RCRA TSD units. • TPA requires that waste be retrieved to the extent "technically possible" before considering "risk based" retrieval per TPA criteria. • Currently assumed that 99% removal is possible. • High-level waste portion will be stabilized in glass logs and disposed in geologic repository. • Low-level mixed waste portion stabilized in form approved by State and disposed in 200 Area. • Remaining residues will be stabilized to meet RCRA land disposal restriction delisting criteria and AEA low-level waste disposal criteria. • Fill tank void space to isolate stabilized waste residuals and prevent tank subsidence. • Remove/demolish ancillary facilities to grade and fill void spaces. • Surface barrier placed over tank farms for long term mitigation of contaminant movement in groundwater and human intrusion. • Barrier construction	• Same as current end state, except: • Meet criteria for exclusive Industrial land-use exposure scenarios for industrial and radiation workers and authorized visitors as described in Alternative 3. • Tank waste retrieved to extent required for closure under RCRA landfill closure and integration with CERCLA requirements. • Central Plateau Core Zone remain under DOE control for waste management activities for the foreseeable future.	• 149 single-shell and 28 double-shell tanks distributed among 18 tanks farms. • 2.04e+008 L (54 million gal) of liquid, sludge and salt cake waste. • Most tanks beyond design life. • 67 tanks have leaked 3.7 million L (1 million gal) of waste with some reaching groundwater. • Additional leaks highly likely. • Chemical vapors released from tanks potentially exposing workers. • Potential for significant radioactive airborne releases. <u>End State Vision compared to current and planned actions</u>: • The end state vision will be based on the conclusion of the Hanford Tank Closure EIS. Various approaches are evaluated, both more and less rigorous than the current baseline. • Less waste treated and disposed. For example, if 90% of waste retrieved rather than 99%, cost savings would be ~$3 billion	<u>Central Plateau End State Workshop Summary</u> • DOE-ORP has agreed with the stakeholder request to use the Tank Closure EIS as a basis for public dialog on the end state for the tanks.	• Tank waste should be retrieved and the tank farms closed based on regulatory requirements (RCRA and CERCLA) and considering risk. • The tank closure EIS is being prepared to evaluate the tradeoffs among a series of alternative actions leading to a range of end states. The EIS will evaluate various waste retrieval levels, treatment techniques and closure approaches. • The range of waste retrieval options include: – None (no action alternative) – 90 percent (potential cost benefit level) – 99 percent (current TPA baseline) – 99 percent (conservative clean closure) • The range of waste treatment options include: – None (no action alternative). – Pretreated and vitrified as high level waste and low activity waste in the Waste Treatment Plant. – Same as above except some waste treated as TRU and some treated by supplemental ther-	• Complete the Tank Closure EIS expeditiously with a Record of Decision that allows the closure permitting process to begin. • Finalize integration strategy, such as the 200 Area zone approaches currently being developed, to expedite development of overall Central Plateau regulatory and ROD strategy. • Implement this alternative and Alternatives 3 and 5 consistent with integration strategy for Central Plateau. • Determine impact of tank waste residuals in concert with expediting the final remediation approach for the Central Plateau. • DOE studies should include tank farm closure pathway analysis and exposure factors for CLUP identified land-use scenarios: industrial exclusive for the 200 Area Core Zone and conservation/preservation outside of the Core Zone.

Alternative 6. Retrieve tank waste and close tank farms based on risk consistent with CLUP (DOE 1999a) industrial exclusive land use and integration of RCRA and CERCLA.					
