DOE/EIS-0245F-SA-03

Supplement Analysis

Management of Spent Nuclear Fuel from the K Basins at the Hanford Site, Richland, Washington

U.S. Department of Energy
Richland Operations Office
Richland, Washington 99352

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Summary

This supplement analysis (SA) has been prepared to allow a determination by the U.S. Department of Energy (DOE) on whether further *National Environmental Policy Act of 1969* (NEPA) review is needed as DOE continues to manage spent nuclear fuel (SNF), including knockout pot (KOP) product material, in multi-canister overpacks (MCOs) at the Hanford Site's Canister Storage Building (CSB).

In January 1996, the DOE issued the Final Environmental Impact Statement (K Basins FEIS) on *Management of Spent Nuclear Fuel from the K Basins at the Hanford Site, Richland, Washington* (DOE/EIS-0245F). The K Basins FEIS analyzed alternatives for managing the SNF located in the K-East (KE) and K-West (KW) SNF storage basins, located on the Hanford Site along the Columbia River in Washington State. The preferred alternative analyzed in the K Basins FEIS was referred to as "drying/passivation (conditioning) with dry vault storage." The K Basins FEIS analyzed six other alternatives for the management of SNF from the K Basins at the Hanford Site: the No-Action; Enhanced K Basins Storage; New Wet Storage; Calcinations with Dry Storage; Onsite Processing; and Foreign Processing Alternatives.

The Record of Decision (ROD) was signed March 4, 1996 (61 FR 10736, March 15, 1996). The ROD documented the DOE decision to implement the preferred alternative evaluated in the K Basins FEIS with two modifications. That is, for the preferred alternative SNF would be removed from the basins, vacuum dried, conditioned and sealed in inert-gas filled canisters for dry vault storage pending final disposition. Sludge would be transferred to double-shell tanks for management. One of the aforementioned modifications was that should it not be possible to put the sludge into the double-shell tanks, the sludge would either continue to be managed as SNF, or disposed of as solid waste. The second modification allowed DOE to place the MCOs inside the transportation casks before the SNF is loaded into the MCOs, instead of loading the SNF into the MCOs prior to placing them inside the transportation casks.

The Council on Environmental Quality Regulations for Implementing NEPA [found in 40 Code of Federal Register Section 1502.9(c)] states that agencies shall prepare supplements to a K Basins FEIS if (a) the agency makes substantial changes in the proposed action that are relevant to environmental concerns; or (b) there are significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts. Further, the DOE regulations for implementing NEPA [10 CFR 314(c)] outline when the DOE shall prepare a supplement analysis - a DOE document used to determine whether a supplemental EIS should be prepared pursuant to 40 CFR 1502.9(c), or to support a decision to prepare a new EIS.

Thus, as stated earlier, this SA has been prepared to support a determination by DOE on whether further NEPA review is needed as the DOE continues to manage SNF, including KOP product material, in MCOs at the Hanford Site CSB.

1 Introduction

This supplement analysis (SA) evaluates operational activities related to continued management of spent nuclear fuel (SNF) in multi-canister overpack (MCO) containers at the Hanford Site. The SNF management includes management of knock-out pot (KOP) product material. This SA compares current operational activities to the analyses conducted in the Final Environmental Impact Statement (EIS) on *Management of Spent Nuclear Fuel from the K Basins at the Hanford Site, Richland, Washington* (DOE/EIS-0245F) ("K Basins FEIS"), particularly with respect to management of KOP material.

In January 1996, the U.S. Department of Energy (DOE), Richland Operations Office (RL) issued the K Basins FEIS, which analyzed alternatives for managing the SNF located in the K-East (KE) and K-West (KW) SNF storage basins, located on the Hanford Site along the Columbia River in Washington State. The preferred alternative analyzed in the K Basins FEIS was referred to as "drying/passivation (conditioning) with dry vault storage." The K Basins FEIS analyzed six other alternatives for the management of SNF from the K Basins at the Hanford Site: the No-Action; Enhanced K Basins Storage; New Wet Storage; Calcinations with Dry Storage; Onsite Processing; and Foreign Processing Alternatives.

The Record of Decision (ROD) (61 FR 10736) for the K Basins FEIS documented the decision to implement the preferred alternative evaluated in the K Basins FEIS with two modifications.

2 Purpose and Need for Agency Action

DOE needs to continue to provide safe storage of KOP product material at the Hanford Site. DOE needs to move the material off the Columbia River and manage the material as SNF in an existing facility; the configuration would include dry storage in MCOs with or without installing and welding a final cover cap.

3 Existing EIS Analyses

In April 1995, DOE issued DOE/EIS-0203-F, *Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement*. DOE's proposed action for the management of SNF was to safely, efficiently, and responsibly manage existing and projected quantities of DOE's SNF through the year 2035, pending ultimate disposition. This programmatic EIS was developed to support DOE's decisionmaking on the most appropriate location for implementing national strategies for managing DOE's SNF until its ultimate disposition is determined and implemented. Appendix A of DOE/EIS-0203-F is Hanford-specific detailed information on the consequences of management activities under each alternative. The ROD was signed on May 30, 1995 (60 FR 28680, June 1, 1995). Therein, DOE decided to regionalize spent nuclear fuel management by fuel type at three sites, including Hanford. Hanford production reactor fuel would remain at the Hanford Site. DOE amended the May 30 ROD, pertaining to SNF shipments into and out of the State of Idaho. The Amended ROD signed on February 28, 1996 (61 FR 9441), reduced the number of shipments of SNF into the State of Idaho; some Hanford SNF originally slated to be transported to Idaho would remain at Hanford.

As noted in Section 1, DOE issued the final K Basins FEIS in January 1996. The K Basins FEIS analyzed alternatives for managing SNF located in the KE and KW storage basins.

The ROD was signed March 4, 1996 (61 FR 10736). The ROD documented the DOE decision to implement the preferred alternative evaluated in the K Basins FEIS with two modifications.

As stated in the ROD, the preferred alternative consisted of removing the SNF from the basins, vacuum drying, conditioning and sealing the SNF in inert-gas filled canisters for dry vault storage in a new facility, to be built at Hanford, for up to 40 years pending decisions on ultimate disposition. The K Basins would continue to be operated during the period over which the preferred alternative is implemented. The preferred alternative also included transfer of the basin sludge to Hanford's double-shell tanks for management, disposal of non-SNF basin debris in a low-level burial ground at the Hanford Site, disposition of the basin water, and deactivation of the basins pending decommissioning. The two modifications in the ROD were with respect to management of the sludge, and the timing of placement of the SNF into the transportation casks. First, the modification for management of the sludge addressed the possibility that the sludge would not be put into the double-shell tanks, and would either continue to be managed as SNF, or disposed of as solid waste. The modification regarding placement of the SNF into the transportation casks would reduce the radiation exposure to the workers by placing the MCOs inside the transportation casks before the SNF is loaded into the MCOs, instead of loading the SNF into the MCOs prior to placing them inside the transportation casks.

