DOE/RL-98-71
Rev. 0

Proposed Plan for the K Basins Interim Remedial Action

United States
Department of Energy

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April 1999

PROPOSED PLAN FOR THE K BASINS INTERIM REMEDIAL ACTION

Hanford Site, Richland, Washington

EPA AND DOE ANNOUNCE PROPOSED PLAN

This **Proposed Plan**[1] identifies the preferred alternative for **interim remedial action** at the K East (KE) and K West (KW) Basins located in the 100-K Area of the Hanford Site near Richland, Washington. In addition, the Plan includes summaries of other alternatives analyzed for the basins. The basins contain nearly 80 percent by weight of the U.S. Department of Energy's (DOE) nationwide inventory of defense **spent nuclear fuel** (SNF). They also contain contaminated **sludge**, water, and **debris**. Due to corrosion of the SNF and past leaks from the KE Basin, **hazardous substances** present a potential threat to human health and the environment.

This Proposed Plan is issued by the U.S. Environmental Protection Agency (EPA), the lead regulatory agency, and the DOE, the lead response agency, with the concurrence of the Washington State Department of Ecology. These three agencies are referred to as the Tri-Parties. The EPA and DOE are issuing this Plan as part of their public participation responsibilities under the ***Comprehensive Environmental Response, Compensation, and Liability Act of 1980*** (CERCLA), also known as "Superfund." The Tri-Parties have determined that the K Basins cleanout can be performed most effectively under CERCLA authority. The DOE is also issuing this Proposed Plan to satisfy public participation requirements under the ***National Environmental Policy Act of 1969*** (NEPA).

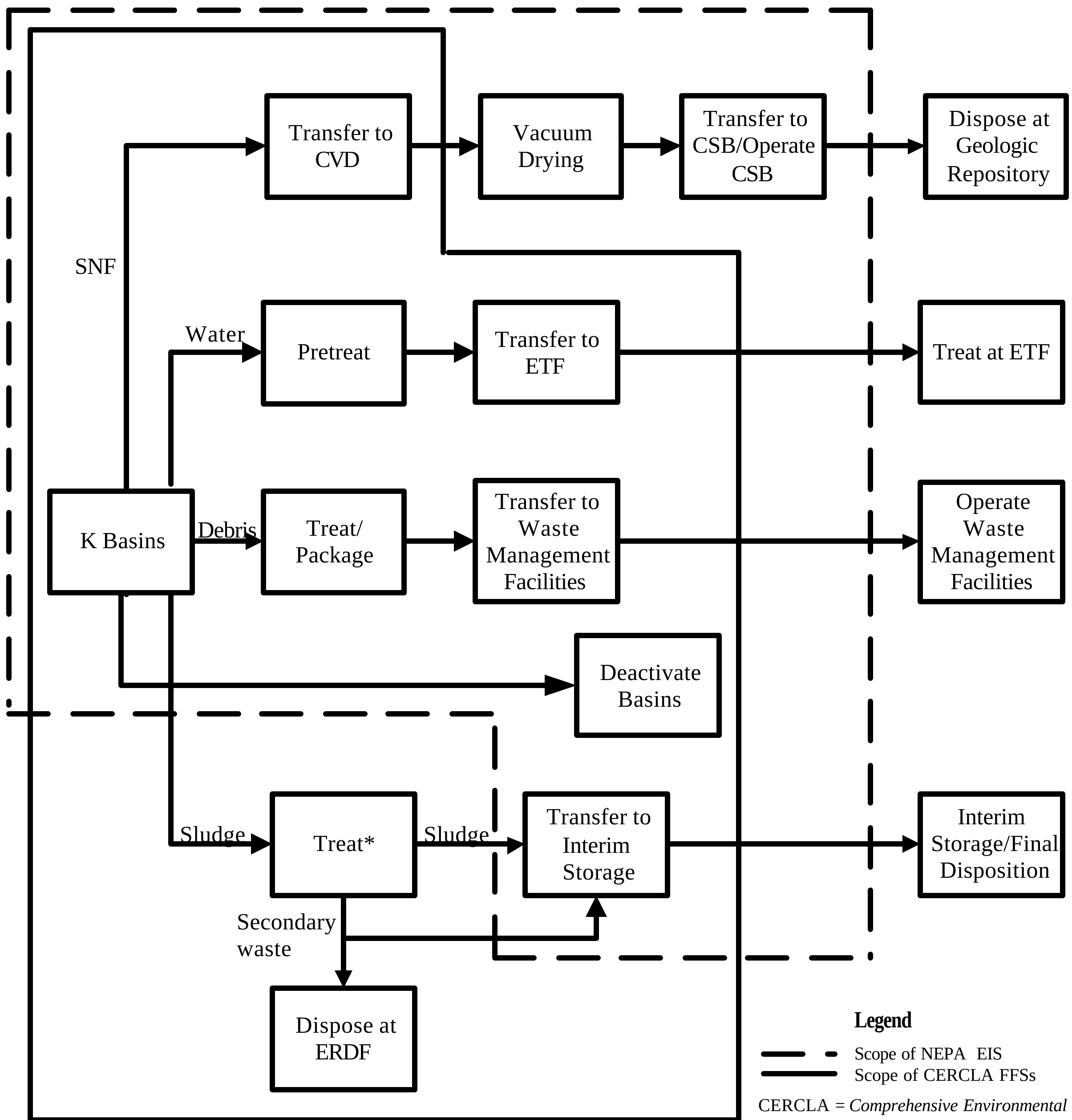
Alternatives to address the problems at the basins were previously reviewed by the public under the NEPA process in the environmental impact statement (EIS), "*Management of Spent Nuclear Fuel from the K Basins at the Hanford Site, Richland, Washington*." The alternative selected in the NEPA **record of decision** (ROD) was to (1) remove the SNF, stabilize it, and place it into interim storage, (2) remove and store or dispose of the sludge, water, and debris, and (3) deactivate the basins. The decision to remove the SNF, sludge, water, and debris from the basins remains unchanged in this CERCLA Proposed Plan. However the K Basins EIS and ROD did not address how the sludge would be treated. The Tri-Parties have decided that treatment is needed for safe storage and disposal of the sludge. Figure 1 shows how the scope of the CERCLA action fits into the overall scope of the SNF project.