Current Baseline	**End State Vision – April 2004 Draft Document**	**Impacts (scope, cost, schedule, risk) – April 2004 Draft Document**	**Input from End State Workshops and Other Issues for Alternative Implementation**	**DOE Revised End State Vision Based on Input from End State Workshops**	**Recommendations for Implementing Alternative**
coordinated with adjacent 200 Area waste site barrier construction. • Implement effective institutional controls and monitoring for indefinite period into future. • Central Plateau Core Zone remain under DOE control for waste management activities for the foreseeable future		• Less waste retrieved and treated: cost savings ~$1.5-$2B • 10% reduction in number of HLW canisters: cost savings ~$0.5 billion for RPP and $0.4 billion repository fee • 10% reduction in ILAW: cost reduction ~ 0.4 billion • Waste treatment completed ~2 years sooner. • Worker dose is expected to be reduced ~10% (1,100 person-rem). • Risk to future Hanford Site workers and visitors is not expected to change. • Risk avoidance to the workforce and would lower transportation risks. • Sources of groundwater contamination will be removed to the extent practicable, but areas and levels of contamination could become higher before attenuation occurs. • Protection of river water quality will not change.		mal or non-thermal techniques (current baseline). – All waste treated as high-level waste. • The range of closure options include: – No closure. – Landfill closure with some tank residuals (current TPA baseline). – Varying levels of contaminated soil removal. – Clean closure including removal of tanks and soil.	

Alternative 7. Leave reactor pipelines in the Columbia River and reactor cores in place based on CLUP (DOE 1999a) conservation and preservation land use exposure scenarios					
Current Baseline	**End State Vision – April 2004 Draft Document**	**Impacts (scope, cost, schedule, risk) – April 2004 Draft Document**	**Input from End State Workshops and Other Issues for Alternative Implementation**	**DOE Revised End State Vision Based on Input from End State Workshops**	**Recommendations for Implementing Alternative**
• Allow decay of activation products in covered reactor cores for 75 years. • Demolish reactors down to shield walls and install 75-year roof ("cocooning"). • Remove reactor remains after 75 years for disposal in 200 Area Core Zone. • Institutional controls until removal of reactor cores. • Draft Explanation of Significant Differences proposes leaving reactor cooling water discharge pipelines in place in river, with removal and disposal in ERDF undertaken if any pipeline segments break away and wash up on the shoreline.	• Meet criteria for conservation and preservation land use exposure scenarios for 100 Area as described in Alternative 1. • Reactor cores decay in place. • Reactor pipelines left in place.	Nine reactor facilities along Columbia River will be decommissioned and cocooned. • Approximately 2,700 m (8,858 ft) of large reactor piping in the river bed. <u>Under current and planned actions</u>: • Pipeline characterization indicates that contamination within CERCLA risk range for rural resident scenario while the pipelines remain in the river. Hypothetical scenario involving pipelines segments washing up on the shoreline shows potential for unacceptable risk under river recreationist scenario. • Reactors would potentially be completely demolished and transported for disposal in 200 Area, in accordance with current EIS. <u>Under the End State Vision:</u> • Leaving pipelines in place poses lower worker and ecological risks than from removal and waste transportation. • Leaving reactor cores in place poses lower worker risks than from removal and waste transportation. • Costs for long-term	<u>100 Area End State Workshop Summary for Reactors</u> • B Reactor has important historical value and if funded a museum strongly supported. Keep in safe configuration for same period as cocooned reactors, and will need access restrictions. The other reactor cores can be left in place for up to 75 years, once cocooned, to allow for radioactive decay, but do 5 year reviews of condition. Don't presume final disposition or technology, but make and execute decision in future before EM leaves Site. Funding for a future decision to move cores must be assured. Participants were split on ultimate end state. May prove safe to leave, but other factors, such as interference with other 100 Area land uses, may drive removal. Tribal members want cores, including B reactor, ultimately moved. Include new technology review in 5-year reviews. Single piece move should be avoided if possible.	• Meet criteria for conservation and preservation land use exposure scenarios for 100 Area as described in Alternative 1. • Cocoon eight of nine reactors and leave in place to decay for up to 75 years. DOE will make a final decision on whether to cut up and move reactor cores to Central Plateau after sufficient decay has occurred. The decision will be made prior to cleanup completion. This delay will require a commitment of future funds toward the final decision. • Keep the B Reactor in its current configuration until funding is secured to support a museum. Should the support not materialize, B Reactor will follow the path described for the other reactors. Cocooning of B Reactor would be finished with the remainder of the 100 Area cleanup completions and no later than the end of the River Corridor Contract period. • Leave the reactor pipelines in the Columbia River if risk levels are protective and ARARs are complied	• DOE-RL recommends that eight of nine reactors be cocooned and left in place to decay. DOE should make a final decision on whether to cut up and move reactor cores to Central Plateau after sufficient decay prior to cleanup completion and commit future funds toward the final decision. • DOE-RL should continue to keep B Reactor in its current configuration until funding is secured to support a museum. Should the support not materialize by October 2006 we recommend that B Reactor follow the same path as described above in number 1. Cocooning of B Reactor would be finished with the remainder of the 100 Area cleanup completions. • DOE-RL recommends the decision for the reactor pipelines in the river should be made in a final CERCLA ROD.

