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K BASIN SPENT FUEL SLUDGE TREATMENT ALTERNATIVES STUDY, VOLUME I - REGULATORY OPTIONS

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DISCLAIMER

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ABSTRACT

Approximately 2100 metric tons of irradiated N Reactor fuel are stored in the KE and KW Basins at the Hanford Site, Richland, Washington. Corrosion of the fuel has led to the formation of sludges, both within the storage canisters and on the basin floors. Concern about the degraded condition of the fuel and the potential for leakage from the basins in proximity to the Columbia River has resulted in DOE's commitment in the Tri-Party Agreement (TPA) to Milestone M-34-00-T08 to remove the fuel and sludges by a December 2002 target date. To support the planning for this expedited removal action, the implications of sludge management under various scenarios are examined. Volume I of this two-volume report describes the regulatory options for managing the sludges, including schedule and cost impacts, and assesses strategies for establishing a preferred path.

EXECUTIVE SUMMARY

The three basic alternatives for K Basin sludge management are based on the classification of the sludge. These classification options are

- Spent nuclear fuel (SNF)
- Mixed (radioactive and hazardous/dangerous) waste
- Radioactive waste (includes transuranic waste).

Evaluating the alternatives leads to the conclusion that both the basin and canister sludges should continue to be managed as SNF while in the K Basins. The canister sludge, which is intimately commingled with the fuel and expected to consist of primarily fuel corrosion products, should continue to be managed as SNF pending completion of the programmatic Environmental Impact Statement (EIS) to establish the disposition of DOE's SNF complex-wide. The basin sludge, which is expected to contain substantial quantities of nonfuel material, should be considered for management as a radioactive or mixed waste after it is removed from the K Basins depending on its characteristics.

This approach is consistent with TPA Milestones M-34-00-T07 and T08, which support encapsulation of the basin sludges without application of Dangerous Waste Regulations. It also enables retrieval activities to be optimized based on expedited removal of all fuel and sludges with minimum worker exposure rather than on regulatory constraints associated with the ultimate classification of specific materials, and avoids potential cost and schedule impacts associated with managing the K Basins as RCRA-regulated units.

Currently, information on sludge characteristics is limited to a few samples of the KE Basin sludge. However, based on differences in the existing conditions in the KE and KW Basins and how the fuel has been stored, it is quite possible that additional information will show that all basin sludges need not be classified and processed in the same manner.

Because the sludge classification is a key factor in selecting a disposition path, process alternatives consistent with all three classification options were evaluated. Alternatives for sludge classified as SNF were limited to those compatible with the Path Forward plan for onsite dry storage of the associated fuel. This included the independent technical assessment (ITA) process for drying sludge collected on cartridge filters, a commercially available dryer, and a commercially available calciner that produce products that can be safely stored in the multi-canister-overpacks with the stabilized fuel. For sludge classified as a radioactive or mixed waste, the final product forms considered (grout or glass/ceramic matrix) were the same. However, the disposition paths evaluated included a range of existing and new facilities and the constraint that mixed wastes must be stored and treated in RCRA-permitted facilities.

The various disposition alternatives were assessed on the basis of cost, schedule, acceptability of the waste form, and technical uncertainties that could impact implementation. The results indicate that acceptable products can be produced by all the processes considered. Cost and schedule were not found to be discriminators for the three SNF processing alternatives (ITA, dryer, and calciner). The preconceptual cost estimates for these alternatives ranged from $44 to $38 million, and all could be implemented by the time sludge was available for processing, after temporary storage with the fuel and prior to stabilization. The calciner was preferred because it was a well-established technology and provided greater process flexibility.

The processes considered for sludge classified as waste included a large-scale melter, a small, dedicated melter, and grout. The small dedicated melter was found to be considerably more expensive than the other two alternatives ($85 versus $24 to $32 million). The large-scale melter [storage and treatment in the Tank Waste Remediation System (TWRS)] was preferred on the basis that it provided the most expeditious path for disposition of basin sludge classified as mixed waste and appears to be comparable or less expensive than disposal as grout. However, further work is needed to confirm the acceptability of disposal in TWRS.

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REGULATORY IMPACTS OF K BASIN SLUDGE DISPOSITION OPTIONS

1.0 INTRODUCTION

1.1 BACKGROUND AND SCOPE

Over 80 percent of the Department of Energy (DOE) owned Spent Nuclear Fuel (SNF) by heavy metal mass is currently in storage at various locations at the Hanford Site in southeastern Washington. Approximately 2100 metric tons of irradiated N Reactor fuel are stored in the KE and KW Basins at the Hanford Site. These basins also contain sludge, a combination of oxidized fuel and cladding pieces (zirconium, uranium and iron oxides, with some canister corrosion product), and concrete grit and materials from the outside environment.[a]

The fuel at the KE Basin is currently stored underwater in open-top canisters. Cladding damage has exposed metallic uranium fuel to the basin water resulting in corrosion of the fuel.[a] Since some of the canisters in the KE Basin have an open-screened bottom, part of the oxidized fuel has migrated to the pool floor to mix with concrete grit, other corrosion products, and materials from the outside environment, forming a sludge.[a] Quantities of fuel and cladding corrosion product in this type of sludge will vary widely, and the quantity of sludge on the floor of KE may increase as the fuel canisters are removed from the basin.

In the KW Basin, the fuel is stored in closed, water-filled canisters and the concrete pool walls are epoxy-sealed. As a result, a minimal amount of sludge has accumulated on the floor of KW. While the water in the closed canisters initially contained a corrosion inhibitor, its effectiveness over the extended storage period is unknown. Because these canisters also contained fuel

(a) WHC. 1994. *N Fuel Dry Storage Technical Evaluation*. Attachment 1 to 9454024, Westinghouse Hanford Company, Richland, Washington.

with damaged cladding, some uranium corrosion products may have accumulated within the canisters.

Both the fuel corrosion products within the canisters and the material on the basin floors are frequently referred to as "sludge." However, from a handling, processing, and composition viewpoint, these two types of materials can be expected to be quite different. As a result, throughout this report these two types of sludge are considered separately. The estimated quantities of K Basin sludges are addressed in Part II, Section 4.0.

Concern about potential leakage from the basins in proximity to the Columbia River has resulted in DOE's commitment in the Tri-Party Agreement (TPA) (Milestone M-34-00-T08) to remove the fuel and sludge by a December 2002 target date (Ecology 1994). The issue of sludge classification as SNF or waste has the potential to impact this expedited removal action.

The scope of this report is to assess the technical and regulatory options for managing the sludges, including schedule and cost impacts, and to present strategies for establishing a preferred path. The information provided is intended to assist WHC project management in developing a recommended sludge management approach.

1.2 SUMMARY OF SLUDGE DISPOSITION OPTIONS

The three disposition options for either basin or canister sludge are shown in Figure 1.2-1 in terms of the sludge classification and the resulting end states. Within each option are a number of alternative pathways that are described in Sections 3.0 through 5.0. Offsite processing alternatives are not addressed in this report.