> **MARK YOUR CALENDAR**
>
> This Proposed Plan is being issued by the EPA and DOE. These agencies encourage you to comment during the public comment period on the alternatives for the K Basins interim remedial action described in this Proposed Plan. Based on new information or public comments, EPA and DOE may modify the preferred alternative or the remedy selection approach presented in this Proposed Plan.
>
> A 45-day public comment period for this Proposed Plan will be from May 15, 1999 through June 28, 1999. A public meeting on this Proposed Plan is scheduled to be held on June 10, 1999.
>
> Send written comments to:
>
> Larry Gadbois
> U.S. Environmental Protection Agency
> 712 Swift Boulevard, Suite 5
> Richland, WA 99352

EPA and DOE are proposing a preferred alternative that could combine chemical, physical, thermal, and solidification treatment for the K Basins sludge to take advantage of the strengths of different technologies to treat specific fractions of the sludge. The public is requested to comment on the preferred alternative, as well as the other alternatives presented in this Proposed Plan. Additional detail on the alternatives for sludge treatment can be found in the ***Focused Feasibility Study** for the K Basins Interim Remedial Action* (DOE/RL-98-66) and other documents contained in the administrative record for the K Basins (the location is listed on page 14). The public is encouraged to review these other documents in order to gain a better understanding of the basins and the environmental problems there. Written comments on this Proposed Plan must be submitted by June 28, 1999 (see box on this page). Responses to comments will be presented in

[1]Technical terms in bold are defined in the glossary at the end of this document.

Figure 1. Scope of K Basins NEPA Environmental Impact Statement Versus CERCLA Interim Remedial Action.



CERCLA = *Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
CSB =Canister Storage Building
CVD = Cold Vacuum Drying
EIS = environmental impact statement
ERDF = Environmental Restoration Disposal Facility
ETF = Effluent Treatment Facility
FFS = focused feasibility study
SNF = spent nuclear fuel
* As appropriate to meet interim storage criteria

a responsiveness summary that will be part of the K Basins Interim Remedial Action ROD.

SITE BACKGROUND

The Hanford Site is located in southeastern Washington. For more than 40 years, the Site was used to produce plutonium for the nation's nuclear weapons program. Nine nuclear reactors were used to produce plutonium, including the KE and KW Reactors. Operation of the K Reactors began in the 1950s. During operation, SNF discharged from the reactors was stored temporarily in basins located next to each reactor until it could be processed. When the K Reactors were shut down in 1970-71, most of the SNF was removed from the basins. In the 1980s, the K Basins were modified to provide temporary storage for SNF from the still-operating N Reactor. The 200 Area facility used to process the SNF was shut down in the late 1980s, leaving about 2,100 metric tons (2,300 tons) of SNF stored in the basins.

The K Basins are located in the northern part of the Hanford Site next to the Columbia River (Figure 2). The two rectangular concrete pools are about 38 meters (125 feet) long and 20 meters (67 feet) wide. Each basin is filled with 5 meters (16 feet) of water to provide a radiation shield for facility workers and to minimize the release of radioactive particles to the air. The SNF in the basins is in the form of fuel rods made of uranium surrounded by a protective **cladding** of metal. The fuel rods are packed into aluminum or stainless steel canisters that sit upright in the bottom of the basins. In the KE Basin, the tops of most of the canisters are open, and in the KW Basin the canisters are sealed. The SNF was not designed to be stored for long periods underwater, and some of the cladding has been damaged. Because of cracks in the cladding, an estimated one-percent of the uranium contained in the SNF has corroded and become radioactive sludge. Most of this sludge is in the canisters, but some is on the basin floors mixed with sand and debris.

The KE Basin leaked up to 56.8 million liters (15 million gallons) of contaminated water to the soil over several years in the 1970s. Another 341,000 liters (90,000 gallons) was leaked in early 1993. The basin has since been repaired to reduce the chance of a future leak.

The K Basins sludge is contaminated with hazardous substances. Radionuclides in the sludge include uranium, **transuranic isotopes** (such as plutonium), cesium-137, and tritium. Chemicals include heavy metals (such as cadmium and lead), zirconium from the cladding material, and polychlorinated biphenyls (PCBs).

SUMMARY OF SITE RISK

The potential risks associated with hazardous substances at the K Basins have been assessed qualitatively and include the following:

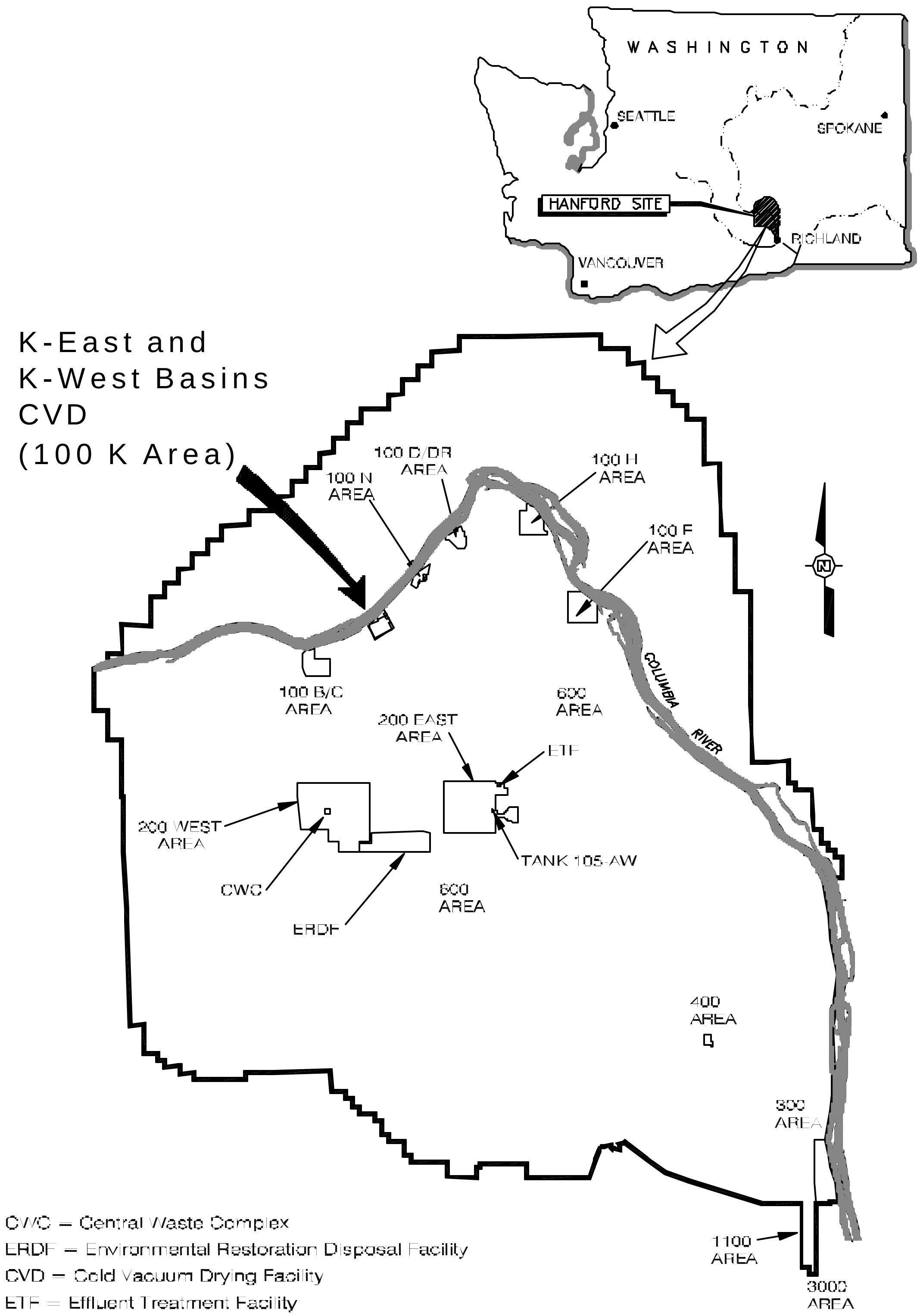
- The KE Basin has leaked large quantities of water contaminated with radionuclides. Because of the leaks, groundwater under and near the basins exceeds drinking water standards. The maximum tritium concentration measured in the groundwater was 3.32 million pCi/L in 1993, and the maximum concentration in 1998 was about 2.36 million pCi/L. For comparison, the drinking water standard for tritium is 20,000 pCi/L.
- Both basins are well beyond their design life and are not suitable for continued long-term storage of SNF. The SNF itself was not designed to be under water for long periods of time and is deteriorating, causing additional contamination of the basins and increasingly hazardous conditions for the workers.
- The basins were not designed to meet modern earthquake standards, and a major earthquake could cause large quantities of contaminated water and sludge to be released from the basins. The basins are close to the Columbia River, so a major release could cause substantial quantities of radionuclides to migrate to the river. In addition, the water is needed in the basins to cool the SNF and provide shielding. Failure to maintain a sufficient amount of water would allow the SNF and sludge to heat, dry, and produce airborne contamination.