Alternative 7. Leave reactor pipelines in the Columbia River and reactor cores in place based on CLUP (DOE 1999a) conservation and preservation land use exposure scenarios					
Current Baseline	**End State Vision – April 2004 Draft Document**	**Impacts (scope, cost, schedule, risk) – April 2004 Draft Document**	**Input from End State Workshops and Other Issues for Alternative Implementation**	**DOE Revised End State Vision Based on Input from End State Workshops**	**Recommendations for Implementing Alternative**
		monitoring and maintenance and periodic review to determine continuing remedy protectiveness would continue after 75 years.	• 100 Area End State Workshop Summary for Pipelines: pipelines are trash in the River and must be removed unless outweighed by worker risk and ecological damage during removal. If left in place, stabilize to minimize physical hazard in long term. • See Section 3.5.5 for additional Tribal input	with and removal results in additional impact. Stabilize the pipelines if required. This evaluation will be part of the final ROD (2008) via the CERCLA process.	

New Alternative. IROD requires monitored natural attenuation for meeting groundwater restoration goals; evaluate alternatives to pump-and-treat remediation technology to reduce flux of strontium-90 to the Columbia River					
Current Baseline	**End State Vision – April 2004 Draft Document**	**Impacts (scope, cost, schedule, risk) – April 2004 Draft Document**	**Input from End State Workshops and Other Issues for Alternative Implementation**	**DOE Revised End State Vision Based on Input from End State Workshops**	**Recommendations for Implementing Alternative**
• IRODS require monitored natural attenuation for meeting groundwater restoration goals; use pump-and-treat remediation technology to reduce flux of strontium-90 (Sr-90) to the river. • Evaluate alternative technologies to reduce flux of Sr-90 to the river; evaluate ecological risk and remove hydrocarbon free product in wells when present. • Natural attenuation by radioactive decay of 30-year half-life, Sr-90 will achieve drinking water maximum concentration levels (MCLs) in groundwater in about 250 years.	• No alternative was proposed for Sr-90 in April 2004 Draft.	• No alternative was proposed for Sr-90 in April 2004 Draft. Thus, the impacts are for the new revised end state Vision alternative. • The pump-and-treat system was installed in 1994 and consists of 4 extraction wells (3 in operation) and 2 injection wells (1 in operation), and a treatment skid operating at a rate of 227 L (60 gal) per minute. • Monitoring for Sr-90 in the groundwater since installation shows no appreciable changes in plume geometry. <u>Under current and planned actions:</u> • The cost of operation of the current system is about $800K per year. • The cost of evaluating other technologies is approximately $800K in FY2004, $1M in 2005, and $1.5 M in 2006. • A treatability test plan will be completed in June 2005, with implementation of the selected technology in 2006.	<u>100 Area End State Workshop Summary</u> • Split in opinions between those who agree that if risk is low and treatment is ineffective as described, then spend dollars on other cleanup needs and those who want pristine cleanup of groundwater. Will need engineering evaluation to consider further. • Oregon, some environmental groups, and tribal representatives have concerns over DOE's characterization of the pump-and-treat system as a failure. In their opinion, the pump-and-treat has been generally successful at keeping strontium from entering the river. Other stakeholders agree that the pump-and-treat system has been ineffective and inefficient. • Therefore, public consensus may be difficult to obtain for terminating the pump-and-treat system.	