Under Option I, sludge would be classified as SNF and managed with the fuel in the canisters. In this option, either or both types of sludge would initially be stored in a Staging & Storage Facility that would be constructed to receive

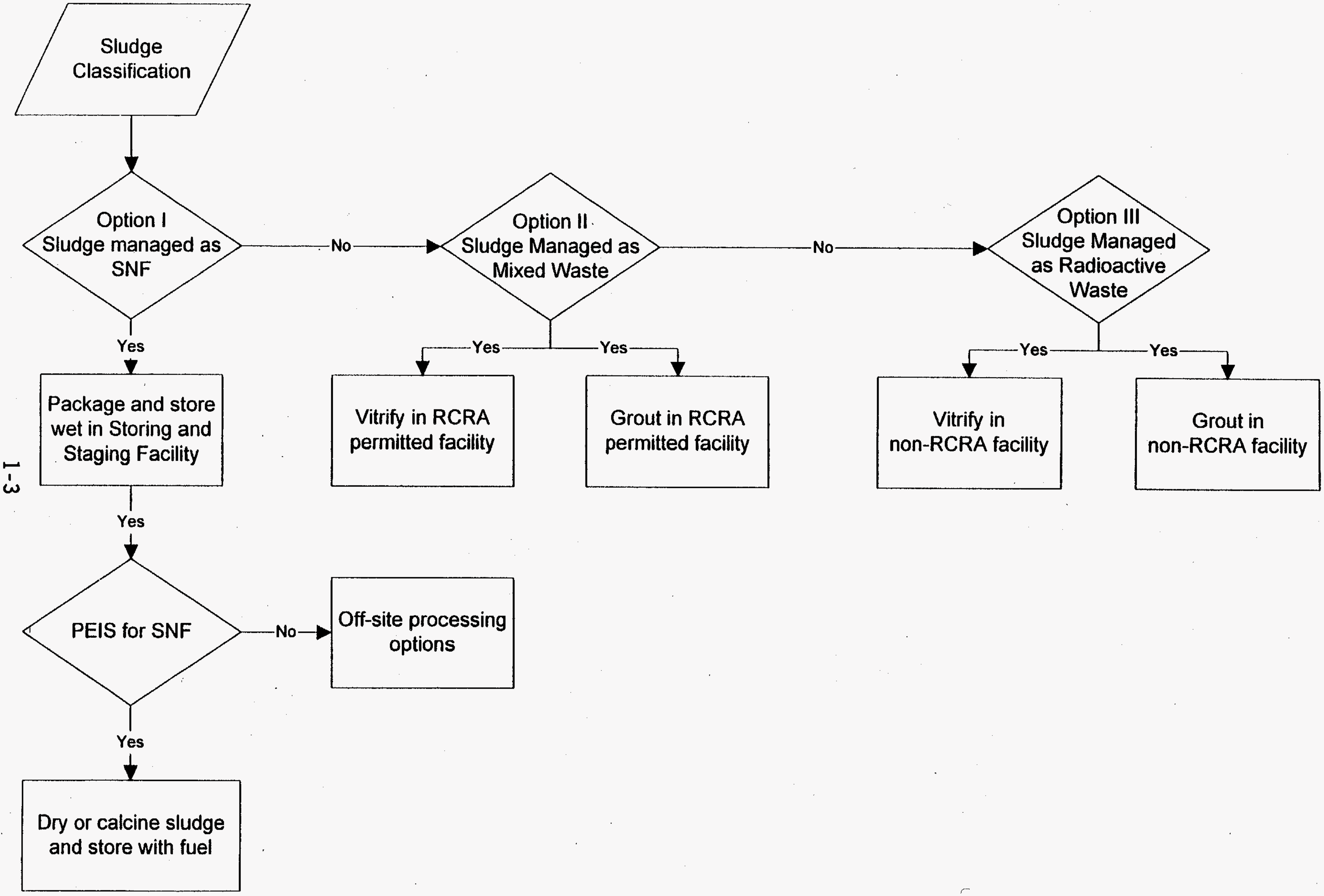

Figure 1.2-1. Sludge Disposition Options

the SNF until transfer to a drying/calcination unit (WHC 1994). Sludge would subsequently be transferred for drying and/or calcination and returned for storage with the fuel pending the outcome of the complex-wide National Environmental Policy Act (NEPA) determination for SNF. The discussion of the regulatory impacts for this option is presented in Section 3.0.

Under Option II, in which the sludge would be classified as a mixed (i.e., hazardous/dangerous and radioactive) waste, several pathways exist. (The term hazardous/dangerous is used in the document to indicate regulation by both EPA and Ecology.) The declaration of the waste status of the sludge could be made immediately or could be delayed until later in the process (i.e., when the sludge is segregated from the fuel and/or removed from the basins). If the sludge were declared a waste immediately, it would be required to be designated under the Washington Dangerous Waste Regulations [Washington Administrative Code (WAC) Chapter 173-303] (Ecology 1991). On the other hand, if the sludge were commingled with the fuel canisters and not accessible for removal until the fuel canisters were removed, classification as a waste could be delayed. The sludge designation procedures could be performed at the time of sludge removal in accordance with the process described in WAC 173-303 (Ecology 1991). Sludge removal would be required to be completed within 90 days of the determination that the sludge was mixed waste (i.e., hazardous/dangerous and radioactive).

Regardless of the path taken under Option II, the sludge would ultimately be required to be managed as regulated mixed waste and be stored and treated in a RCRA-permitted facility. [The term Resource Conservation and Recovery Act (RCRA)-permitted facility is used in this report because of its greater familiarity, although the RCRA-equivalent program is implemented by Washington State, and permits will be issued under the Dangerous Waste Regulations.] From the discussion of regulatory implications in Section 4.0, strategies can be developed for approaches to the pathway selected.

Figure 1.2-2 summarizes the key decisions and resulting pathways for the basin and canister sludges under the options depicted in Figure 1.2-1. The process is based on the assumption that both sludges are managed as SNF while