Actual or threatened releases of the hazardous substances at the K Basins, if not addressed by the preferred alternative or one of the other active measures considered, may present a current or potential threat to public health or the environment.

SCOPE AND ROLE OF ACTION

The remedial action objectives identified for the K Basins interim remedial action are as follows:

- Reduce the potential for future releases of hazardous substances from the K Basins to the environment
  - Remove hazardous substances from near the Columbia River
  - Prevent further deterioration of the SNF
  - Provide a pathway for safe treatment, storage, and final disposal of the SNF, sludge, water, and debris removed from the K Basins


WASHINGTON
SEATTLE
SPOKANE
HANFORD SITE
RICHLAND
VANCOUVER
K-East and
K-West Basins
CVD
(100 K Area)
100 D/DR AREA
100 N AREA
100 H AREA
100 F AREA
100 B/C AREA
600 AREA
200 EAST AREA
ETF
COLUMBIA RIVER
200 WEST AREA
TANK 105-AW
CWC
600 AREA
ERDF
400 AREA
300 AREA
1100 AREA
3000 AREA
N
CWC = Central Waste Complex
ERDF = Environmental Restoration Disposal Facility
CVD = Cold Vacuum Drying Facility
ETF = Effluent Treatment Facility

- Reduce occupational radiation exposure to workers at the basins.

The scope of the interim remedial action includes:

- Removing the SNF, sludge, water, and debris from the basins
- Pretreating the water and sending it to the **Effluent Treatment Facility** in the 200 Area
- Treating the sludge and sending it to an interim storage facility in the 200 Area
- Treating the debris, as appropriate, and packaging and sending to storage or disposal facilities in the 200 Area
- **Deactivation** of the basins.

The scope does not include:

- Drying the SNF
- Interim storage of the SNF, the treated sludge, the pretreated water, or debris
- Operation of waste management facilities used to further treat (if required) or dispose of the sludge, water, or debris
- Final disposition of the basins or cleanup of the soil and groundwater under the basins. Final decommissioning of the basin structure and cleanup of the soil and groundwater will be addressed in separate CERCLA actions.

SUMMARY OF REMEDIAL ALTERNATIVES

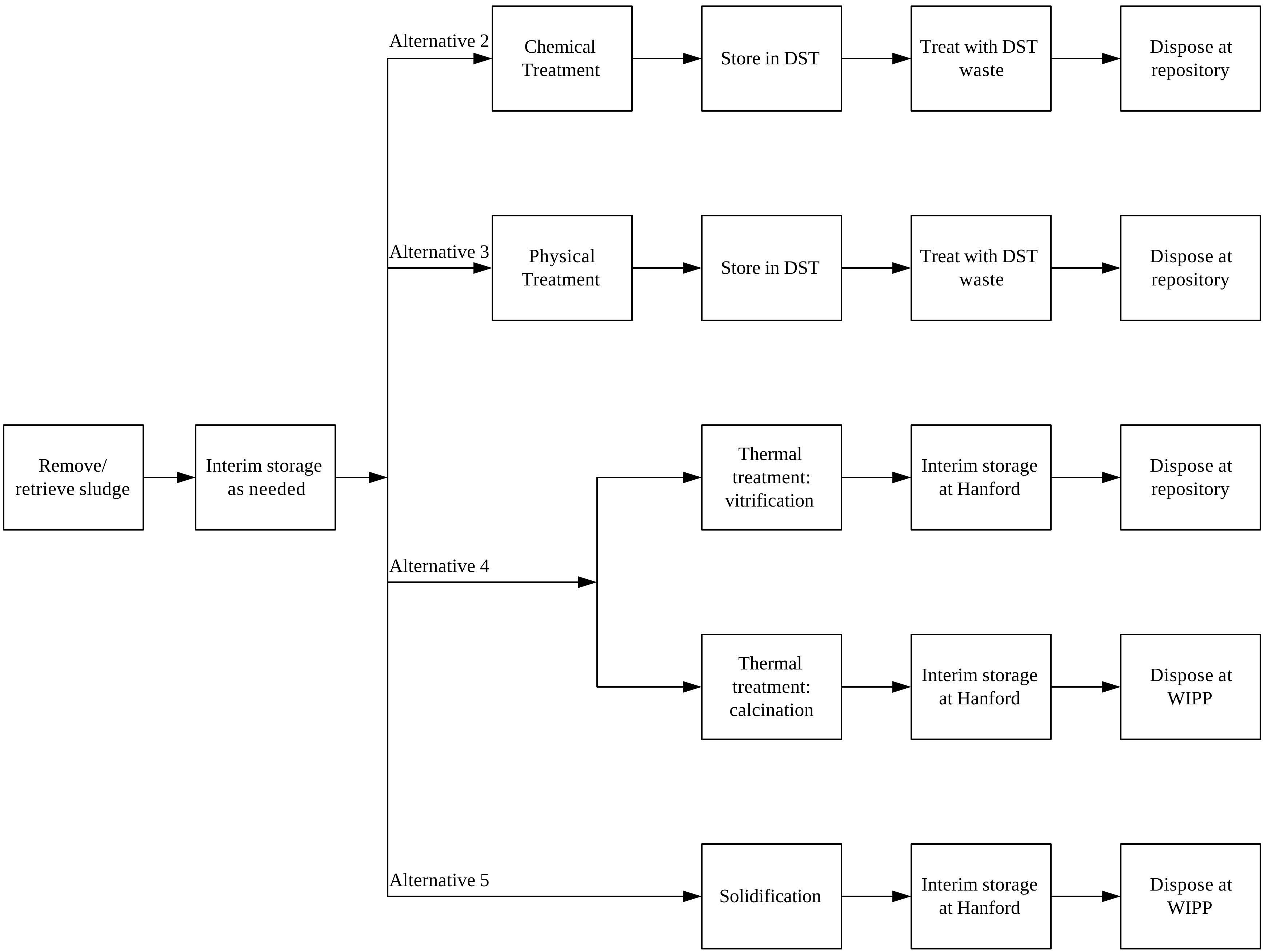
The K Basins Focused Feasibility Study identified five alternatives for interim remedial action. Alternative 1, No Action, would consist of leaving the SNF, sludge, water, and debris in the basins. CERCLA requires inclusion of a No Action alternative to provide a baseline for evaluation of the other alternatives. It is not the intent of the Tri-Parties to change decisions made via the K Basins EIS and ROD to remove the SNF, sludge, water, and debris from the basins. Alternatives 2 through 5 all include the following activities:

- About 2,100 metric tons (2,300 short tons) of SNF will be removed from the basins and transferred to the **Cold Vacuum Drying Facility** in the 100-K Area.
- About 51 m^3 of sludge (13,000 gallons) will be removed from the basins with water added to make the sludge pumpable, treated in the 100-K Area or 200 Area, and transferred by truck to interim storage in the 200 Area. The storage location will depend on the type of treatment done before the transfer and the waste form and waste designation after treatment.
- About 9.8 million liters (2.6 million gallons) of water will be pretreated at the basins and transferred by tanker truck to the Effluent Treatment Facility in the 200 Area.
- Debris will be removed, treated as appropriate, packaged, and transferred to the Hanford Site Environmental Restoration Disposal Facility in the 200 Area (if it meets disposal criteria for that facility) or to other waste management facilities in the 200 Area for final treatment and disposal.
- The basins will be deactivated by removing equipment, decontaminating or stabilizing contaminated surfaces, shutting down systems, and controlling access.

Environmental impacts of these five components were previously analyzed in the K Basins EIS. Although Alternatives 2 through 5 all include these five components they are different in the type of sludge treatment proposed. Sludge treatment was not anticipated or analyzed in the K Basins EIS, but sludge treatment is an important part of the CERCLA action. The goal of sludge treatment is to change the characteristics of the sludge so that it can be transported and stored in compliance with safety and regulatory requirements until its final treatment and/or disposal. Some factors that make sludge management particularly complex are concerns about the potential for **criticality**; the presence of potentially reactive metals; waste storage and disposal acceptance criteria; and safety of the workers and public.

Several studies have been performed to screen different technologies for treating the K Basins sludge. Based on those studies, four treatment alternatives were evaluated in detail. All of these alternatives would be designed to meet the **Tri-Party Agreement** milestone that requires the sludge to be removed from the K Basins by August 2005. The alternatives are illustrated in Figure 3 and consist of the following:

Alternative 2: Chemical Treatment – Two options were evaluated in this alternative, Baseline Chemical Treatment and Modified Chemical Treatment, but they would include the same basic steps. Acid would be used to dissolve the sludge to reduce the size of sludge particles (a part of criticality control) and make metals less reactive. Iron or depleted uranium that absorbs radioactive energy would be added to the acid solution to prevent criticality. Chemicals would be added to neutralize and adjust the solution. PCBs would either



Remove/ retrieve sludge
Interim storage as needed
Alternative 2
Chemical Treatment
Store in DST
Treat with DST waste
Dispose at repository
Alternative 3
Physical Treatment
Store in DST
Treat with DST waste
Dispose at repository
Alternative 4
Thermal treatment: vitrification
Interim storage at Hanford
Dispose at repository
Thermal treatment: calcination
Interim storage at Hanford
Dispose at WIPP
Alternative 5
Solidification
Interim storage at Hanford
Dispose at WIPP

be volatilized and treated or would be removed with the insoluble solids.

The resulting slurry would have an estimated volume of about 1,500 to 1,600 m^3 (about 400,000 gallons), including the water added to make the sludge pumpable. This extra water is later evaporated. The chemical process would be designed so that the slurry would meet the requirements for storage in **double-shell tanks**. The slurry would be transferred to the Tank 105-AW and managed as a small part of Hanford's large inventory of tank waste. (Tank waste will be vitrified and eventually shipped offsite to the national geologic repository. Management of tank waste is not part of the K Basins interim remedial action.) During sludge treatment, organic resin beads and insoluble solids (such as zirconium) would be separated from the sludge. This secondary waste would contain radionuclides and some PCBs. Under the Baseline Option, the waste would be leached to remove TRU radionuclides. Under the Modified option, the resin beads and solids would not be leached. The resin beads and insoluble solids would be treated as appropriate and disposed at the Environmental Restoration Disposal Facility or at the Waste Isolation Pilot Plant in New Mexico. Air emissions from the treatment system would be collected and treated to meet air emission standards. Airborne PCBs would be collected on filters, and disposed at the Environmental Restoration Disposal Facility.

Alternative 3: Physical Treatment – There are many physical treatment methods. The two that were combined for this Alternative were grinding/milling and physical separation. A high-energy mill would be used to grind the sludge to reduce the size of sludge particles (a part of criticality control) and make metals less reactive. The grinder would have a special liner to absorb PCBs and remove them from the sludge. Large particles would be separated out and recycled to the grinder. Iron or depleted uranium would be added to the solution after grinding to prevent criticality. Chemicals would be added to adjust the solution.

The resulting slurry would have an estimated volume of about 1,200 m^3 (300,000 gallons), including the water added to make the sludge pumpable. The physical process would be designed so that the slurry would meet the requirements for storage in double-shell tanks. The slurry would be transferred to the Tank 105-AW and managed as a small part of Hanford's large inventory of tank waste. (Management of tank waste is not part of the K Basins interim remedial action.) During sludge treatment, ungrindable solids (such as zirconium) would be separated from the sludge. This secondary waste would contain radionuclides and some PCBs. The ungrindable solids would be treated as appropriate and disposed at the Environmental Restoration Disposal Facility or at the Waste Isolation Pilot Plant in New Mexico. Air emissions from the treatment would be collected and treated to meet air emission standards. Airborne PCBs would be collected on filters, solidified, and disposed at the Environmental Restoration Disposal Facility.