Since the *National Environmental Policy Act of 1969* (NEPA) ROD in 1996, two supplement analyses have been prepared. DOE/EIS-0245/SA1, *Supplement Analysis of Environmental Effects of Changes in DOE's Preferred Alternative for Management of Spent Nuclear Fuel from the K Basins at the Hanford Site, Richland, Washington* (August 1998) addressed deletion of the hot conditioning/passivation step from the preferred alternative selected in the ROD. DOE/EIS-0245-FS/SA2, *Alternate Fuel Transfer for the 105-KE Basin Spent Nuclear Fuel, 100 K Area, Hanford Site, Richland, Washington,* addressed the preferred alternative selected in the ROD, involving transfer of SNF from the 105-KE Basin to the 105-KW Basin for processing and packaging into MCOs. This processing and packaging activity occurred directly in the 105-KE Basin for transfer to the Cold Vacuum Drying Facility (CVDF) for subsequent dewatering and drying.

For both supplement analyses, DOE determined that the proposed actions did not constitute a substantial change in actions previously analyzed in the K Basins FEIS, and that there were no significant circumstances or new information relevant to environmental concerns associated with the proposals. Therefore, no additional NEPA review was required, and no amended ROD(s) were issued. The aforementioned DOE/EIS-0245/SA1 and DOE/EIS-0245-FS/SA2 are reproduced in Appendices A and B, respectively. It should be noted that SA2 addressed transferring SNF from the 105-KE Basin to the 105-KW Basins, and does not address any aspects of managing KOP product material.

As discussed in DOE/EIS-0245/SA1, the series of operations to transition the K Basins SNF from wet to dry storage include:

- Remove K Basin SNF from existing canisters, clean and desludge.
- Repackage the SNF into fuel baskets designed for MCO dimensions that would include provision for water removal, SNF conditioning requirements, and criticality control.
- Place the empty MCOs in their transportation casks.
- After loading the SNF into the MCOs in their casks and installing a mechanical seal, drain the MCOs, dry the SNF under vacuum at approximately 50°C (120°F), flood the MCOs with inert gas and seal penetrations.
- Transport the SNF (in sealed MCOs) in these casks via truck to the CSB site in the 200 East Area.

- At the CSB, remove the MCOs from the transportation casks, weld-seal a final cover on the MCOs containing the SNF in an inert gas and place the MCOs in dry interim storage in a vault for up to 40 years.
- Collect and remove the sludge from the basins and disposition as waste in Hanford's double-shell tanks. Should it not be possible to put the sludge into the double-shell tanks, the sludge will either continue to be managed as SNF, or disposed as solid waste.

As of April 2011, the CSB has received 388 MCOs of SNF from K Basins. Of these, 379 have had cover caps installed and welded. Nine MCOs did not have cover caps installed and welded specifically in order to allow gas sample monitoring. The K Basins FEIS (Section 3.2.3) noted that "…The MCOs would have a removable, but sealable, thick-walled top closure, with features allowing monitoring of internal conditions and venting of any excessive gas. The thick-walled top provides sufficient shielding to allow operator access to the monitoring and venting features of the top closure, and to seal and leak-check the MCO before shipment." Further, in the K Basins FEIS Section 3.2.4, it was noted that the MCOs could be transported to the CSB and "…provide for temporary vented staging, as necessary…".

The monitoring program is described in SNF-5536, *The Multi-Canister Overpack (MCO) Monitoring Plan*, for these activities. This plan established two separate activities: Limited Monitoring and Long Term Monitoring. Limited Monitoring includes pressure, temperature, and gas sampling for a limited number of MCOs without welded cover caps in the first two years of storage. The Long Term monitoring includes only approximate MCO high-pressure indication capability for MCOs with welded cover caps.

The purpose of the limited monitoring program (initiated in calendar year 2000) is to acquire data on full-scale MCOs that may be useful in gaining a fuller understanding of an engineered system. Documented MCO monitoring results to date (SNF-10563, et al) indicate that the MCOs are well within established models regarding pressure, temperature, and gas composition.

Addressing long term monitoring, an approach has been developed and implemented for long-term pressure indication on the MCOs with welded cover caps over the 40-year storage time using a magnetically coupled gauge installed in the MCO shield plug that can be read from the outside surface of the welded cover cap.

Since the NEPA ROD based on the K Basins FEIS was issued in 1996, documentation also has been prepared and implemented under CERCLA addressing the K Basins. Relevant CERCLA documentation for K Basins is listed below. The 1999 CERCLA ROD states that following removal of SNF from the K Basins, stabilization, interim storage, or final disposition of SNF is not within the scope of the CERCLA action but would continue to be conducted under the authority of the *Atomic Energy Act of 1954*. The selected remedy for sludge was amended (CERCLA ROD amendment) documenting that sludge will be treated, packaged for disposal, interim stored pending shipment, and ultimately shipped to a national repository for disposal. The details of sludge treatment and what national repository the sludge would be sent to for disposal would be further defined during remedial design. Therefore, following removal of the portion of KOP sludge that would be managed as SNF from the K Basins, its future management would no longer be a part of the K Basin Interim Remedial Action.

- CERCLA Record of Decision for the K Basins Interim Remedial Action (September 1999)
- *Addendum to the Focused Feasibility Study for the K Basins Interim Remedial Action*, DOE/RL-98-66, Rev. 0, Addendum (January 2005)
- CERCLA Record of Decision Amendment for the K Basins Interim Remedial Action (June 2005)

- *Remedial Design/Remedial Action Work Plan for the K Basins Interim Remedial Action: Removal of K Basin Sludge from the River Corridor to the Central Plateau; and Removal of Knock Out Pot Contents from the K Basins*, DOE/RL-2010-63, Revision 0 (March 2011)

Further, since the K Basins FEIS and ROD were issued, other documents describing the Hanford Site environs have been prepared, including PNNL-6415, *Hanford Site National Environmental Policy Act (NEPA) Characterization* (Revision 18, September 2007), which provides current information and data concerning the existing environment and regulatory permits and approvals at the Hanford Site, and DOE/EIS-0391, *Draft Tank Closure and Waste Management Environmental Impact Statement* (TC&WM EIS, October 2009). The TC&WM EIS scope covers retrieval, treatment, and disposal of waste from 149 single-shell tanks (SSTs) and 28 double-shell tanks (DSTs), and closure of the SSTs system; final decontamination and decommissioning of the Fast Flux Test Facility; and ongoing waste management activities including disposal of Hanford's low-level waste (LLW) and mixed low-level waste (MLLW) as well as from other DOE sites. Cumulative impacts associated with Hanford Site remediation and decommissioning activities, based on the end states assumed, also are evaluated in combination with the impacts from the proposed actions and alternatives. These documents also were reviewed and considered for purposes of Affected Environment and descriptions of resource areas, Hanford Site activities, permits, and regulatory approvals, and thus provide documented sources of current information for consideration.

4 Proposed Action

DOE proposes to include KOP product material in its continued management of SNF. DOE would transport the KOP product material to the CSB for monitoring and storage. DOE would continue its monitoring program of stored SNF at the CSB (SNF-5536, *The Multi-Canister Overpack (MCO) Monitoring Plan*), which has been established since receiving SNF at CSB. In addition, SNF MCOs (refer to Figure 1) could be stored with or without installing and welding a final cover cap.