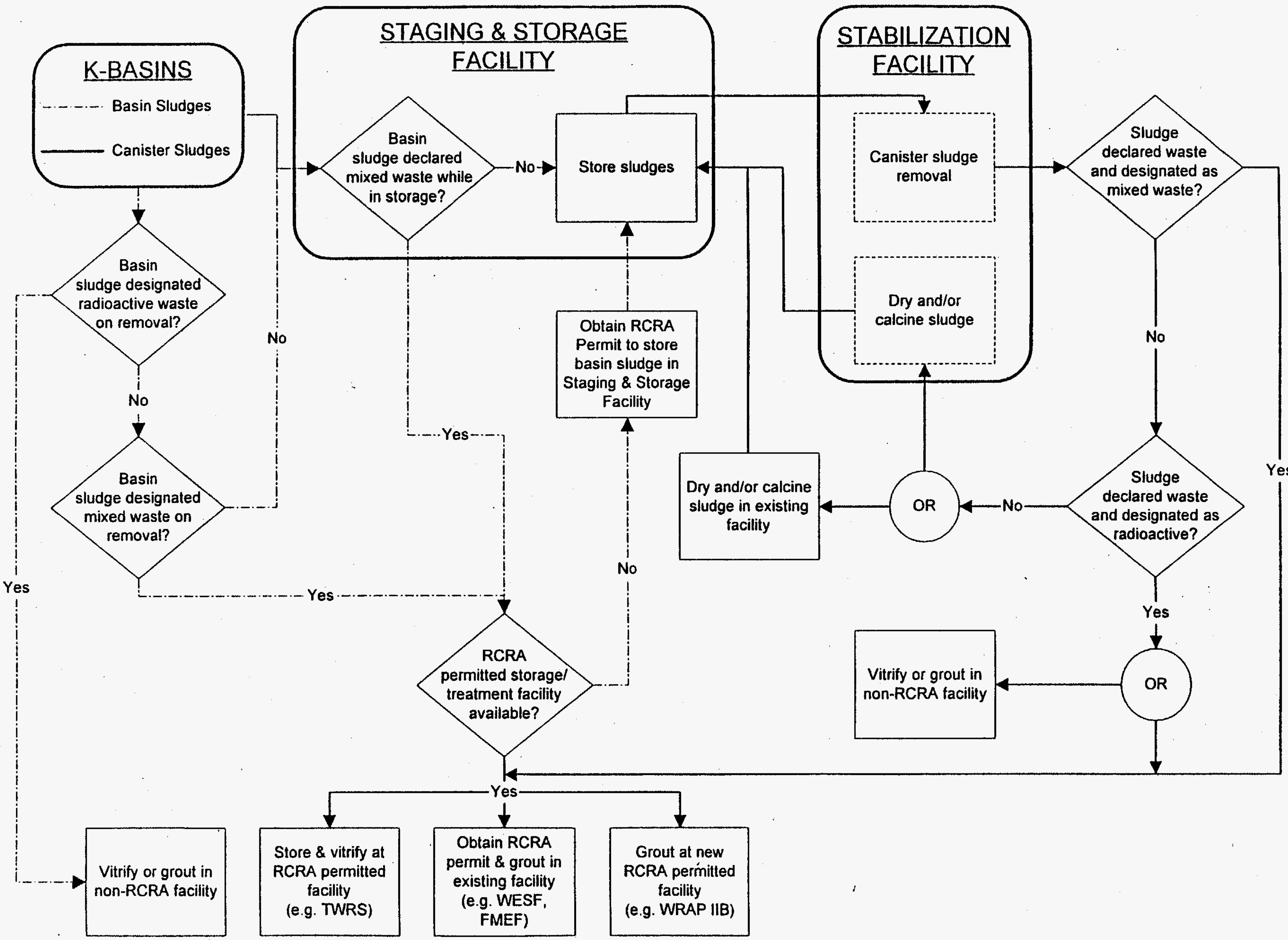

Figure 1.2-2. Sludge Management Pathways

they remain in the K Basins. If either sludge is designated as a mixed waste while in K Basins, the potential pathways become more complex. If the sludge cannot be removed from the basin within 90 days of designation, the basins may be regulated as either interim status surface impoundments or tanks invoking, most significantly, the RCRA closure requirements. The regulatory implications of designating K Basins as RCRA-regulated units may be partially mitigated through negotiated closure milestones that complement other cleanup milestones within the TPA process. After the sludges are removed from the basins, the impact of sludge classification as a mixed waste depends on the availability of RCRA-permitted storage and treatment facilities. If no permitted facility is available for storage of the sludge upon removal from the basins, the Staging & Storage Facility would be subject to the RCRA permit requirements. Because the sludge is planned to be doubly contained in a Staging & Storage Facility, the design requirements for RCRA compliance may not be as onerous as one would suspect. The RCRA permitting process would add to the cost and may impact acquisition plans, but it should not constrain the availability of a Staging & Storage Facility provided that the permitting process is initiated early in the planning process.

If, on the other hand, the basin sludge can be transferred directly to an existing RCRA-permitted storage and treatment facility, the cost of permitting the Staging & Storage Facility need not be incurred. An analysis of the Tank Waste Remediation System (TWRS) waste acceptance criteria for the Double-Shell Tank (DST) System indicates that, with appropriate precautions, the waste sludge may be able to be accepted and stored in a DST until the vitrification treatment process has been permitted (WHC 1988b). This pathway would substantially reduce the cost of sludge storage and treatment.

Under Option III, the sludge would be determined to be a radioactive waste only (i.e., not regulated as mixed waste) and transferred either to an existing facility or a facility that will be designed and constructed to treat the waste for permanent disposal (vitrification or grouting). While the treatment choices provided under this option are the same as those depicted under Option II, the facility that accepts the sludge for treatment would not be required to have a RCRA permit, although a RCRA-permitted facility could be used if desired.

2.0 SLUDGE DESCRIPTION AND RETRIEVAL

2.1 DESCRIPTION OF SLUDGE

Limited analysis has been completed on the KE Basin sludge. As settled sludge, densities ranged from 1.11 g/mL to 1.54 g/mL.[a] The sludge samples appear to consist mostly of hydrated iron oxides, some hydrated aluminum oxides, uranium oxide, and a large quantity of unidentified acid-insoluble matter, possibly sand.[a] Chemical analysis of the samples found high concentrations of iron, some uranium, and small quantities of aluminum, silicon, calcium, magnesium, lead, cadmium, chromium and other metals. These constituents are thought to have resulted from corrosion of basin structural materials and fuel within the canisters, and environmental dust.[a] Trace amounts of cadmium, chromium, and lead are also present in the sludge. Based on the radioactive constituents and current DOE Orders (on radioactive waste management), the sludge probably meets the definition of transuranic waste (TRU). According to depth measurements, the sludge volume in KE Basin and associated pits has been estimated to be 50 m^3.[a] More detailed discussion of the sludge characteristics is provided in Volume II of this report.

The volume of sludge contained in the closed canisters in KW Basin is unknown at the present time. Because a corrosion inhibitor was placed in the closed canisters, the corrosion rate may be an order of magnitude less than that in KE Basin. On the other hand, due to the lack of oxygen in the sealed containers, the corrosion rate could be up to two orders of magnitude greater. Because these uncertainties cannot be reduced without further information, sludge accumulation is conservatively assumed to be equivalent to that in KE, or

(a) Bechtold, D. B. July 27, 1993. *Analysis of 105-KE Basin Sludge Samples.* Memorandum 12110-PCL93-069 to M. A. Meier. Westinghouse Hanford Company, Richland, Washington.

approximately 50 cubic meters.[a] The sludge within the closed containers has not been sampled and analyzed. The sludge is expected to be mostly uranium oxide, other oxides, and fission product nuclides.[a]

2.2 SLUDGE RETRIEVAL

Retrieving and packaging the basin sludge is common to all disposition options. Although the process has not been finalized, retrieval options under investigation use the Best Available Technology (BAT) and are based on the following criteria:

- Maintain criticality control at all times
- Minimize water surface disturbance and sludge dispersion to prevent airborne release of radioactivity.
- Minimize turbidity of pool water for operator efficiency
- Minimize operator dose commitment
- Minimize cost of retrieval and packaging
- Minimize quantity of contaminated solids needing ultimate disposal (waste minimization).

The retrieval process is in the design phase and has not yet been finalized. Therefore, in order to evaluate preferred paths for sludge disposition, some enabling statements are made to provide a link between the retrieval handling and final disposition of the sludge.

- The retrieval process should not preclude any sludge disposal alternatives. In other words, sludge disposal alternatives will not be disregarded simply due to incompatibility with sludge retrieval processes.

(a) Praga, A. N. 1994. *Sludge Management Options Report* (Draft). Westinghouse Hanford Company, Richland, Washington.

- Sludge that remains in the storage canisters during the fuel retrieval operation will be packaged and transported with the fuel. Basin sludges will be packaged and transported separately. This statement defines the separation between sludge in the basins and sludge in the canisters for purposes of evaluating sludge disposition options.

- The sludge will be handled in a "wet" condition, as it is retrieved out of the basins without processing. The sludge will contain a significant amount of water as it is withdrawn from the basin, although the exact moisture content is not currently known. No drying operation will be applied prior to transport of the sludge.

- No chemical modifier will be introduced to the sludge in the retrieval and packaging process, other than is required for transportation and/or acceptance to disposition process. Addition of chemical modifiers will not preclude any treatment alternatives.

2.3 SLUDGE PACKAGING

In the near term, sludge from the discharge chute, the main basin in front of the discharge chute, the tech view pit, and the front of the weasel pit will be pumped to the back of the weasel pit for gravity separation. Subsequent cleaning operations will likely retrieve sludge for direct concentration, transport, and storage. The concentration process may use hydrocyclones, gravity separation tanks, filters or combinations of these techniques. The sludge container selected (if used) will be compatible with the primary containers used for fuel transport and storage. Containers are discussed in greater detail in Volume II of the report.