Alternative 4: Thermal Treatment – There are many thermal treatment methods. Two options that were evaluated were **Vitrification** and **Calcination**. This vitrification process should not be confused with the large-scale vitrification plant to be constructed for treatment of tank waste. The sludge would be separated into three streams as it is removed from the basins: small particles, large particles, and organic resin beads.

The small particles would be vitrified or calcined. The large particles would be dissolved in acid, then vitrified or calcined. Vitrification would produce about 27 m^3 of glass. The glass would be stored in the 200 Area of the Hanford Site and eventually shipped offsite to the national geologic repository. Calcination would produce about 16 m^3 of dry particles. The particles would be packaged and stored in the 200 Area of the Hanford Site and eventually shipped offsite to the Waste Isolation Pilot Plant. The thermal process would be designed so that the treated waste would meet the requirements for the offsite disposal facility. (Interim storage and disposal of the treated sludge are not part of the K Basins interim remedial action.) During sludge treatment, insoluble solids (such as zirconium) would be separated from the sludge. The organic resin beads and insoluble solids would contain radionuclides and some of the PCBs. They would be treated as appropriate and disposed at the Environmental Restoration Disposal Facility or at the Waste Isolation Pilot Plant in New Mexico. Air emissions from the treatment system would be collected and treated to meet air emission standards. Airborne PCBs would be collected on filters, solidified, and disposed at the Environmental Restoration Disposal Facility.

Alternative 5: Solidification – The sludge would be separated into three streams as it is removed from the basins: organic resin beads, small particles, and large particles. The sludge containing small particles would be oxidized in hot water and the sludge containing large particles would be oxidized in small furnaces. The organic resin beads and oxidized sludge would be combined and solidified using materials such as Portland cement. PCBs in the sludge would be included in the solidification.

Solidification would produce about 315 m^3 of solid waste. The solid waste would be stored in the 200 Area of the Hanford Site and eventually shipped offsite to the Waste Isolation Pilot Plant. The solidification process would be designed so that the treated waste would meet the requirements for the Waste Isolation Pilot Plant. Air emissions from the treatment system would be collected and treated to meet air emission standards. Airborne PCBs would be collected on filters, solidified, and disposed at the Environmental Restoration Disposal Facility.

PREFERRED INTERIM REMEDIAL ALTERNATIVE

There are advantages and disadvantages to all of the sludge treatment alternatives. No single alternative that was developed stands out as the best way to treat all of the sludge. There is a high degree of confidence that Chemical Treatment would be able to meet the double-shell tank criteria for the entire range of K Basins sludge. However, it is probably more extensive treatment than necessary for some of the sludge, it would produce a large waste volume, and it is very costly to build a chemical treatment system for the entire volume of sludge. Some of the sludge might be able to meet the double-shell tank criteria with very little treatment, such as simple separation and chemical adjustment. Some of the sludge has very high concentrations of uranium and plutonium. This sludge fraction might best be disposed at the national geologic repository. The repository is most likely to accept a glass form, so Calcination and Solidification would not be good options for this fraction. Grinding and physical separation processes could be a simple way to reduce the size of some particles. However, it is complicated to use grinding and physical separation to make very small particles that meet the double-shell tank criteria, so physical treatment would not be a good option for the entire volume of sludge. Finally, it would be very difficult to design and construct a treatment system large enough to treat all of the sludge using any of the individual treatment alternatives in time to treat the sludge immediately after as it is removed from the basins.

Based on these considerations, DOE and EPA propose a hybrid treatment system as the preferred alternative. The system could incorporate a combination of chemical, physical, thermal, and solidification treatment. The goals of the hybrid system would be as follows:

- Considering the characteristics of the different sludge fractions, identify the best treatment method or combination of methods for each fraction.
- Use the most cost-effective combination of technologies that is protective.
- Meet the waste acceptance criteria of the intended disposal facility for each fraction.
- Meet all safety and regulatory requirements, including air emissions standards and the requirement to provide treatment for PCBs.

The hybrid system would likely involve physically separating the sludge into different fractions based on characteristics such as particle size and radioactivity. Each fraction eventually would be treated using the chemical, physical, or thermal technology or technologies that are most appropriate and cost effective for that fraction. It is possible that some of the sludge in the basins is already close to meeting the double-shell tank criteria or solid waste disposal criteria. This sludge could undergo minimal treatment (such as chemical adjustment, simple grinding, or solidification) at the basins. Any sludge fraction that would require more extensive treatment (such as chemical dissolution or thermal treatment) to meet the criteria of a double-shell tank, the Waste Isolation Pilot Plant, or the repository would be placed into interim storage upon removal from the basins. In this case, the public will be requested to comment per CERCLA before extensive treatment is undertaken.

EVALUATION OF REMEDIAL ALTERNATIVES

The alternatives were evaluated against nine CERCLA criteria (see box on page 13). A summary of that evaluation is provided in Table 1.

Overall Protection. The treatment alternatives (Alternatives 2 through 5) would protect human health and the environment by removing hazardous substances from the K Basins and transferring them to facilities that are more protective. This would reduce the potential for further deterioration of the SNF and future releases from the basins. The No Action Alternative would fail to protect human health and the environment because hazardous substances would remain in the basins. In addition, the No Action Alternative would fail to meet commitments made by DOE to the regulators, oversight agencies, stakeholders, and public.

Compliance with Applicable or Relevant and Appropriate Requirements (ARARs). The treatment alternatives (Alternatives 2 through 5) would all meet ARARs. Under these alternatives, basin cleanout activities and sludge treatment would comply with nuclear safety requirements and would be designed to comply with federal and State of Washington air emission standards. Contaminated water would be transferred to a permitted treatment facility. Contaminated debris would be transferred to approved disposal facilities. The sludge would be regulated

Table 1. Summary of Evaluation of Alternatives.

Criterion[1]	Alt. 1: No Action	Alt. 2: Chemical Treatment		Alt. 3: Physical Treatment	Alt. 4: Thermal Treatment		Alt. 5: Solidification
		Baseline	Modified		Vitrification	Calcination	
Overall protection	*	***	***	***	***	***	***
Compliance with ARARs [2]	NA	***	***	***	***	***	***
Long-term effectiveness	*	***	***	***	***	***	***
Reduction in toxicity, mobility, and volume	*	*	*	**	***	**	**
Short-term effectiveness	*	**	**	**	**	**	**
Implementability	*	**	**	*	*	*	*
Cost: CERCLA action[3]	NA	$689 M	$689 M	$689 M	$689 M	$689 M	$689 M
Sludge[4]	NA	$126 M	$116 M	$ 98 M	$122 M	$ 81 M	$ 94 M
Total	NA	$815 M	$805 M	$787 M	$811M	$770 M	$783 M

[1] State and community acceptance were not rated on the star system. They are discussed in the text.
[2] Assumes approval of the TSCA risk-based disposal approval and RCRA treatability variance.
[3] Excludes costs associated with sludge treatment and disposal.
[4] Includes costs to design, construct, and operate a sludge treatment system; and to dispose of the treated sludge. Does not include contingency, escalation, transport to final disposal facility, project management, regulatory support, or decontamination/decommissioning.