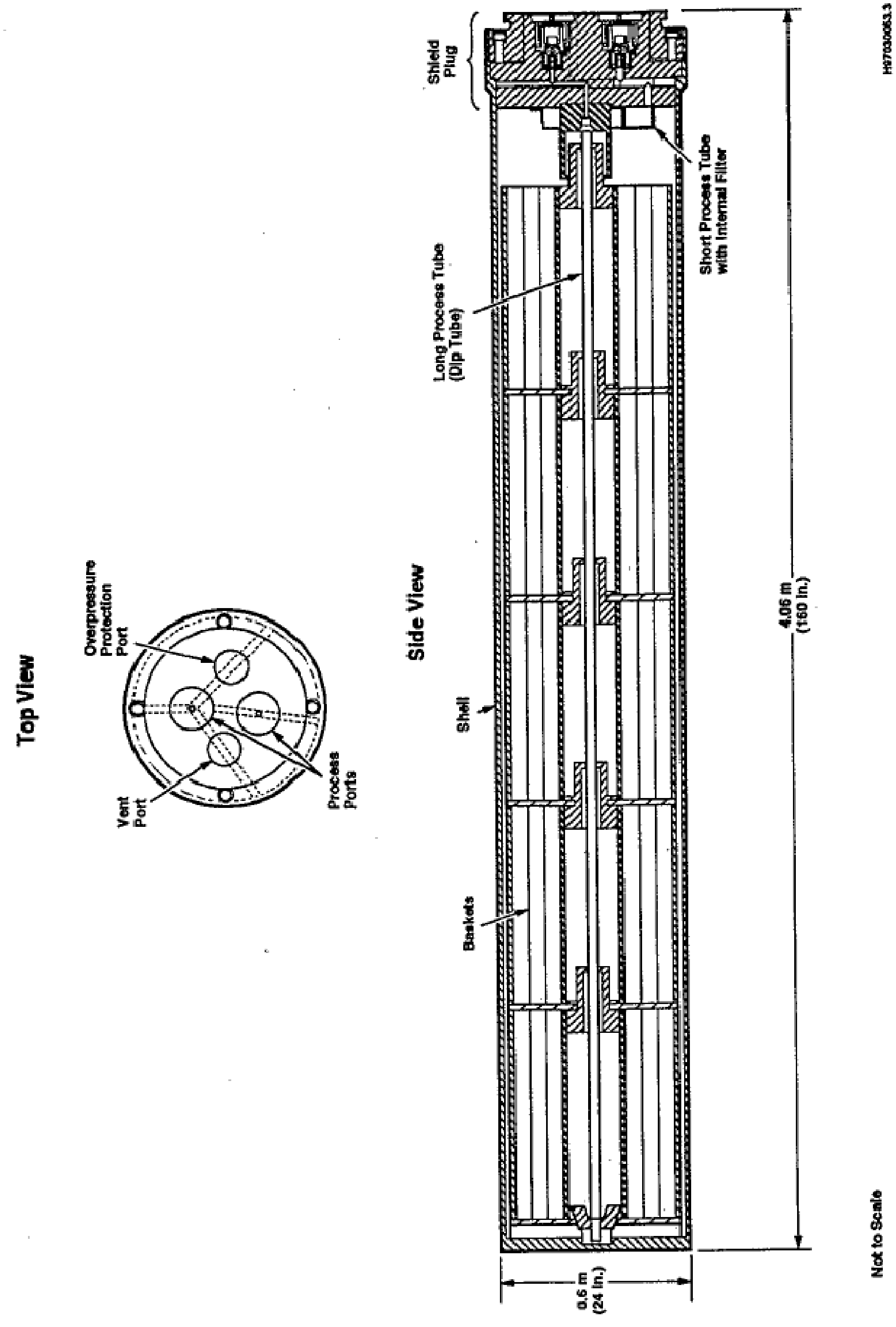

Figure 1. Depiction of MCO

5 Environmental Impacts

This section addresses the potential environmental impacts associated with managing KOP product material in unwelded MCOs.

In accordance with DOE's "sliding scale" guidance[1] the description of potential environmental impacts in this section emphasizes the resource areas and considerations most likely to be affected by the proposed action and highlights information that is necessary to assess or understand the potential environmental impacts. The areas addressed herein are air quality (routine operations only because construction activities have been completed), accident consequences, land use, historical/cultural resources, ecological resources, transportation, waste management, and cumulative impacts.

Examples of resource areas not addressed specifically in this section include aesthetic and scenic resources, geology and soils, water quality, noise, floodplains and wetlands, and socioeconomics and environmental justice. No new information pertaining to these areas of environmental interest that are relevant to the proposal have been identified when considering the information presented in the K Basins FEIS and other more currently published documents. Further, water quality is not evaluated, as potential impacts to surface and groundwater from continued dry storage of SNF at CSB are unlikely to occur.

5.1 Air Quality, Radiological Consequences, Routine Operations

As noted in the K Basins FEIS (Section 5.7.1), no fatal cancers would be expected from routine operations associated with SNF storage in MCOs. Table 5-1 shows projected K Basins FEIS consequences for removing SNF, sludge, debris, and water from the K Basins and staging the fuel in the 200 Area.

Table 5-1. Dose and Consequences from Fuel, Sludge, Water, and Debris Removal

Receptor	Routine annual dose	Fatal Cancers
Offsite Population	0.019 person-rem	None (1 E-05)
Collective Workers	0.0035 person-rem	None (1 E-06)
Offsite resident	6.6 E-07 rem	Not Applicable
Onsite worker	3.0 E-05 rem	Not Applicable

Table 5-2 shows projected K Basins FEIS consequences of routine air emissions from a drying/passivation facility.

[1] Recommendations for the Preparation of Environmental Assessments and Environmental Impact Statements, 2nd edition, U.S. Department of Energy, Washington, D. C., 2004. Online at http://gc.energy.gov/NEPA/nepa_documents/TOOLS/GUIDANCE/Volume2/2-10-greenbook-recommendations.pdf.

Table 5-2. Dose and Consequences of Routine Air Emissions from a Drying/Passivation Facility

Receptor	Routine annual dose	Fatal Cancers
Offsite Population	0.59 person-rem	None (3 E-04)
Collective Workers	0.0016 person-rem	None (6 E-07)
Offsite resident	1.7 E-05 rem	Not Applicable
Onsite worker	6.2 E-07 rem	Not Applicable

Currently, the Cold Vacuum Drying Facility (CVDF) and CSB are licensed under the DOE Hanford Site Radioactive Air Emissions License #FF-01 http://www.doh.wa.gov/ehp/rp/air/aff02lic.pdf. License limits, shown in Table 5-3, are bounded by those presented in the K Basins FEIS.

Table 5-3. License Limits for the CVDF and CSB

Facility	Abated Emission Limit (mrem/yr)	Unabated Emission Limit (mrem/yr)
CVDF	4.95 E-03	1.27 E+01
CSB	1.64 E-02	3.64 E+01

Emissions at these facilities routinely are monitored. As noted previously, some unwelded MCOs also have been stored at the CSB for purposes of implementing the monitoring program. Historically, air emissions from the CVDF and the CSB have been substantially lower than the license limits. As noted in DOE/RL-2010-17, Rev. 0, *Radionuclide Air Emissions Report for the Hanford Site, Calendar Year 2009*, periodic confirmatory measurements have been taken and low emissions verified (DOE/RL-2010-17, Table 5-5, page 5-6). Preliminary calculations associated with the storage (and attendant monitoring) of unwelded MCOs containing KOP product material are provided in Table 5-4 and would not exceed the current license limits for the CSB (refer to Table 5-3). Table 5-4 considers (1) the current inventory of MCOs containing SNF (sealed sources and therefore no emissions); (2) the current and projected inventory of unwelded MCOs containing SNF; and (3) the projected inventory of unwelded MCOs containing KOP product material.