2.4 REGULATORY IMPLICATIONS OF SLUDGE RETRIEVAL, PACKAGING, AND TRANSPORT

The regulations that pertain to retrieval, packaging, and transportation of the sludge depend on the location, the risk to workers, and the risk to the public. The DOE is responsible for transport solely within the public exclusion areas of the Hanford Site. The requirements of the Nuclear Regulatory Commission (NRC) and the Department of Transportation (DOT) are referenced as standards with respect to DOE transport of the sludge. For implementation of these requirements, Westinghouse Hanford Company (WHC) operates its packaging and transportation activities via a company-controlled manual. The applicable regulations and requirements are listed below and are discussed in greater detail in Volume II of this report.

DOE Order 1540.2	*Hazardous Material Packaging for Transport - Administrative Procedures*
DOE Order 5480.3	*Safety Requirements for Packaging and Transportation of Hazardous Materials, Hazardous Substances, and Hazardous Wastes*
DOE Order 5820.2A	*Radioactive Waste Management*
WHC-CM-2-14	*Hazardous Material Packaging and Shipping.*

3.0 SLUDGE MANAGEMENT AS SPENT NUCLEAR FUEL

3.1 RATIONALE FOR SNF DESIGNATION

DOE has historically accounted for and managed SNF (including failed fuel and associated non-fuel components) as product material for the recovery of source and special nuclear materials in accordance with the Atomic Energy Act (AEA) of 1954 and DOE Orders. On May 1, 1987, DOE issued its by-product rule clarifying applicability of the RCRA to DOE-generated mixed waste. The clarification stated, "The effect of this ruling is that all DOE radioactive waste which is hazardous under RCRA will be subject to regulation under both RCRA and the AEA" (52 FR 15937). As currently stated, this clarification applies only to waste. Thus, if the sludge is not determined to be waste and will be processed with the SNF because it is fuel-like material and commingled with the fuel, then the requirements of the federal RCRA or state equivalent Dangerous Waste Regulations are not invoked.

This approach is consistent with 10 CFR 961.11, which established the conditions for disposal of SNF and high-level radioactive waste from the civilian nuclear power program. While 10 CFR 961.11 does not apply to defense program SNF, the concepts employed for treatment of failed fuel and non-fuel components commingled with the fuel are useful in considering alternatives for management of K Basin sludges.

Under 10 CFR 961.11, failed fuel is accepted for disposal as SNF provided that it is packaged in accordance with applicable transportation regulations and properly classified as failed fuel. Although not specifically addressed, acceptance of failed fuel as SNF implies that any corrosion products present with the failed fuel can also be considered SNF. Appendix E of 10 CFR 961.11 addresses classification of the various types of SNF including non-fuel components that are typically associated with a fuel assembly. The examples provided in Appendix E include a wide variety of non-fuel components that can be classified as standard or non-standard SNF depending on whether special handling is required. Thus, under the regulations governing disposal of SNF in the civilian nuclear program, failed fuel, fuel corrosion products, and associated non-fuel components can be managed as SNF.

The sludge within the canisters in both the KE and KW Basins is expected to be primarily fuel corrosion products, whereas the sludge on the KE Basin floor appears to contain substantial quantities of foreign materials in addition to fuel corrosion products. However, from the standpoint of worker and public safety, the fuel and both types of sludge need to be removed from K Basins as soon as practical and with minimum handling. To this end, the path-forward recommendation (WHC 1994) calls for overpacking the fuel canisters (including their associated sludge), retrieving and packaging the sludge on the basin floors, and shipping both in Multi-Canister Overpacks (MCOs) to a new Staging & Storage Facility away from the Columbia River. However, other alternatives are being considered. The new Staging & Storage Facility, together with the MCO, provide double containment of the SNF during storage. A second new facility would be used to stabilize the fuel for interim dry storage pending a decision on its ultimate disposition.

To achieve early removal of all the fuel and sludge with minimum worker exposure, it will be necessary to maximize the flexibility in retrieving and transporting both the fuel and sludges from K Basins. Most of the sludge outside the fuel canisters in the KE Basin is around and possibly beneath the canisters, which are stored in racks resting on the basin floor. As the fuel canisters are moved for overpacking, it is expected that some of the sludge within the canisters will be dislodged. To minimize worker exposure, it will be necessary to control the suspension of sludge in the basin water and thereby minimize the increase in turbidity and dose rates. Measures to control suspension in water will probably involve a combination of underwater sludge "vacuuming" and optimizing the sequence of activities in the various portions of the basin. To the extent that the classification of the sludges imposes constraints on the nature, timing, or sequence of work activities in the basins, it could delay removal of the fuel and sludge from the basins and/or increase worker exposure.

The process of preparing the fuel for interim dry storage will probably require removal of much of the sludge within the canisters before the fuel can be stabilized. However, this sludge when dried is expected to be chemically the same as the oxidized portions of the fuel after stabilization. Thus, one alternative would be to dry or calcine this sludge and store it with the stabilized fuel as SNF. If this option were selected, it is likely that the sludge collected from the basin floors could also be calcined in the same process and stored with the stabilized fuel.

Managing the fuel and both types of sludge as SNF provides maximum flexibility to ensure expedited removal with minimum worker exposure, is consistent with past DOE practice and the management of SNF in the commercial nuclear program and does not preclude managing separated sludge as a waste at some later point. This approach also minimizes special nuclear material (SNM) accountability issues during the expedited removal phase, because all the SNM present in K Basins would be moved to a single new location.

3.2 TREATMENT OPTIONS

The two treatment options considered for sludge classified as SNF are drying and calcination. Both processes produce a dry solid, but calcination will produce a lower-moisture-content product. The preferred path is dependent on the technical requirements for final moisture content of the product as determined by long-term storage requirements. Moisture content must be low enough to minimize radiolysis of the residual water and the associated gas generation within the storage canisters. Treatment of the SNF sludge may be performed either in existing facilities on the Hanford Site, such as the Waste Encapsulation and Storage Facility (WESF) and the Fuels and Materials Examination Facility (FMEF), or in a new facility such as the Stabilization Facility as depicted in Figure 1.2-2.

3.2.1 Treatment by Drying

Dried sludge, with proper packaging, may be adequate to ensure safe long-term storage and does not preclude any options that may be considered in the ongoing NEPA process examining options for SNF complex-wide. A technical description of the drying process is provided in Volume II.

DOE has no requirements specific to treatment technologies such as drying; however, any such technology is bounded by the DOE requirements pertaining to personnel health and safety, facility safety, environmental protection, and permitting requirements. DOE Order 5820.2A, *Radioactive Waste Management*, provides general requirements for handling the Department's radioactive materials and mixed wastes. The pertinent sections of DOE Order 5820.2A are Chapters I through III (*High-Level Waste*, *Management of Transuranic Waste*, and *Management of Low-Level Waste*). Attachment 1 of DOE Order 5820.2A provides a comprehensive reference listing of the health and safety and environmental protection requirements and includes references on waste acceptance criteria at some DOE facilities.

If the drying process results in new or increased air emissions or increased ambient air concentrations of contaminants for which the EPA and Washington have emission standards, a new source review must be conducted by Ecology. Prior to construction of the emissions source, the facility would be required to submit a notice of construction (NOC) to Ecology or the local air pollution control authority. NOC approval is contingent on a determination that the source will be operated in accordance with all applicable federal and state regulations. These regulations include General Regulations for Air Pollution (WAC 173-400), Standards for Performance of New Stationary Sources (40 CFR 60 and WAC 173-460), the National Emission Standards for Hazardous Air Pollutants (NESHAPS) (40 CFR 61), and Ambient Air Quality Standards (WAC 173-470). All sources that emit an air pollutant for which a NESHAP has been promulgated (radionuclides have promulgated NESHAPs) must be registered with Ecology or the local air pollution control authority. It may also be necessary to obtain an operating permit or modify an existing operating permit for drying the sludge, if the emission is designated as a "major stationary source." The amount of allowable emissions, the pollutants discharged, the source type, and the surrounding air quality level are evaluated to determine whether the emission is a major source. The air emission permitting requirements are estimated to cost $200,000 and require up to 18 months of permit development. The permit development process can be performed concurrent with design. Construction of the source cannot proceed until the NOC has been approved.