Note: * Does not perform well against this criterion or there is significant uncertainty about performance.
** Performs moderately well against this criterion.
*** Performs very well against this criterion.

NA = Not applicable.

as a **mixed waste** because of heavy metals. If the sludge were to be disposed at the national geologic repository, it would require treatment to **immobilize** the metals before it could be disposed. Under the repository alternatives, either the initial treatment in the CERCLA action or future treatment (outside of this CERCLA action) would solidify and thus immobilize the metals as appropriate. The Waste Isolation Pilot Plant does not require immobilization of oxidized metals prior to disposal. The DOE has also requested a treatability variance to allow vitrification and calcination as methods for treating PCBs under the mixed waste requirements. This variance is described further in Appendix D of the Focused Feasibility Study. The sludge treatment system would be designed to meet dangerous waste facility requirements, such as requirements for secondary containment. Sludge treatment would include treatment for PCBs. The DOE has requested that EPA grant a risk-based disposal approval for the PCBs based on treatment and the low risk associated with the PCBs in the sludge. If EPA grants the approval, the sludge will not be regulated under the ***Toxic Substances Control Act*** for PCBs after treatment. Failure to receive the risk-based disposal approval may eliminate options for managing the sludge at double-shell tanks or disposing of the sludge at the repository. Any waste intended for management at Hanford's double-shell tanks, Environmental Restoration Disposal Facility, the Central Waste Complex, Effluent Treatment Facility or any other Hanford facility would be required to meet the waste acceptance criteria for the respective facility.

No waivers from ARARs would be necessary to implement any of the alternatives.

Long-Term Effectiveness. The treatment alternatives (Alternatives 2 through 5) would provide a significantly higher degree of long-term effectiveness than the No Action Alternative. The contaminants associated with the SNF, sludge, water, and debris would be removed from the K Basins and transferred to authorized facilities that are designed to provide safe interim storage and/or disposal and minimize the potential of an environmental release. Removing the water from the basins would eliminate the potential driving force for carrying contaminants to groundwater. After deactivation, the basins would be left in a condition where they would present minimal threat to human health and the environment.

Reduction of Toxicity, Mobility, or Volume Through Treatment. The No Action Alternative would not provide treatment. The other alternatives would all provide treatment of the K Basins water and sludge and, therefore, would be substantially better than the No Action Alternative. In all of the alternatives, the toxicity of the water would be reduced significantly. All of the alternatives would also reduce the toxicity of the sludge by eliminating the reactivity of metals, reducing the generation of hydrogen gas, and treating PCBs.

With respect to sludge, the Thermal Treatment (Vitrification) Alternative would perform best because it also would reduce mobility significantly by immobilizing the contaminants in glass and would reduce volume by 50 percent.

The Physical Treatment, Thermal Treatment (Calcination), and Solidification Alternatives would all perform fairly well, but not as well as vitrification. Solidification would reduce mobility better than physical treatment or calcination, but would increase volume significantly. Calcination would reduce volume by 75 percent, but would not reduce mobility. Physical treatment would not reduce mobility as part of the CERCLA action (mobility would eventually be reduced by processing the sludge with double-shell tank waste) and the volume of sludge requiring interim storage would increase significantly; however, the final volume of glass made from the sludge would only be slightly greater than the original volume.

Neither option under the Chemical Treatment Alternative would perform well against this criterion. Although chemical treatment would reduce toxicity, it would not reduce mobility as part of the CERCLA action (mobility would eventually be reduced significantly by processing the sludge along with existing double-shell tank waste) and both the interim and final volumes of waste would be much greater than the original volume.

Short-Term Effectiveness. All of the treatment alternatives have the potential to affect the public and onsite workers through airborne releases during removal and treatment activities. None of the alternatives are expected to pose significant risks, and air emission treatment systems would be used to minimize impacts.

Workers could also be affected by radiation exposure and industrial hazards during the CERCLA action. The amount of sludge in the treatment system at one time would be about the same for all the alternatives so they would not be expected to have significantly different risks. Engineering controls (such as shielding and remote operations), administrative controls, monitoring, and personal protective equipment would be used to minimize risks to workers.

All of the treatment alternatives (Alternatives 2 through 5) were designed to meet Tri-Party Agreement requirements and have identical schedules. Key dates include:

- Begin removing SNF: November 30, 2000
- Finish removing SNF: December 31, 2003
- Begin sludge removal: July 31, 2004
- Begin water removal and replacement: April 30, 2004
- Finish sludge removal: August 31, 2005
- Finish water removal: October 31, 2006
- Complete removal of SNF, sludge, debris, and water: July 31, 2007.

Implementability. The No Action Alternative is not implementable because it would fail to comply with the K Basins EIS and ROD, Tri-Party Agreement schedules, and commitments made to the regulators, oversight agencies, stakeholders, and public.

None of the treatment alternatives by themselves would perform really well against this criterion for all of the sludge because of technical and/or administrative uncertainties. The options under the Chemical Treatment Alternative would perform better than the others with respect to implementability. Chemical treatment is well established in the nuclear industry and laboratory tests using K Basins sludge have demonstrated that chemical treatment could meet the double-shell tank criteria. However, the Chemical Treatment Alternative would involve about 200 transfers to the double-shell tanks, which could present a problem with keeping pace with sludge removal from the basins. This problem could be solved by interim storage.

Physical treatment would rely on technologies that have not been used for wastes like the K Basins sludge. There is significant uncertainty as to whether grinding/milling alone could meet the double-shell tank waste acceptance criteria for all the sludge and testing would be required. Physical treatment would require very long grinding times if used for the largest particles, which could present a problem with keeping pace with sludge removal from the basins. This problem could be solved by interim storage. In addition, it would be difficult to separate very small particles to allow recycle of larger particles with physical separations processes. Testing would be required to see if these issues could be resolved.

Vitrification, calcination, and solidification are well established in the nuclear industry. However, they have not been tested on K Basins sludge and testing would be required. These alternatives are potentially worse than physical treatment in the long term because of uncertainty about whether the sludge must be disposed at the Waste Isolation Pilot Plant or the national geologic repository. If the sludge has been vitrified or solidified, it would be difficult to rework it to meet different criteria. Calcined particles could be reworked more easily, but this would affect the cost and schedule.

Under all of the treatment alternatives, a treatment system that could treat all of the sludge in a relatively short time (one to two years) would have to be fairly large. It would be difficult to construct such a treatment system and install it in a facility by July 2004. That means it might not be possible to treat all of the sludge right after it is removed from the basins. Interim storage in the 200 Area of untreated or partially treated sludge would likely be required until more extensive treatment capability was available.