Table 5-4. Preliminary Calculations for CVDF and CSB Emissions with KOP Product Material

Facility	Abated Emission Limit (mrem/yr)	Unabated Emission Limit (mrem/yr)
CVDF	1.31 E-03	1.7 E+00
CSB	4.52 E-04	2.47 E+00

5.2 Air Quality, Nonradiological Consequences, Routine Operations

The K Basins FEIS (Section 5.7.2) analyzed the impacts of emissions of nonradiological air pollutants. The analysis focused on emission of nitrogen oxides (NO_x) modeled as nitrogen dioxide (NO_2), oxides of sulfur modeled as sulfur dioxide (SO_2), and particulate matter with a 10-micron-or-less aerodynamic diameter (PM_{10}). For the drying/passivation with dry storage alternative, during operation none of the facilities (passivation facility, the staging facility, the dry storage facility, or the existing K Basins storage facilities) would have any significant releases of nonradiological pollutants. However, temporary emissions from construction activities were anticipated to contribute to the nonradiological consequences in the passivation alternative. Since the issuance of the K Basins FEIS and ROD, all construction activities have been completed.

No substantial increase in nonradiological air emissions is expected from the management of KOP product material in MCOs. The CVDF is considered an insignificant emission unit in the Hanford Site Air Operating Permit (Number 00-05-006). It is expected that the CVDF will maintain compliance with the general requirements in Table 1.2 of the AOP, and will comply with Section 1.3 of the AOP (General Standards for Maximum Emissions). The CSB does not produce any nonradiological emissions.

5.3 Accident Consequences

The bounding accident scenario presented in the K Basins FEIS relevant to the proposed action presented in this SA was for fuel handling at a cold vacuum drying facility in the 100 Area, involving an MCO containing 19 canisters of irradiated fuel and sludge in the process of being dried. As a result of a loss of system pressure boundary integrity or other failure (the presence or absence of welded cover caps on the MCOs was not a factor) control of the process was lost, The K Basins FEIS analysis was based on a mitigated release of approximately 1.6 E-05 curies of uranium (U-234, U-235, and U-236). The consequences of this accident were calculated to be a maximum individual dose of 17 rem to the offsite resident. The collective dose to the population would result in 84 latent fatal cancers if the accident occurs and no protective action is taken. Repackaging fuel to load the MCO more efficiently would increase the estimated release by a factor of 1.9.

Initial calculations associated with an MCO overpressure involving an MCO of KOP product material (the bounding accident scenario) indicate that a mitigated (two-stages of high-efficiency particulate air filtration at CVDF) release of approximately 3 E-07 curies of uranium (assuming U-234 with a specific activity of 6.25 E-03 curies per gram) could occur; this represents less than two percent of the uranium releases from the accident presented in the K Basins FEIS.

5.4 Land Use

Since the K Basins FEIS was issued, the Hanford Reach National Monument (Monument) was established by Presidential Proclamation (http://clinton6.nara.gov/2000/06/2000-06-09-proclamation-on-hanford-reach-national-monument.html). The K Basins are located along the Monument boundary, adjacent to the Columbia River.

Land use management at the Hanford Site is governed by the Hanford Comprehensive Land Use Plan (CLUP) that was established by the ROD issued in November 1999, and is based on the analyses presented in the associated *Hanford Comprehensive Land-Use Plan (HCP) Environmental Impact Statement* (EIS) (DOE/EIS 0222 F). The HCP EIS analyzed the impacts of alternatives for implementing a land use plan for the DOE's Hanford Site for at least the next 50 year planning period and lasting for as long as DOE retains legal control of some portion of the real estate. DOE recently prepared a supplement analysis to the HCP EIS in June 2008 (DOE/EIS-0222-SA-01, *Supplement Analysis, Hanford Comprehensive Land-Use Plan Environmental Impact Statement*) and issued an amended ROD in September 2008 (73 FR 55824).

The K Basins FEIS (Section 5.2) addressed potential new construction and the attendant land use. No new construction would be required for the continued management of SNF, including the proposed KOP product material; therefore, no change in impacts on land use as analyzed in the K Basins FEIS would be expected. Section 3.2.1 of the TC&WM EIS provides the most current overview of land resources on the Hanford Site.

5.5 Historical/Cultural Resources

The K Basins FEIS (Section 5.4) discussed cultural resources. No new historical/cultural issues have been identified to date specifically related to management of SNF at the CSB. Cultural issues associated with remediation of the K Areas are being addressed under CERCLA. DOE continues to use the *Hanford Cultural Resources Management Plan* (HCRMP) and other management plans developed under the CLUP to implement environmental controls consistently across the Hanford Site.

Section 3.2.8 of the TC&WM EIS provides an updated overview of cultural resources on the Hanford Site.

5.6 Ecological Resources

Section 3.2.7 of the TC&WM EIS provides an update of ecological resources on the Hanford Site. Ecological resources include terrestrial resources, wetlands, aquatic resources, and threatened and endangered species. No new ecological issues have been identified for the management of K Basins' SNF which have not been evaluated previously. As stated in the aforementioned CLUP, DOE would continue to use the *Hanford Site Biological Resources Management Plan* (BRMaP), the *Hanford Site Biological Resources Mitigation Strategy* (BRMiS), and other applicable resource management plans developed under the CLUP to implement environmental controls consistently across the Hanford Site.

5.7 Transportation Impacts

Under the current proposal, it is expected that approximately 814 kilograms of KOP product material (DOE/RL-2010-63, Revision 0) would be transported to the CVDF via truck for drying, and subsequently transported to the CSB. It is expected that less than 15 MCOs would be required for the KOP product material.[2] The K Basins FEIS (Table 5-33) analyzed 60 shipments of canister sludge to the CSB.

No increase in potential transportation impacts above those presented in the K Basins FEIS are anticipated. The bounding radiological impacts for dry storage of SNF and sludge that are presented (K Basins FEIS, Table 5-38) resulted in an estimated0.40 person-rem to the transportation crew, and 0.0016 person-rem to onsite workers, equating to 6.4 x 10-7 latent cancer fatalities (LCF) from routine transportation. Maximum radiological accident consequences were 0.099 person-rem, resulting in 4.0 x 10-5 LCFs.

Bounding nonradiological truck transportation impacts for the dry storage alternative in the K Basins FEIS (Table 5-39) were expressed in fatalities. Routine transport resulted in 1.3 x 10-4 onsite fatalities (from pollutants emitted during transport). There were 6.8 x 10-4 worker fatalities, and 0.0024 onsite fatalities from postulated traffic accidents.