• The strontium-90 ground water plume at 100-N will attenuate through radioactive decay and efforts will be made to reduce the flux of strontium-90 to the Columbia River • Continue implementing the 100-NR 01/02 interim action record of decision for soils and groundwater. Focus on implementing a groundwater remedial alternative that is more effective and efficient than pump-and-treat for reducing the flux of strontium-90 to the Columbia River. Utilize established CERCLA processes to modify the ROD for groundwater decisions. • Proceed with the planned tests for assessing alternative technologies designed to reduce flux of strontium-90 to the river (in-situ permeable reactive barrier technology and phytoremediation) • Put pump-and-treat system in cold standby during tests and continue groundwater monitoring of plume.	DOE-RL recommends the following: • Pursue monitored natural attenuation as the final record of decision for that portion of the plume identified in the ITRD remedial options evaluation report that is not expected to reach the Columbia River. • Proceed with the planned ecological risk assessment. • Proceed with the planned tests for assessing alternative technologies designed to reduce flux of Sr-90 to the river (in situ permeable reactive barrier technology and phytoremediation). • Put pump-and-treat system in cold standby during tests and continue groundwater monitoring of plume. • Evaluate the new technologies for effectiveness in reducing flux of Sr-90 to the river, including human and ecological risk reduction return for the cost of implementing alternative(s) as compared to pump-and-treat and monitored natural attenuation options. • Utilize established CERCLA processes to determine ROD.

New Alternative. IROD requires monitored natural attenuation for meeting groundwater restoration goals; evaluate alternatives to pump-and-treat remediation technology to reduce flux of strontium-90 to the Columbia River					
Current Baseline	**End State Vision – April 2004 Draft Document**	**Impacts (scope, cost, schedule, risk) – April 2004 Draft Document**	**Input from End State Workshops and Other Issues for Alternative Implementation**	**DOE Revised End State Vision Based on Input from End State Workshops**	**Recommendations for Implementing Alternative**
		Under the End State Vision: • Costs for operation and maintenance of treatment system would be eliminated. Some costs would be incurred in keeping system in cold standby for use if restart deemed necessary because attenuation objectives not met. • If alternative technologies still must be evaluated, the costs and schedule for the evaluation is not expected to change. • Cost for monitoring groundwater and river may increase to verify that monitored natural attenuation objectives are being met. • Schedule for restoration, primarily due to radioactive decay, would be unchanged because current system is ineffective in lowering Sr-90 flux to the Columbia River.	• The Sr-90 concentrations in the groundwater plume at 100-N are 1,000X drinking water standards. On the basis of concentration, the Sr-90 plume is viewed by many stakeholders as the worst plume in the 100 Area; hence, there is a reluctance to agree to passive remedial technologies at this site. • Environmental risk assessments have not been completed. The data quality objective process for these assessments has been initiated. Establishment of acceptable levels of environmental contamination will be difficult and controversial. • More information on the technical implementability of possible technologies for reducing flux to the river is needed to better understand practicability of treatment and to improve acceptability of monitored natural attenuation. • Tribal representatives and Oregon have expressed concerns on stopping the pump-and-treat system, so their level of acceptability of this approach is deemed to be low.	Maintain monitored natural attenuation in the final ROD for that portion of the plume that is not expected to reach the Columbia River. • Proceed with the planned ecological risk assessment. • Evaluate new technologies as they become available for effectiveness in reducing flux of strontium-90 to the river. • Preclude groundwater consumptive use at 100-N for 250 years by maintaining federal ownership. • Complete planned ecological risk assessment, human health risk assessment, and conduct field scale treatability studies for reducing contaminant flux to the river and reducing groundwater concentrations.	