Costs. The total estimated cost for the CERCLA action excluding the treatment and disposal of sludge would be $689 million. The cost of sludge treatment and disposal under the treatment alternatives ranges from $81 to 126 million, excluding project management, regulatory support, contingency, and escalation. The total cost of the CERCLA action would be nearly one-half of the total SNF project cost.

State of Washington Acceptance. The State of Washington concurs with the appropriate use of chemical, physical, thermal, or solidification treatment. The State also concurs with removing SNF, sludge, water, and debris from the basins and deactivating the basins.

Community Acceptance. Community acceptance will be evaluated after all public comments on this Proposed Plan have been received.

OTHER NATIONAL ENVIRONMENTAL POLICY ACT VALUES

In accordance with DOE policy and orders, DOE relies on the CERCLA process for environmental review of actions to be taken under CERCLA, and in doing so, takes steps to ensure opportunities for early public involvement and incorporates NEPA values to the extent practicable in DOE documents prepared under CERCLA. The following summarizes NEPA values that supplement those considered elsewhere under the Evaluation of Remedial Alternatives. Criteria used to compare alternatives include potential effects on ecological, cultural, and historical resources; socioeconomic aspects; environmental justice; and identification of irreversible and irretrievable commitment of resources. None of the alternatives would be expected to have a significant impact on ecological, cultural, or historical resources, primarily because the interim remedial action would take place in areas that have already been disturbed and releases would be minimal. The action would not have a significant socioeconomic impact because it would use existing Hanford labor forces and local resources. No environmental justice issues would be expected for Alternatives 2, 3, 4, or 5 because they would not disproportionately affect minority or disadvantaged groups. There would be a relatively small commitment of resources in the form of energy and equipment.

SUMMARY OF PREFERRED ALTERNATIVE

In summary, all of the alternatives except the No Action Alternative would reduce risk to protective levels by removing SNF, sludge, water, and debris from the K Basins, transferring them to environmentally-protective facilities, and deactivating the basins. Sludge would be treated to meet the acceptance criteria and all other applicable requirements at the interim storage and final disposal facilities. No single treatment technology appears to be appropriate for all of the sludge. A hybrid of several treatment technologies appears to offer the greatest opportunity for a simple and cost-effective process that meets the Tri-Party Agreement schedule.

The hybrid system would likely involve physically separating the sludge into different fractions based on characteristics such as particle size and radioactivity. Each fraction eventually would be treated using the technology or technologies that are most appropriate and cost-effective for that fraction. Chemical, physical, or thermal technologies could be used. If a sludge fraction is already close to meeting the double-shell tank criteria or solid waste disposal criteria, it could undergo minimal treatment (such as chemical adjustment, simple grinding, or solidification) shortly after it is removed from the basins. Any sludge fraction that would require more extensive treatment (such as chemical dissolution or thermal treatment) to meet the criteria of a double-shell tank, the Waste Isolation Pilot Plant, or the repository would be placed into interim storage in the 200 Area upon removal from the basins. The public would be involved as appropriate before extensive treatment is undertaken.

The hybrid alternative would perform well against the CERCLA evaluation criteria. Key points include the following:

- The hybrid alternative would provide overall protection of human health and the environment because it would remove hazardous substances from the K Basins and ensure appropriate interim storage and treatment for the sludge.

- Interim storage and all of the treatment technologies that might be used would meet applicable or relevant and appropriate requirements, including the requirement to treat PCBs as part of the risk-based disposal approval and treatability variance.

- The hybrid alternative would be at least as protective in the long term as any of the individual treatment alternatives because it would remove hazardous substances from the K Basins or the Tri-Party Agreement schedule described earlier and transfer them to environmentally-protective facilities.

- Under any combination of technologies, the hybrid alternative would reduce the toxicity and mobility of contaminants. Reduction in volume depends on the technology. Some types of chemical treatment (such as acid dissolution followed by caustic precipitation) would not perform well in reducing volume. However, one of the objectives of the hybrid alternative would be to keep final waste volumes to a minimum. This would be accomplished in part by limiting the amount of sludge that has to undergo acid dissolution.

- The hybrid alternative is at least as effective in the short term as any of the individual treatment alternatives. All interim storage and treatment systems would be provided with appropriate engineering controls and monitoring to ensure that the public, the environment, and workers are protected during the remedial action. The hybrid alternative would meet the same Tri-Party Agreement schedule as the individual treatment alternatives.

- The hybrid alternative would be more implementable than any of the individual alternatives. All of the individual treatment alternatives have significant issues related to the technical feasibility of using a particular technology or process for all of the sludge. The hybrid alternative would solve this by separating the sludge into fractions and treating with the technology or technologies most appropriate for that fraction. There is also significant uncertainty about whether any of the individual alternatives, which require an extensive treatment system, could be in place in time to treat the sludge as it is removed from the basins. This problem would be addressed by placing the sludge into interim storage with treatment sufficient to meet interim storage requirements. The sludge could then be treated to meet final storage and disposal requirements at a later time.

- An important reason for developing the hybrid alternative would be to manage the sludge more cost effectively. All of the individual treatment alternatives are very expensive, mostly because they assume that extensive treatment (and thus a large treatment system) would be required for all of the sludge. By separating the sludge into fractions and only doing treatment appropriate for that fraction, it would be expected that the costs to treat and dispose of the sludge would be reduced.

- The State of Washington concurs with the appropriate use of chemical, physical, thermal, and solidification treatment for treating the K Basins sludge.

Because of the lack of definition regarding the future disposition of the sludge, EPA and DOE commit to providing additional opportunity for public comment per CERCLA before any extensive treatment of the sludge.

EXPLANATION OF CERCLA EVALUATION CRITERIA

1. *Overall Protection of Human Health and the Environment* is the primary objective of the remedial action and addresses whether a remedial action provides adequate overall protection of human health and the environment. This criterion must be met for a remedial alternative to be eligible for consideration.
2. *Compliance with Applicable or Relevant and Appropriate Requirements* addresses whether a remedial action will meet all of the applicable or relevant and appropriate requirements and other federal and State of Washington environmental statutes, or provides grounds for invoking a waiver of the requirements. This criterion must be met for a remedial alternative to be eligible for consideration.
3. *Long-Term Effectiveness and Permanence* refers to the magnitude of residual risk and the ability of a remedial action to maintain long term reliable protection of human health and the environment after remedial goals have been met.
4. *Reduction of Toxicity, Mobility, or Volume Through Treatment* refers to an evaluation of the anticipated performance of the treatment technologies that may be employed in a remedy. Reduction of toxicity, mobility, and/or volume contributes toward overall protectiveness.
5. *Short-Term Effectiveness* refers to evaluation of the speed with which the remedy achieves protection. It also refers to any potential adverse effects on human health and the environment during the construction and implementation phases of a remedial action.
6. *Implementability* refers to the technical and administrative feasibility of a remedial action, including the availability of materials and services needed to implement the selected solution.
7. *Cost* refers to an evaluation of the capital, operation and maintenance, and monitoring costs for each alternative.
8. *State of Washington Acceptance* indicates whether the State of Washington concurs with, opposes, or has no comment on the preferred interim alternative based on review of the focused feasibility study and the proposed plan.
9. *Community Acceptance* assesses the general public response to the Proposed Plan, following a review of the public comments received during the public comment period and open community meetings. The remedial action is selected only after consideration of this criterion.