[2] As noted in DOE/RL-2010-63-ADD1, Revision 0 http://idmsweb.rl.gov/idms/livelink.exe/fetch/2000/18814/1081672/60626/145203477/145207109/145562868/145570421/DOE-RL-2010-63-ADD1_-_Rev_00.pdf?nodeid=159968141&vernum=-2, material volume loaded into an MCO is a function of final material bulk wet density; the limiting factor for determining the amount of KOP product material that can be loaded into each MCO is the quantity of chemically bound water present in the matrix. Chemically bound water, in the presence of metallic uranium will cause the metallic uranium to corrode and generate hydrogen.

5.8 Waste Management

No new waste management issues have been identified for the proposed action as compared to those analyzed in the K Basins FEIS (Section 5.14.4). No meaningful increase in waste volume would occur as a result of managing MCOs containing KOP product material as SNF; it is expected that any waste generated would be typical of current operations (e.g., disposable gloves swabs from field radiation surveys for no more than 10 MCOs) and well within the projected volumes analyzed in the K Basins FEIS.

5.9 Cumulative Impacts

The impacts associated with the transport and storage of K Basins SNF at the Hanford Site's CSB, as identified above, would not contribute in a meaningful way to the cumulative impacts that have been presented in Chapter 6 of the TC&WM EIS. Resource areas selected for short-term cumulative impacts analysis in the TC&WM EIS included land resources (land use and visual resources); ecological resources; cultural and paleontological resources; public and occupational health and safety-normal operations; public and occupational health and safety-transportation; waste management; and industrial safety. Resource areas selected for long-term cumulative impacts analysis included groundwater quality, public health, ecological risk, and environmental justice. For example, the cumulative impacts analysis in the TC&WM EIS concludes that the collective dose to the Hanford involved workers would be 14.1 person-rem, equating to no latent-cancer-fatalities (0.008 LCFs). Additionally, there would be little or no radiation exposure to the public.

6 Conclusion

The potential environmental impacts of the current proposal are comparable to, or less than, those predicted by the K Basins FEIS. Potential radiological releases would continue to be well below current license limits for CVDF and CSB. The continued management of MCOs with unwelded caps would not present unanticipated issues; the MCO monitoring program has demonstrated that MCOs are well within established models regarding pressure, temperature, and gas composition.

7 Determination

Based on the analyses of the potential impacts of the current proposed action as discussed in this SA, DOE concludes that the current proposal concerning KOP product material does not constitute a substantial change to the proposed action analyzed in the K Basins FEIS that raise important environmental concerns or considerations. Further, based on DOE's review of other relevant NEPA documents and current information, no significant new circumstances or information relevant to environmental concerns and bearing on the current proposed action or its impacts have been identified. Therefore a supplement to DOE/EIS-0245F or a new EIS is not needed and changes to the ROD issued March 15, 1996 are not warranted.

Approval Date 8/10/11

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Appendix A

DOE/EIS-0245/SA1

DOE/EIS-0245/SA1

Supplement Analysis

Supplement Analysis of Environmental Effects of Changes in DOE's Preferred Alternative for Management of Spent Nuclear Fuel from the K Basins at the Hanford Site, Richland, Washington

Prepared by:

U.S. Department of Energy

Richland Operations Office

Richland, Washington

August 1998

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List of Acronyms and Abbreviations

CFR	Code of Federal Regulations
CSB	Canister Storage Building
CVD	cold [50 °C] vacuum drying
DOE	U.S. Department of Energy
EIS	Environmental Impact Statement
FEIS	Final Environmental Impact Statement
FR	Federal Register
KE	K-East Basin
KW	K-West Basin
kg	kilogram(s)
kPa	kiloPascal(s)
lb	pound(s)
MCO	Multi-Canister Overpack
mrem	millirem [1/1000th of a rem]
MWh	megaWatt-hour(s)
NEPA	National Environmental Policy Act
psig	pounds per square inch gauge
rem	Roentgen equivalent-mankind
ROD	Record of Decision
SNF	Spent Nuclear Fuel
Sv	Sievert(s) [1 Sv = 100 rem]

INTRODUCTION

DOE prepared and issued a final environmental impact statement (FEIS) on the "Management of Spent Nuclear Fuel from the K Basins at the Hanford Site, Richland, Washington" (DOE/EIS-0245F) in January 1996 [DOE 1996]. A notice of availability of the FEIS was published in the Federal Register on February 2, 1996 (61 FR 3932). The FEIS evaluated the potential environmental impacts of alternatives for managing the spent nuclear fuel (SNF) located in the K-East (KE) and K-West (KW) SNF storage basins at the Hanford Site located in southeastern Washington State.

Based on the analysis in the FEIS and after careful evaluation of environmental impacts, costs, compliance requirements, engineering considerations, worker and public health and safety, and public, agency and tribal comments, DOE decided to implement the preferred alternative evaluated in the FEIS, with two modifications, and documented that decision in the Record of Decision (ROD). The ROD was published in the Federal Register on March 15, 1996 (61 FR 10736).

The preferred alternative described in the ROD consists of removing the SNF from the basins, vacuum drying, conditioning and sealing the SNF in inert-gas filled canisters for dry vault storage in a new facility, to be built at Hanford, for up to 40 years pending decisions on ultimate disposition. The K Basins will continue to be operated during the period over which the preferred alternative is implemented. The preferred alternative also includes transfer of the basin sludge to Hanford's double-shell tanks for management, disposal of non-SNF basin debris in a low-level burial ground at the Hanford Site, disposition of the basin water, and deactivation of the basins pending decommissioning.

The two modifications to the FEIS in the ROD were with respect to management of the sludge, and the timing of placement of the SNF into the transportation casks. The modification for management of the sludge was that should it not be possible to put the sludge into the double-shell tanks, the sludge would either continue to be managed as SNF, or disposed of as solid waste. The modification regarding placement of the SNF into the transportation casks was to reduce the radiation exposure to the workers by placing the Multicanister Overpacks (MCOs) inside the transportation casks before the SNF is loaded into the MCOs, instead of loading the SNF into the MCOs prior to placing them inside the transportation casks.

In the ensuing two years since the Record of Decision was published, a large number of process design analyses have been completed and characterization data have been obtained that better describes the chemical and physical properties of the fuel and sludge in the K Basins. This information resulted in a reassessment of the SNF drying process that lead to the conclusion that the hot conditioning/passivation step would not provide a benefit commensurate with the risk associated with heating the SNF to high temperature.

Section 1502.9(c) of the Council on Environmental Quality Regulation for Implementing the Procedural Provisions of NEPA, 40 CFR Parts 1500-1508, requires the preparation of a Supplemental Environmental Impact Statement if (1) the agency makes substantial changes in the proposed action that are relevant to environmental concerns; or (2) there are significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts. Section 1021.314(c) of the DOE NEPA Regulations (10 CFR 1021, 61 FR 64603, December 6, 1996) provides that, where it is unclear whether a Supplemental EIS is required, DOE will prepare a Supplement Analysis to support a DOE determination with respect to the criteria of 40 CFR 1502.9(c). The purpose of this Supplement Analysis is to provide a basis for a determination of whether or not a Supplemental EIS is required as a result of deleting the hot conditioning/passivation step from the preferred alternative selected in the Record of Decision.