Any waste water that is generated as a result of the drying process would be regulated by either the National Pollutant Discharge Elimination System for discharges to a surface water body (40 CFR 122) or the State Waste Discharge Permit System for discharges to the ground (WAC 173-216). Both of these permitting systems require submittal of an application including an analysis of the waste water constituents, proposed treatment processes, an engineering report demonstrating attainment of the state technology-based standard, and plans and specifications (WAC 173-240). These submittals must be provided to Ecology and approved prior to construction. The cost of obtaining a waste water discharge permit is estimated at approximately $150,000 and could require up to 24 months.

A more cost-effective alternative could be to transfer the waste water to an existing processing unit with the required permit. This alternative would require a permit modification submitted to and approved by Ecology. The Effluent Treatment Facility (ETF) in the 200 Area has submitted a state waste discharge permit application under WAC 173-216. The ETF may be able to accept the waste depending on the waste constituents or may route the waste water through the 242-A Evaporator prior to treatment at the ETF. The Ecology permit modification process is estimated to require approximately six months and cost $50,000. The permit modification may require a demonstration that the ETF provide the state technology-based standard for this specific waste stream.

3.2.2 Treatment by Calcining

The production of a calcine may be required for long-term storage of SNF sludge if drying alone cannot achieve a low enough residual water content or if passivation is required to reduce the potential for rapid oxidation of the dried product. As with drying, calcining does not preclude any alternatives that may be considered in the ongoing NEPA process examining options for SNF complex-wide. Further, calcination would be regulated by the same set of air and waste water pollution control regulations and DOE Orders as the drying process.

3.2.3 Regulatory Driven Cost and Schedule Impacts

The cost and schedule impacts attributable to regulatory requirements for managing either or both sludges as SNF are largely independent of the treatment technology or the facility selected for the range of options considered. As shown in Figure 1.2-2, sludges managed as SNF would initially be stored in the Staging & Storage Facility. They would subsequently be dried or calcined in the new Stabilization Facility or in an existing Hanford facility and returned to the Staging & Storage Facility for storage with the passivated fuel. During both the wet and dry storage phases, the regulatory and permitting requirements for storage of the fuel are expected to be equal or more stringent than those for the sludges. If the sludge is dried or calcined in the new Stabilization Facility, the nature and magnitude of effluents from this facility should not be significantly altered. This observation is based on the fact that processing the sludge in the Stabilization Facility will increase the number of MCOs to be de-watered by ~10% and the water removed from the containers is the same (i.e., contaminated K Basin water). In addition, the fuel drying and passivation process is expected to operate under similar conditions as sludge drying and calcining, leading to similar gaseous effluents.

The regulatory impacts of drying or calcining the sludge in an existing facility depend on the facility selected and the status of its air and waste water permits. Assuming the facility selected can comply with the applicable DOE orders, the worst case, as discussed in Section 2.3.1, would be

- Up to an 18-month constraint on construction plus $200,000 for a new or modified air emission permit.
- A 6- to 24-month constraint on operation plus $50,000 to $150,000 for a modified or new liquid effluent permit.

Because the permitting costs for the new Stabilization Facility will be the same with or without sludge processing, using an existing facility to process the sludge could result in additional permitting costs. However, permitting requirements are unlikely to constrain the processing schedule for sludge managed as SNF under either option since there is ample time (at least four years) before sludge could be available for processing based on the Path Forward schedule (WHC 1994).

3.3 DECISION PATHWAYS

The previous sections addressed managing the sludges as SNF from retrieval through drying or calcining and interim storage. If the treated sludge continues to be classified as SNF, geologic disposal would be managed by the Office of Civilian Radioactive Waste Management under requirements of the Nuclear Waste Policy Act of 1982. However, any sludge separated from the SNF and determined to be "a discarded material" may be classified as a waste potentially subject to the requirements of the Dangerous Waste Regulations. The drying and calcination processes considered for managing sludge as SNF will not treat the hazardous constituents. In fact, these processes will likely concentrate the metals. Thus any sludge declared a hazardous/dangerous waste would need to be stored and treated in a RCRA-permitted facility.

The impact of changes in classification depend on which sludge is to be managed as waste, whether it is classified as a mixed (hazardous/dangerous and radioactive) or radioactive waste, and the point at which the status of the sludge is changed. The first decision relates to sludges that are collected in a separate location (bay) in the basins or in separate containers during the fuel canister overpacking operation. This includes the sludge on the basin floor and any loose sludge collected from open canisters prior to or during the overpacking. The impacts of classifying this sludge as waste while it is still in the K Basins are discussed in Section 4.0.

The other potential points for reclassification depicted in Figure 1.2-2 are after the basin sludge is removed, while it is being stored as SNF in the Staging & Storage Facility, and when the canister sludge is separated from the fuel in preparation for passivating the fuel. In all cases, the pathways for disposition of the sludge as a waste are the same. Once the sludge has been removed from the basins, the impacts of reclassification depend primarily on whether it is a mixed or radioactive waste and the availability of appropriate facilities as discussed in Sections 4.0 and 5.0.

A study is needed to determine the availability of a RCRA-permitted storage facility at the time of sludge removal. This section assumes that a RCRA-permitted storage facility will exist on the Hanford Site and will be able to accept the wet, dried, or calcined sludge by the time it is available. The facility selected may need to amend its Part B Permit Application to include this new waste stream. The facility's storage procedures, waste acceptance criteria, waste analysis plan, contingency plan, and training plan may also be required to be revised to provide provisions for the acceptance of a new waste. The alternative depicted in Figure 1.2-2 is to obtain a RCRA permit for the Staging & Storage Facility.

In addition, tracking of the waste would be required from the point of generation through a RCRA-permitted treatment facility that can process the waste and meet the Land Disposal Restriction (LDR) standards. Once treatment has succeeded in meeting the LDR standards, the waste can be disposed.

4.0 SLUDGE MANAGEMENT AS MIXED WASTE

4.1 RATIONALE FOR WASTE DETERMINATION

As discussed in Section 3.0, DOE has managed SNF as product material for the recovery of source and special nuclear materials in accordance with the Atomic Energy Act (AEA) of 1954 and applicable DOE Orders. However, on May 1, 1987, DOE issued its byproduct rule clarifying applicability of RCRA to DOE-generated mixed waste. The clarification stated, "The effect of this ruling is that all DOE radioactive *waste* which is hazardous under RCRA will be subject to regulation under both RCRA and the AEA" (52 FR 15937) (italics added for emphasis). EPA has not considered asserting RCRA authority over SNF until DOE identifies those categories of SNF that have the potential for processing and those that may be determined to be waste.[a] Thus, if the sludge is determined to be a waste, applicable RCRA or Washington-equivalent regulations would need to be implemented.