SUPPORTING DOCUMENTS

The public is encouraged to read the following documents to gain a better understanding of the K Basins Project:

Management of Spent Nuclear Fuel from the K Basins at the Hanford Site, Richland, Washington, DOE/EIS-245F, January 1996.

Record of Decision, Management of Spent Nuclear Fuel From the K Basins at the Hanford Site, Richland, Washington, Federal Register, Volume 61, Number 52, page 10736, March 15, 1996.

Focused Feasibility Study for the K Basins Interim Remedial Action, DOE/RL-98-66, February 1999.

ADMINISTRATIVE RECORD

The Administrative Record can be reviewed at the following location:

Lockheed Martin Services, Inc.
Administrative Record
2440 Stevens Center Place, Room 1101
Richland, Washington 99352
509/376-2530
ATTN: Debbi Isom

POINTS OF CONTACT	INFORMATION REPOSITORIES
U.S. Department of Energy Representative Robert Holt Project Manager P.O. Box 550 MSIN S7-41 Richland, Washington 99352 509/376-9989 U.S. Environmental Protection Agency Representative (Region 10) Larry Gadbois Project Manager 712 Swift Blvd, Suite 5 Richland, Washington 99352 509/376-9884	This Proposed Plan is available for viewing at the following public information repositories: University of Washington, Suzzallo Library Government Publications Room Box 3529000 Seattle, Washington 98195 206/543-4664 ATTN: Eleanor Chase Gonzaga University, Foley Center Tri-Party Information Repository E. 502 Boone Spokane, Washington 99258 509/324-5932 ATTN: Tim Fuhrman Portland State University, Branford Price Millar Library Science and Engineering Floor Tri-Party Information Repository SW Harrison and Park Portland, Oregon 97207-1151 503/725-3690 ATTN: Michael Bowman U.S. DOE Richland Public Reading Room Washington State University, Tri-Cities Consolidated Information Center, Room 101L 2770 University Drive Richland, Washington 99352 509/372-7443 ATTN: Terri Traub

GLOSSARY

The first usage of technical terms and other specialized text in this Proposed Plan is shown in bold in the document and defined below.

Applicable or relevant and appropriate requirements - Cleanup standards, standards of control, and other environmental protection requirements based on federal or state law that address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, or that address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well-suited to the particular site.

Calcination – A process that uses high temperatures to destroy organic contaminants and oxidize metals producing unconsolidated granules or powder.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) – A federal law, also known as "Superfund," that provides a framework to deal with abandoned hazardous materials. CERCLA has jurisdiction over any release or threatened release of any "hazardous substance" to the environment and provides for control and cleanup of hazardous substances to protect human health and the environment.

Cladding – The outer jacket of reactor fuel elements, usually made of aluminum, stainless steel, or zirconium alloy.

Cold Vacuum Drying Facility – A facility under construction in the 100-K Area that will be used to dry SNF to make it safe for interim storage. It might also be used to house the sludge treatment system.

Criticality – An uncontrolled nuclear chain reaction.

Deactivation – Actions taken to place a facility into a radiologically and environmentally safe condition such that it can be decontaminated and decommissioned at a later date.

Debris – Objects such as metal containers, equipment, tools, and structural materials that are no longer needed.

Double-shell tank – One of 28 one-million gallon underground tanks located in the 200 East and 200 West Areas of the Hanford Site. The tanks are double-contained and have leak detection capabilities.

Effluent Treatment Facility – A wastewater liquid treatment facility located in the 200 East Area of the Hanford Site. Liquid radioactive and mixed waste is treated using several technologies to meet discharge standards for disposal to the soil.

Environmental Restoration Disposal Facility – A large landfill located near the 200 West Area of the Hanford Site that is used to dispose of non-liquid radioactive and mixed waste from CERCLA cleanups. The facility meets current radioactive and mixed waste design standards.

Focused feasibility study – An engineering study on a CERCLA site that evaluates a limited number of remedial alternatives for cleaning up contaminants.

Hazardous substances – Chemical substances and radionuclides that may pose a threat to human health or the environment.

Interim remedial action - A remedial action that is taken at a site to address one or more of the contamination problems, but that is not considered a final action for the site. For example, the K Basins interim remedial action addresses cleanout of the basins but does not address soil or groundwater contamination under the basins. (Soil and groundwater are addressed under separate CERCLA actions.)

Immobilize – To treat contaminated material to keep contaminants from being released from the material to the environment.

Mixed waste – Waste that contains both dangerous waste subject to regulation under the State of Washington Hazardous Waste Management law and radioactive material subject to regulation under the Atomic Energy Act. Dangerous waste is waste that, because of its source or characteristics, has been determined by the State of Washington to require controlled management to protect the public and environment. Dangerous waste is subject to land disposal restrictions that require specific treatment prior to land disposal.

National Environmental Policy Act of 1969 (NEPA) - A federal law that requires federal agencies to consider the environmental impacts of their actions.

Proposed plan – A fact sheet that summarizes the remedial alternatives analyzed in the feasibility study and presents the alternatives, including a preferred alternative, for public review and comment.

Record of decision – A public document that records the final decision regarding a proposed action. This term is used in both the CERCLA and NEPA processes. Under CERCLA, a ROD is a public document that records the decision regarding an interim or final action. Under NEPA, a record of decision is a public document that records the decision resulting from an environmental impact statement. In either case, the record of decision is based on information and technical analyses that take into consideration public comments and community concerns.

Sludge – A mixture of very small solid particles and water.

Spent nuclear fuel – Nuclear fuel that has been exposed to a form of radiant energy in a reactor and that is now highly radioactive.

Toxic Substances Control Act (TSCA) – A federal law that controls the manufacture, use, storage, and disposal of certain toxic substances including PCBs.

Transuranic isotopes – Radionuclides with an atomic number greater than uranium and a half-life greater than 20 years.

Tri-Party Agreement – A document with the formal title of *Hanford Federal Facility Agreement and Consent Order* that governs waste management and cleanup at the Hanford Site. The EPA, the Washington State Department of Ecology, and DOE are all signatories to the Tri-Party Agreement.

Vitrification – A process in which waste is mixed with glass formers and melted at high temperatures. The molten material cools to a glass-like solid that immobilizes contaminants.