Preferred Alternative as Originally Proposed

The preferred alternative is referred to in the FEIS as "drying/passivation (conditioning) with dry vault storage". As noted in the FEIS, the details of the proposed processes and perhaps their order were expected to change somewhat as the designs evolved and as the results of ongoing characterization testing became available. However, the impacts of the steps described in the FEIS and the ROD bounded those necessary to place the K Basins SNF in safe dry storage. The proposed series of operations to achieve the preferred alternative as described in the ROD, with the modifications described in the ROD, was as follows:

- Continue K Basin operations until the removal of SNF, sludge and debris, and disposition of the water is completed. Make modifications to the K Basins, as necessary, for maintenance, monitoring and safety, and provide systems necessary to support the activities described below.
- Remove K Basin SNF from existing canisters, clean and desludge.
- Repackage the SNF into fuel baskets designed for MCO dimensions, that would include provision for water removal, SNF conditioning requirements, and criticality control.
- Place the empty MCOs in their transportation casks.
- After loading the SNF into the MCOs in their casks and draining the MCOs, dry the SNF under vacuum at approximately 50°C (120°F), flood the MCOs with inert gas and seal penetrations.

- Transport the SNF (in MCOs) in these casks via truck to the Canister Storage Building (CSB) site in the 200 East Area and, after removing them from the casks, provide for temporary vented staging, as necessary.
- Further condition the SNF in MCOs, as soon as practicable, heating the SNF in a vacuum to about 300°C (570°F) to remove water that is chemically bound to the SNF and canister corrosion products, and to dissociate, to the extent practicable, any reactive uranium hydride present.
- Following conditioning, weld-seal the SNF in an inert gas in the MCOs for dry interim storage in a vault for up to 40 years.
- Collect and remove the sludge from the basins and disposition as waste in Hanford's double-shell tanks. Should it not be possible to put the sludge into the double-shell tanks, the sludge will either continue to be managed as SNF, or disposed of as solid waste.
- Collect the non-SNF debris from the basins and dispose of as low-level waste in Hanford's existing low-level waste burial grounds.
- Remove and transport basin water to the 200 Area Effluent Treatment Facility for disposal at the 200 Area State-Approved Land Disposal Site.
- Prepare the K Basins for deactivation and transfer to decontamination and decommissioning program.

Proposed Change to the Preferred Alternative

The principal change to the preferred alternative is the deletion of the conditioning/passivation step. This step is described in the FEIS and the ROD as "further condition the SNF in MCOs, as soon as practicable, heating the SNF in a vacuum to about 300°C (570°F) to remove water that is chemically bound to the SNF and canister corrosion products, and to dissociate, to the extent practicable, any uranium hydride present." The revised series of operations to transition the K Basins SNF from wet to dry storage, including changes that have occurred as the design of the MCO has evolved, is as follows:

- Continue K Basin operations until the removal of SNF, sludge and debris, and disposition of the water is completed. Make modifications to the K Basins, as necessary, for maintenance, monitoring and safety, and provide systems necessary to support the activities described below.
- Remove K Basin SNF from existing canisters, clean and desludge.
- Repackage the SNF into fuel baskets designed for MCO dimensions, that would include provision for water removal, SNF conditioning requirements, and criticality control.
- Place the empty MCOs in their transportation casks.
- After loading the SNF into the MCOs in their casks and installing a mechanical seal, drain the MCOs, dry the SNF under vacuum at approximately 50°C (120°F), flood the MCOs with inert gas and seal penetrations.
- Transport the SNF (in sealed MCOs) in these casks via truck to the Canister Storage Building (CSB) site in the 200 East Area.

- At the CSB, remove the MCOs from the transportation casks, weld-seal a final cover on the MCOs containing the SNF in an inert gas and place the MCOs in dry interim storage in a vault for up to 40 years.
- Collect and remove the sludge from the basins and disposition as waste in Hanford's double-shell tanks. Should it not be possible to put the sludge into the double-shell tanks, the sludge will either continue to be managed as SNF, or disposed of as solid waste.
- Collect the non-SNF debris from the basins and dispose of as low-level waste in Hanford's existing low-level waste burial grounds.
- Remove and transport basin water to the 200 Area Effluent Treatment Facility for disposal at the 200 Area State-Approved Land Disposal Site.
- Prepare the K Basins for deactivation and transfer to decontamination and decommissioning program.

Original Purpose of Conditioning/Passivation Step and Why it Can be Deleted

The reason for including the (hot) conditioning/passivation step in the original preferred alternative was twofold. First, the conditioning process, which involved heating the fuel to a higher temperature than is attainable in the Cold Vacuum Drying (CVD) facility, was intended to remove more of the chemically-bound waters of hydration than could be achieved by CVD alone. This would reduce the maximum pressure that could be attained in the MCO. Second, the purpose of the passivation process was to destroy any uranium hydride and uranium fines that might be present by exposing them, at high temperature, to a controlled amount of oxygen. This would lessen the concern for an air ingress accident by removing essentially all of the most susceptible pyrophoric materials. These steps are discussed in more detail below.

Conditioning Step

The purpose of the conditioning step was to reduce the water inventory in the MCO to as low as practicable since water, in any form, is the principal source of gas, and therefore pressure, in the MCO. Water can be present in the MCO in three forms: residual free water, chemically bound water and chemisorbed water.

- Residual free water is that remaining in the MCO after the cold vacuum drying process. This will be a small amount, perhaps in capillaries or small inaccessible pockets, that does not manifest its presence during the pressure rebound test that determines the completion of drying.

- Chemically bound water is water in the form of hydrates of various oxides (principally uranium oxides) produced by corrosion of the exposed uranium and other metals present in the basin during the wet storage period. These oxides can be on the fuel surfaces or in any of the sludge entrained with the fuel when it is placed into the MCO.
- Chemisorbed water exists on all wetted surfaces of all materials within the MCO. This is water bound to the surfaces by forces that are much stronger than the normal (van der Waals) forces between molecules. A much higher temperature, well beyond the conditioning temperature of 300 °C (570 °F), is required to release chemisorbed water. While chemisorbed water cannot practically be removed, it requires an extremely large surface area to accumulate an amount sufficient to have any appreciable impact on the pressure in the MCO.

There are two means by which gas can be produced from water in the MCO. Free water or water vapor can react with exposed uranium to form uranium dioxide and hydrogen gas. All forms of water can undergo radiolysis, producing hydrogen and oxygen gases in the process. Therefore, each mole of water present in the MCO in any form can ultimately produce one mole of hydrogen gas, either through reaction with exposed uranium or by radiolysis. In addition, water that is consumed by radiolysis results in the production of another one-half mole of oxygen gas. Both processes will occur in the MCO (that is, not all water will be consumed by radiolysis), but for analysis purposes it was assumed that each mole of water in any form present in the MCO when it is sealed will ultimately yield 1.5 moles of gas.

Other potential sources of gas in the container (fission products such as krypton or xenon liberated from the fuel in the corrosion process, helium formed from alpha emitters in the fuel and sludge, and radiolysis of any hydrocarbons that may be present; e.g., residual cutting oil on the container surfaces or contaminants in the sludge) are negligible compared to that from the water that may credibly be present.