Probable applicability of Washington's RCRA-equivalent regulations to the K Basin sludge has a three-part rationale. First, the Washington State legislation (Revised Code of Washington Chapter 70.95) and the Dangerous Waste Regulations (Chapter 173-303 WAC) do not provide an equivalent exemption to Section 1004(27) of RCRA (i.e., exclusion of source, special nuclear and by-product materials from the definition of solid waste). Second, the definition of solid waste includes "any material that is abandoned or recycled" (WAC 173-303-016). Ecology may determine that the sludge is abandoned because it has been "accumulated or stored in lieu of being abandoned by being disposed of" (WAC 173-303-016). Third, the KE Basin sludge is not integrally bound with the SNF; rather, it has accumulated on the basin floor and in adjacent pits. If one assumes a strict regulatory interpretation, Ecology could determine that the sludge has been a waste since the commencement of storage in the basins. In

(a) WHC. 1994. *Issue Paper on the Application of the Resource Conservation and Recovery Act to Spent Nuclear Fuel*. Attachment 1 to 9453737, Westinghouse Hanford Company, Richland, Washington.

summary, the probability appears to be high that some of the sludge, if not SNF, could be classified as a "solid waste" and potentially subject to the Dangerous Waste Regulations. Sludge that is subject to the Dangerous Waste Regulations and is radioactive is termed mixed waste.

Classification of sludge as a waste may be delayed until the fuel canisters are removed based on the need for accountability. If the sludge is maintained with the fuel, accountability can be more easily ensured. A second justification for this delay can be provided because the storage racks that support the canisters are designated Safety Class 1 equipment. The racks prevent movement of the fuel during seismic events and preserve the spacing requirements for criticality control. The racks are welded as one piece throughout the Basin and are freestanding on the floor and next to the basin walls. In order to retrieve the sludge on the Basin floor, it may be necessary to remove the racks from the basin.[a] In addition, the process of retrieving and overpacking the fuel canisters in KE will undoubtedly release additional sludge to the basin.

Because the sludge may be considered to be commingled with the SNF until the racks are removed, schedule constraints may call for integration of sludge removal with fuel canister removal, e.g., final sludge retrieval would occur as fuel removal is reaching completion. If this were the case, then the sludge could be determined to be a waste and designated through the characterization procedure after the racks and canisters were removed.

4.2 SLUDGE DESIGNATION AND CHARACTERIZATION

If the sludge is determined to be a solid waste, the generator is responsible for designating the waste. Designation is the process of determining whether or not the Dangerous Waste Regulations are applicable to the waste.

(a) Bechtold, D. B. July 27, 1993. *Analysis of 105-KE Basin Sludge Samples*. Memorandum 12110-PCL93-069 to M. A. Meier. Westinghouse Hanford Company, Richland, Washington.

Designation may be accomplished by 1) analytical determination or 2) knowledge of the specific process that generated the waste.

The remainder of the discussion in this section assumes that the sludge would be designated as dangerous and would be regulated as mixed waste. This assumption has two rational bases: First, an analysis of the sludge constituents[a] indicates the waste would designate as a dangerous waste on the basis of exceedance of the Toxicity Characteristic Leaching Procedure (TCLP) thresholds. Using the 20-to-1 ratio established by the TCLP procedure, the dry weight concentrations of lead, cadmium, and chromium would exceed the regulatory thresholds in more than one sample of sludge. Second, should the sludge be determined not to exceed regulatory thresholds, it would be classified as a radioactive solid waste.

A generator is not required to use process knowledge to designate the waste and may opt to sample and analyze the sludge for designation purposes. Such analyses should include not only the analyses required for hazardous/ dangerous waste designation but also any analyses required for acceptance at a treatment facility. A list of the analyses required for designation and for potential acceptance at the DST Tank Farm System is provided in Table 4.3-1 (WHC 1991).

If the sludge is determined not to be a mixed waste, it can be treated as a solid waste and is not subject to the requirements of WAC 173-303. Section 5.0 describes regulatory implications for sludge management as a radioactive waste.

(a) Bechtold, D. B. July 27, 1993. *Analysis of 105-KE Basin Sludge Samples*. (Memorandum 12110-PCL93-069 to M. A. Meier. Westinghouse Hanford Company, Richland, Washington.

Table 4.3-1. Analytical Parameter List for Designation and Waste Acceptance (WHC 1991)

Parameter	SW-846 or Other Methods
Metals	
ICP Metals (Ba, Cd, Cr, Pb, Ag)	6010
As	7060
Hg	7470
Se	7740
TCLP Metals (As, Ba, Cr, Pb, Hg, Se, Ag)	Extraction 1311 followed by above listed method
Inorganic Analyses	
NO_2	300.0
NO_3	300.0
OH	9040
pH	9040
Total Pu	
Differential Scanning Calorimeter	
Organic Analyses	
Total Organic Carbon	9060
Volatile Organic Analyses	8240
Other Analyses	
Toxicity	WAC 173-303-110(3)(b) or WAC 173-303-100(5)

4.3 INTERIM STORAGE IN K BASINS

If the sludge in the K Basins is designated as a mixed waste and is to remain stored for more than 90 days, a treatment, storage, and/or disposal (TSD) RCRA Permit is required in accordance with WAC 173-303 until the sludge is removed. The TWRS currently has interim status for the DST System that will allow the storage of the mixed waste sludge if the mixed waste meets the TWRS Dangerous Waste Acceptance Criteria (WHC 1991). (A RCRA Part B Permit Application for the DST System is currently being processed by Ecology and EPA and is scheduled to be incorporated into the Hanford Facility Permit in 1999.) A comparison of the TWRS acceptance criteria for the DST System and the current data available on the mixed waste sludge does not indicate that the mixed waste sludge exceeds the boundaries of the TWRS acceptance criteria. However, based on the TWRS acceptance criteria, the radiological exposure would need to be controlled by blending. These issues need to be further investigated before the mixed waste sludge is transferred to the DST System. Once the mixed waste sludge has been designated, the DST System Part A will need to be reviewed and revised. Based on the preliminary dangerous waste constituents within the mixed waste sludge, the DST System Part A may not require a revision before the mixed waste sludge is accepted.

If the DST System Part A revision is required to allow the mixed waste sludge to be stored in the DST System, the revision process could cost approximately $5,000 and would require a minimum of four months to be submitted to Ecology and EPA. A revision to the DST System Part B would be required and could delay the submittal of the DST System Part B into the Hanford Facility Permit. If the DST System Part B has been incorporated into the Hanford Facility before this revision, then a permit modification and Ecology approval will be required before the mixed waste sludge can be transferred to the DST System. The addition of the mixed waste sludge to the DST System could cost from $10,000 to $100,000, depending on where the DST System Part B is in the permitting process.

If storage of sludge that is designated as a mixed waste exceeds the 90-day limit in K Basins, the Basins will be subject to the WAC 173-303 requirements for storage in surface impoundments. Current Ecology thinking would consider the sludge as having been stored for a period of time substantially longer than 90 days, i.e., the start of sludge accumulation would be the date that sludge began to be generated. Because sludge storage began prior to November 19, 1980, the Dangerous Waste Interim Status Standards would be applicable. Compliance with these regulations would require amendment to the Hanford Part A Notification and compliance with the interim status standards for surface impoundments or tanks but would not require the development of a RCRA Part B Permit Application. The status of the basins as either tanks or surface impoundments will need to be negotiated with Ecology. A permitting plan will be required to establish the regulatory requirements for the storage of mixed waste sludge in the K Basins. The permitting plan will need to be developed by December 1996 to achieve the TPA M-34-00-T08 Milestones.

Interim status compliance with surface impoundment regulations may require installation of a liner and leachate collection/detection system beneath the basins, installation of groundwater monitoring wells around the basins, and implementation of a quarterly groundwater monitoring program. Interim status regulations for either type of unit would also require the development of contingency, personnel training, and waste analysis plans, and implementation of inspections and maintenance of an operating record. While these plans do not require Ecology approval, they would need to be maintained at K Basins.

Most noteworthy of the interim status standards are the closure and post-closure requirements. Closure plans must be submitted to Ecology at least 180 days prior to the commencement of closure of the basins and must be approved by Ecology. Because at least one of the basins has had demonstrated releases to the environment, the basins may be subject to the landfill closure regulations (i.e., closure of waste or waste constituents in place, post-closure monitoring of the groundwater, and potential subsequent corrective action should the groundwater contamination be demonstrated). Alternatively, closure of the basins could include removal of the basins and any underlying soils that have become contaminated. Groundwater remediation could be proposed as part of a larger groundwater remediation effort.

The requirement for a liner and leachate collection/detection system cannot be technically implemented. Therefore, near-term compliance in not achievable. Negotiation via the TPA process may provide a mechanism to achieve sludge designation as waste or mixed waste concurrent with or immediately following fuel removal. A negotiating position that allows sludge to be classified as waste upon removal and that provides for compliance with limited number of interim status surface impoundment or tank requirements for K Basins may be viewed as reasonable provided that closure is achieved by newly established TPA Milestones (M-34-00-T08). Interim status requirements with which Ecology is likely to desire compliance include written plans such as the contingency, personnel training, and waste analysis plans, installation and implementation of a groundwater monitoring system, and closure and post-closure plan submittal. Because the interim status requirements are relatively costly, and because the sludge is awaiting removal, this option should be investigated if the sludge is classified as waste.

4.4 STAGING AND STORAGE FACILITY

If the mixed waste sludge is stored in the Staging & Storage Facility for an interim period of time, the facility will be required to obtain a RCRA permit for storage prior to acceptance of the sludge. Unlike the storage permit for K Basins, this permit is a final status permit requiring the facility to be sited under the siting criteria (WAC 173-303-282). To obtain a RCRA permit, a storage facility must comply with the secondary containment requirements for storage in either containers or tanks. Many of the containment requirements under the Dangerous Waste Regulations can be met by the NRC licensing requirements. However, since the acquisition strategy is to use established NRC-licensed spent fuel storage technologies from the commercial nuclear industry to the maximum extent practical, the cost and schedule impacts of superimposing RCRA requirements need to be evaluated further.

The RCRA Part B Permit Application would also require development of plans (e.g., contingency, personnel training, and waste analysis plans), performance of inspections and maintenance, and maintenance of an operating record and other records. The cost of developing a RCRA Part B Permit Application is approximately $200,000 and requires 16 to 24 months. The permit application development can be performed concurrently with construction of the facility; however, the facility cannot accept waste until the permit has been issued.

4.5 TREATMENT OPTIONS

Grouting and vitrification are assumed to be the only treatment options if the sludge is classified as waste and designated as a mixed waste as shown in Figures 1.2-1 and 1.2-2. If the sludge were designated as a mixed waste, the treatment facility would be subject to WAC 173-303 and would require a RCRA permit for a treatment unit. The cost of obtaining a RCRA permit for a new facility is approximately $200,000 and could be expedited in two years.

4.5.1 Grouting

Grouting is considered in this report as a typical immobilization process. Other immobilization processes, while not considered in this report, may be available (e.g., polyethylene immobilization). For the purposes of this report, the grouting process is assumed to be performed so that the grout can be cured in small containers (such as 55-gallon containers). Sludge could be immobilized with a grout formulation estimated at approximately 3.25 kg of grout added for each kilogram of dry sludge, creating a total of 420 MT of treated sludge. A detailed description of the grout treatment process is provided in Volume II.

Two onsite facilities (WESF and FMEF) are possible locations for the grouting process. Although compliance with the RCRA permit requirements may require building modifications, the grout equipment could be installed in these facilities. The waste acceptance criteria developed for grouting in either of these facilities could include the sludge. Another potential location for a grouting facility is the Waste Receiving and Processing (WRAP) facility (IIB). WRAP IIB is currently in the conceptual design phase. The full scope of the facility has not yet been defined but it is assumed to manage remote-handled mixed waste. Waste acceptance criteria for WRAP IIB could be developed to accept the sludge.

The grouting process at WRAP IIB, WESF, FMEF, or elsewhere would be subject to the Dangerous Waste Regulations. Thus, any of these facilities would be required to be designed and constructed or modified in accordance with the requirements including development of a Part B Permit Application. Because WRAP IIB is currently in the conceptual phases and will accept a variety of waste streams, the incremental cost of permit application development and compliance need not be assessed as a cost of managing K Basin sludge.

Any grouting treatment facility will be required to comply with DOE Orders and emissions and discharge permitting requirements. The DOE Orders do not apply to specific treatment technologies. DOE Orders applicable to the management and handling of the sludge are discussed in Section 3.2.1.

If the grouting process is conducted in a facility such that the process has the potential to result in new or increased air emissions or increased ambient air concentrations of contaminants, the air permitting process, costs, and schedules would be similar to those described and estimated in Section 3.2.1 ($200,000 and up to 18 months to obtain the necessary permits). The permit process can be performed concurrently with design, although construction of the source cannot proceed until the NOC has been approved.

Any water associated with the sludge is assumed to be incorporated into the grout mixture to meet the water requirements of the process. Therefore, only a small amount of waste water is anticipated to be generated from grout processing. If this assumption is correct, delivery of any waste water to the ETF would be the recommended pathway. This action would require a permit modification for the ETF with associated cost and schedule implications discussed in Section 3.2.2 (approximately six months and $50,000).

4.5.2 Vitrification

The vitrification process can also be used to stabilize the sludge if it is designated as a mixed waste. The process entails formulation of a glass block by heating the sludge and silica to the molten state. The waste loading ratio (i.e., the ratio of sludge to glass formers) ranges from 3.5 to 80%, depending on the chemistry of the sludge. Assuming a 25% waste loading, 130 MT of sludge would produce 320 MT of vitrified glass. A technical description of the vitrification process is provided in Volume II.

Vitrification of sludge considered to be mixed waste would be subject to the Dangerous Waste Regulations. Volume II addresses two vitrification options, a small dedicated melter and the high-level waste vitrification plant planned for TWRS. Both options would need to comply with the applicable DOE Orders and be subject to gaseous and liquid effluent permitting requirements discussed in Section 3.2.1.

4.5.3 Regulatory-Driven Cost and Schedule Impacts

The impacts of the air emissions and waste water regulations as discussed in Section 3.2.1 are determined by the sludge processing technology and the facility selected, not the classification of sludge as SNF or waste. Further, because new or modified effluent permits are likely to be required for all of the sludge processing options considered, the cost and schedule impacts associated with obtaining the necessary effluent permits would be similar. Thus the primary impacts of classifying the sludge as a dangerous waste are associated with RCRA compliance. The largest potential impacts would result from classifying the sludge as a mixed waste while it is still in the K Basins. The impacts on the other storage and treatment facilities depicted in Figure 1.2-2 include the following:

- Facility siting per WAC 173-303-282
- Facility design and operation in accordance with the Dangerous Waste Regulations
- A 16- to 24-month constraint on the start of operation plus $200,000 to obtain a RCRA Part B Permit

- Characterizing and tracking the waste from the point of generation through storage, treatment, and disposal.

Managing the sludges as SNF under current DOE Orders or NRC regulations also involves constraints on facility siting, design, authorization to begin operation and material tracking. Further, the key facility design features such as containment and effluent treatment are likely to be similar for either case. Thus the issue becomes establishing which regulations and approval processes are to be applied early in the planning process to avoid delays in facility siting and design.

The regulatory impacts of classifying the basin sludge as a mixed waste after it is out of K Basins should be minimal provided that a RCRA-permitted storage facility such as the DST System at TWRS is available to receive the sludge. If not, the alternative of obtaining a RCRA Part B Permit for the Staging & Storage Facility should be evaluated.