Characterization measurements [PNNL 1997] of the drying behavior of actual K Basins sludge showed that conditioning at 300 °C (570 °F) would remove most of the bound water of hydration left after cold vacuum drying. Only a small amount would remain that, through radiolysis, would produce a small amount of gas. However, there is no practical way to verify the amount of bound water in an MCO at the start of vacuum drying, nor is it possible to measure the bound water remaining after either cold vacuum drying or hot conditioning. The safety case must, therefore, conservatively bound the amount of water that might be present in an MCO at the time it is sealed, and take no credit for removal of bound water.

Safety basis calculations [DESH 1997] using extreme values for all parameters that affect pressure conclude that the maximum pressure that can be attained in an MCO, over the 40 year interim storage period following cold vacuum drying, is 916 kPa (133 psig). The expected maximum pressure is considerably less, about 365 kPa (53 psig). These calculations take no credit for removal of any bound water in CVD, nor would they take credit for any bound water removed in the hot conditioning process if it were done. Thus, while the hot conditioning process would decrease the maximum attainable pressure in the MCO by reducing the amount of water, it would carry the risk of a fuel fire associated with heating the uranium fuel to the higher temperature and would not allow a reduction in the MCO design pressure.

To provide a safety margin to allow for the presence of as-yet-unidentified water-bearing substances in the sludge, and to accommodate process errors, the safety approach has been to modify the design of the MCO to accommodate the maximum design pressure rating attainable without major changes in the MCO dimensions or materials. Small changes in the MCO hardware design (principally a small increase in the thickness of the bottom head) have resulted in an increase in its design pressure from 1,034 kPa (150 psig), as originally configured, to 3,101 kPa (450 psig).

Passivation Step

The inclusion of a passivation step in the preferred alternative was based on an early analysis of the French conditioning process for metallic fuel. The French process was developed to destroy uranium hydride and uranium fines to account for an accident scenario in which a failure of the fuel container occurred during transportation over public roads. Such a failure would allow air to enter the container and react with these pyrophoric materials, resulting in a fuel fire. For Hanford's metallic uranium fuel, this type of container failure has been demonstrated [WMFS 1997] to be incredible (less than 10^{-6}) by the subsequent robust design of the MCO transportation cask and the transportation and storage processes. The analyses detailed in [WMFS 1997] show that the MCO cask maintains leak-tight containment of the SNF through all normal transfer and accident conditions, including drops and a fully engulfing fire. Analyses have also been done for drops of the MCO outside of the transportation cask, at the CSB. These analyses show that in no case is the MCO breached as a result of the drop. Consequently, an air ingress accident is not credible and it is not necessary to destroy uranium hydride or uranium fines.

Furthermore, as noted above, some tightly bound water would have remained in the MCO following hot conditioning. This water would undergo radiolysis over time, producing oxygen and hydrogen gas. Since the hydrogen can react with any exposed uranium in the container to form uranium hydride, and the oxygen could react with some of the existing uranium hydride to produce uranium fines, the passivation process would only temporarily remove these materials. Consequently, air would have to be precluded from entering the MCO following processing even if the hot conditioning/passivation step were performed.

Absent the requirement for the accommodation of the container rupture accident, the inclusion of the passivation process does not significantly improve the condition of the fuel with respect to performance during interim storage.

Elimination of the passivation process, however, reduces system complexity, eliminates potential accident scenarios and results in cost savings for the Project.

Impact of Change to Preferred Alternative

Among the purposes of an Environmental Impact Statement is a requirement that it provide a full and fair discussion of significant environmental impacts of the alternatives considered and that these impacts be used, together with other relevant information, in the decision making process. This section presents a review of the effects of the change to the preferred alternative on the factors that were considered in the EIS. In each of the paragraphs below, the impact of the change in the preferred alternative on the factor addressed in the paragraph with the same title in Section 5 of the EIS [DOE 1996] is described.

Land Use.

Since hot conditioning was to done within the CSB, and the CSB "footprint" is not affected, the change to the preferred alternative has no impact on land use as analyzed in the EIS.

Socioeconomics.

A small decrease in employment and population impacts related to construction and operation of the hot conditioning facility would be expected relative to the EIS analyses.

Cultural Resources.

The change to the preferred alternative has no impact on cultural resources as analyzed in the EIS.

Aesthetic and Scenic Resources.

The change to the preferred alternative has no impact on aesthetic and scenic resources as analyzed in the EIS.

Geologic Resources.

The change to the preferred alternative has no impact on geologic resources as analyzed in the EIS.

Air Quality and Related Consequences: Radiological Consequences.

Deletion of the hot conditioning step means that the fuel will not be heated under vacuum a second time. As a result, the potential for radiological emissions associated with the normal safe operation of the hot conditioning equipment will also be eliminated.

Air Quality and Related Consequences: Nonradiological Consequences.

Deletion of the hot conditioning step means that the fuel will not be heated under vacuum a second time. As a result, the potential for non-radiological emissions associated with the normal safe operation of the hot conditioning equipment will also be eliminated.

Water Quality and Related Consequences.

The change to the preferred alternative has no impact on water quality and related consequences as analyzed in the EIS.

Ecological Resources.

The change to the preferred alternative has no impact on ecological resources as analyzed in the EIS.

Noise.

The change to the preferred alternative has no impact on noise as analyzed in the EIS.

Transportation.

The change to the preferred alternative has no impact on transportation as analyzed in the EIS.

Occupational and Public Health and Safety - Radiological Consequences to the Public.

Deletion of the hot conditioning process from the preferred alternative reduces the potential to release radioactive materials to the environment, whether from the normal hot conditioning operation or because of an accident that could occur during hot processing.

Occupational and Public Health and Safety - Radiological Consequences to Workers.

In addition to the reduction in the potential release of radioactive materials to the environment brought about by eliminating the hot conditioning process from the preferred alternative, the direct exposure of workers to radiation from the MCOs is also reduced. Any worker dose that would have been received during the additional handling steps required to conduct the hot conditioning step is eliminated.

Occupational and Public Health and Safety - Nonradiological Consequences to the Public and to Workers.

Deletion of the hot conditioning process from the preferred alternative reduces the risk of occupational injuries and illnesses.

Site Services.

Elimination of the hot conditioning step in the fuel drying process results in a reduction in the utility and energy usage associated with the preferred alternative. A conservative estimate is that approximately half of the 6,800 MWh/yr of electricity consumption estimated [DOE 1996] for the drying facilities would not be required. Over the approximately two-year operating period, then, 6,800 MWh of electricity would be saved. Similarly, helium usage would be reduced by at least half each year, saving approximately 160 kg (355 lb) of helium, and argon usage would be curtailed, saving about 40,000 kg (88,800 lb) of that gas. No oxygen would be required for operations, eliminating the need for 1,000 kg (2,220 lb) of oxygen/yr.

Waste Management.

The change to the preferred alternative has no impact on waste management as analyzed in the EIS.

Facility Accidents.