Under the Path Forward recommendation (WHC 1994), the canister sludge remains commingled with the fuel until completion of the NEPA process for disposition of DOE's SNF complex-wide. If the results of this NEPA action support interim dry storage of the N-Reactor fuel as SNF, it is reasonable to assume that the canister sludge would be stored with the fuel as SNF, because after drying or calcining it would be essentially the same as the oxidized portions of the passivated fuel. The alternative, classifying the separated canister sludge as mixed waste, is shown in Figure 1.2-2. While not considered a likely path, the regulatory impacts should not be great provided a RCRA-permitted facility such as the DST System at TWRS can receive the waste.

4.6 WASTE MANAGEMENT FOLLOWING TREATMENT

Treatment by grouting may cause chemical alteration of the waste that would be adequate to either render the waste nonhazardous or reduce the concentrations of hazardous constituents to less than the Land Disposal Restriction (LDR) standards under 40 CFR 268 (EPA 1989). The grouting process requires grout to be added to the sludge, which may contribute hydroxide ions to the matrix of the sludge. The resulting mixture may thus possess adequate buffering capacity to prevent the metals in the sludge from leaching during the TCLP analysis. If the metals are adequately chemically neutralized and will not leach, the treated waste would be rendered non-dangerous and no longer regulated by WAC 173-303. However, the regulations would require a demonstration that the treated sludge/grout mixture does not exceed the regulatory threshold. The addition of 3.25 kg of grout per kilogram of sludge would also result in an increase in the waste volume.

The vitrification process may not necessarily stabilize the metals adequately to prevent them from leaching in a sample that has been crushed as required by the TCLP process. However, current EPA policy thinking is that waste vitrification may provide adequate assurance that hazardous constituents will not leach from the vitrified logs to the environment and therefore will not present a substantial risk to human health. Based on this thinking, the vitrified sludge may not be required to be disposed of in a RCRA-permitted facility. Should the vitrified waste exhibit the characteristics of hazardous/dangerous waste, the DOE could petition EPA for a variance to exclude the treated waste on the basis that it will not adversely impact human health or the environment. Once the treated waste is determined to meet the LDR standards, the waste can be land-disposed.

5.0 SLUDGE MANAGEMENT AS RADIOACTIVE WASTE

5.1 RATIONALE FOR SLUDGE MANAGEMENT AS RADIOACTIVE WASTE

If the sludge does not exceed the regulatory levels in the Dangerous Waste Regulations, it will be considered a solid waste not subject to the dangerous waste management requirements of WAC 173-303. In the case of K Basin sludge, the solid waste would be classified as a radioactive waste. Option III appears to be a viable pathway only if the sludge does not exceed the TCLP or other dangerous waste regulatory levels.

A discussion of a similar waste originating as N Basin sediment indicated that the constituents of a sludge/inert product would not designate the waste as a mixed waste (WHC 1988a). However, prior to this evaluation, the study considered adding gypsum to enhance the settling characteristics of the sludge for processing. Addition of a five-fold excess volume (ten-fold excess mass) of inert gypsum would likely reduce the concentration of the dangerous constituents in the K Basin sludge. However, adding gypsum does not meet the waste minimization objectives of the sludge disposal. The addition of gypsum could be interpreted as either dilution, a violation of the Dangerous Waste Regulations, or as in-situ treatment of the mixed waste sludge. Thus the only viable pathway to reach Option III appears to be a TCLP analysis of the sludge indicating that the sludge does not exceed the thresholds.

5.2 DECISION PATHWAYS AND REGULATORY IMPLICATIONS

The treatment options for radioactive waste parallel the options provided for mixed waste (Figure 1.2-1). The treatment processes are described briefly in Section 4.0 and in detail in Volume II of this report. The DOE, air emissions, and waste water discharge regulatory requirements applicable to treatment of radioactive waste are the same as for treatment of the sludge as a mixed waste. These requirements are presented in Section 3.2.1 and are not repeated here. The substantive difference between radioactive waste management and mixed waste management is that the Dangerous Waste Regulations do not apply to treatment, storage, and final disposal of the sludge. Thus, no costs would be incurred for RCRA permitting of storage or treatment facilities. If the sludge is determined to be a radioactive waste, the K Basins would not be subject to the RCRA interim status requirements. The DST System at TWRS may be able to accept this radioactive sludge; however, radioactive waste acceptance at TWRS would require further investigation with the TWRS staff.

6.0 RECOMMENDED STRATEGIES

Evaluation of the preceding discussions leads to the conclusion that all sludges still in the K Basins should continue to be managed as SNF, an approach that is consistent with TPA Milestones M-34-00-T07 and T08, which support encapsulation and removal of the sludge in the KE and KW Basins. Continuing to manage the sludge with the fuel as SNF after removal from the basins is technically sound and does not compromise the ongoing NEPA process to establish the disposition of DOE's SNF complex-wide. The question of a separate classification of the sludge need not necessarily be raised for negotiation. However, the basin sludge, because it is segregated from the fuel during removal and contains substantial quantities of non-fuel materials, should be considered for management as a waste after removal from the basins.

The above approach is based on the concept that none of the sludge is waste until it has been separated from the SNF and removed from the K Basins. Under this concept, designation of sludge as a mixed waste can be deferred until it has been separated from SNF and removed from the K Basins. Because the canister sludge is commingled with and not able to be differentiated from the fuel until some processing has occurred, it may be able to be processed with the fuel and maintain its classification as SNF. Continuing this strategy, only the basin sludge should be considered a waste as defined in the Dangerous Waste Regulations.

The sludge in the bottom of K Basin is separated from the fuel stored in canisters. The composition of the KW Basin is unknown but is likely to be found to be a radioactive waste rather than a mixed waste. If this is the case, then a firm could be contracted to make the waste into grout. However, it may be easier and more economical to dispose of this small quantity of sludge in the tank farm with the same equipment used to remove and dispose of the KE Basin sludge.

Analysis of the TWRS waste acceptance criteria indicates that, with appropriate precautions, the basin sludge may be able to be accepted for storage in a DST System for subsequent treatment in the planned high-level vitrification facility. If this option were not available to support the expedited removal of fuel and sludge from K Basins, obtaining a RCRA permit to store the basin sludge in the Staging & Storage Facility should be considered.

Finally, if either or both sludges were to be designated as a mixed waste while still in K Basins, subsequent negotiations should focus on mitigating the impacts of the RCRA interim status standards on the K Basins and the expedited removal plans through the TPA process.

7.0 REFERENCES

Ecology. 1991. *Dangerous Waste Regulations*. Chapter 173-303, Washington State Department of Ecology, Olympia, Washington.

Ecology. 1994. *Hanford Federal Facility Agreement and Consent Order*, Fourth Amendment. Washington State Department of Ecology, Olympia, Washington.

EPA. 1989. *Land Disposal Restrictions*, Title 40, Code of Federal Regulations, Part 268, as amended, U.S. Environmental Protection Agency, Washington, D.C.

Resource Conservation and Recovery Act of 1976. Public Law 94-580, as amended, 42 USC 6901 et seq.

WHC. 1988. *Hanford Production Reactor Fuel Storage Basin Sediment-Characterization and Processing for Disposal*. WHC-SD-CP-TI-135 Rev. 1, Westinghouse Hanford Company, Richland, Washington.

WHC. 1998b. *Hanford Site Solid Waste Acceptance Criteria*. WHC-EP-0063, Westinghouse Hanford Company, Richland, Washington.

WHC. 1991. *Double-Shell Tank Waste Analysis Plan*. WHC-SD-WM-EV-053, Westinghouse Hanford Company, Richland, Washington.

WHC. 1994. *Hanford Spent Nuclear Fuel Project Recommended Path Forward*, Vols. I and II. WHC-EP-0830, Westinghouse Hanford Company, Richland, Washington.

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