The most serious accident associated with the preferred alternative is a loss of control of the drying/passivation process in which the fuel in the MCO rapidly oxidizes. The associated release of radioactive particles could, in the "worst case" scenario evaluated in the EIS, result in a maximum individual dose of 0.02 Sv (2 rem) to the offsite resident. The collective dose to the population could result in less than one to as many as 32 latent cancer fatalities if the accident occurs and no protective action is taken. Vacuum drying was to be done at both the Cold Vacuum Drying Facility and at the CSB (hot conditioning) in the preferred alternative; however, a fire is more likely at the CSB than at the CVD Facility because the process at the CSB involves heating the fuel to 300 °C as compared to 50 °C at the CVD Facility. Therefore, eliminating hot conditioning reduces the probability that this serious accident would occur.

Cumulative Impacts Including Past and Reasonably Foreseeable Actions: Land Use, Geological Resources and Ecological Resources.

The change to the preferred alternative has no impact on this consideration as analyzed in the EIS.

Cumulative Impacts Including Past and Reasonably Foreseeable Actions: Air Quality.

Deletion of the hot conditioning process from the preferred alternative reduces the potential for air emissions and, consequently, the potential cumulative impact on air quality.

Cumulative Impacts Including Past and Reasonably Foreseeable Actions: Waste management.

The change to the preferred alternative has no impact on this consideration as analyzed in the EIS.

Cumulative Impacts Including Past and Reasonably Foreseeable Actions: Socioeconomics.

The change to the preferred alternative has no impact on this consideration as analyzed in the EIS.

Cumulative Impacts Including Past and Reasonably Foreseeable Actions: Occupational and Public Health.

Deletion of the hot conditioning process from the preferred alternative reduces the risk of occupational injuries and illnesses.

Adverse Environmental Impacts that Cannot be Avoided.

The change to the preferred alternative has no impact on this consideration as analyzed in the EIS.

Relationship Between Short-Term Uses of the Environment and the Maintenance and Enhancement of Long-Term Productivity.

The change to the preferred alternative has no impact on this consideration as analyzed in the EIS.

Irreversible and Irretrievable Commitment of Resources.

The change to the preferred alternative has no impact on irreversible and irretrievable commitment of resources as analyzed in the EIS.

Potential Mitigation Measures.

The strengthened MCO eliminates over pressurization accidents; otherwise, the change to the preferred alternative has no impact on potential mitigation measures as analyzed in the EIS.

Environmental Justice.

The change to the preferred alternative has no impact on environmental justice as analyzed in the EIS.

Estimated 40-Year Storage and Life-Cycle Costs.

Elimination of the hot conditioning step in the fuel drying process results in a reduction of about $31 Million in the life-cycle cost for the preferred alternative. Part of this reduction is the decrease in Site Services already noted. The remainder is associated with deletion of the equipment associated with the hot conditioning/passivation step and omission of the safety analysis and procedure preparation work supporting its operation.

References

DESH (Duke Engineering and Services-Hanford) 1997. *K Basins Particulate Water Content, Behavior and Impact*, HNF-1523, Rev.0, November 1997.

DOE (U.S. Department of Energy) 1996. *Management of Spent Nuclear Fuel from the K Basins at the Hanford Site, Richland, Washington*, DOE/EIS-0245F, January 1996.

PNNL (Battelle - Pacific Northwest National Laboratory) 1997. *Drying Behavior of K-East Canister Sludge*, PNNL-11628, December 1997.

WMFS (Waste Management Federal Services) 1997. *Safety Analysis Report for Packaging (Onsite) - Multicanister Overpack Cask*, HNF-SD-TP-SARP-017, Rev. 0, July 1997.

Determination

Deletion of the hot conditioning/passivation step from the preferred alternative for the management of spent nuclear fuel from the K Basins at the Hanford Site does not result in potential environmental impacts that are significantly different from those analyzed in the FEIS. Changes in the impacts associated with elimination of this step either reduce or do not affect the environmental impact of the preferred alternative. Therefore, no additional NEPA analysis is required under 10 CFR Part 1021 or 40 CFR Parts 1511-1508.

Signed in Richland, Washington this 27th day of August, 1998, for the U.S. Department of Energy.

John D. Wagoner

Manager

Richland Operations Office

Appendix B

DOE/EIS-0245-FS/SA2

DOE/EIS-0245-FS/SA2

Supplement Analysis

Alternate Fuel Transfer for the 105-KE Basin Spent Nuclear Fuel, 100 K Area, Hanford Site, Richland, Washington

U.S. Department of Energy
Richland Operations Office
Richland, Washington 99352

August 2001

INTRODUCTION

The U.S. Department of Energy (DOE) is planning to transfer spent nuclear fuel (SNF) from the 105-KE Basin (KE) to the 105-KW Basin (KW) to package the SNF into multi-canister overpacks (MCOs) using existing equipment at KW. The MCOs would be transported to the existing Cold Vacuum Drying Facility (CVDF) at KW for vacuum drying and transferred to the 200 East Area Canister Storage Building (CSB). Approximately 1,200 metric tons (1,323 tons) of SNF are stored under water in 3,673 open canisters[1] at KE. Approximately 1,000 metric tons (1,102 tons) of SNF are stored under water in 3,817 closed containers at KW.

The environmental impacts of the management of SNF from the K Basins were analyzed in an environmental impact statement (EIS): DOE/EIS-0245F, *Management of Spent Nuclear Fuel from the K Basins at the Hanford Site, Richland, Washington*, issued in January 1996 (hereafter referred to as the K Basins EIS). In the *National Environmental Policy Act* (NEPA) *of 1969* Record of Decision (ROD, 61 FR 10736, March 15, 1996), DOE selected the preferred alternative that consists of "...removing the SNF from the basins, vacuum drying, conditioning and sealing the SNF in inert gas filled canisters for dry vault storage in a new facility, to be built at Hanford, for up to 40 years pending decisions on ultimate disposition. The K Basins will continue to be operated during the period over which the preferred alternative is implemented". The environmental impacts associated with the preferred alternative considered packaging the SNF at the respective basin.

When the DOE schedule for implementing the preferred alternative was delayed, activities to mitigate the potential to release radioactive substances from the K Basins to the environment were brought under the authority of the *Comprehensive Environmental Response, Compensation and Liability Act* (CERCLA) *of 1980*. A CERCLA Focused Feasibility Study (DOE/RL-98-66, *Focused Feasibility Study for the K Basins Remedial Action*, April 1999) adopted the analyses of environmental impacts provided in DOE/EIS-0245F. A CERCLA ROD was issued in September 1999 (*Record of Decision for the USDOE Hanford 100-KR-2 Operable Unit K Basins Interim Remedial Action*).

The purpose of this Supplement Analysis (SA), prepared in accordance with Section 1021.314 of the DOE NEPA regulations, is to provide a basis for a determination of whether or not a supplemental EIS is required before transferring the KE SNF to KW. The analysis in this SA incorporates the most current process knowledge and data, which reflect differences when compared with K Basins EIS analyses.

Section 1502.9(c) of the Council on Environmental Quality Regulation for Implementing the Procedural Provisions of NEPA (40 CFR 1500-1508) requires the preparation of a Supplemental EIS if: (1) the agency makes substantial changes in the proposed action that are relevant to environmental concerns or (2) there are significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts. Section 1021.314(c) of the NEPA Regulations (10 CFR 1021, 61 FR 36222, July 9, 1996) provides that where it is unclear

[1] This SNF has been stored for varying periods of time ranging from 8 to 24 years. The fuel is corroding and an estimated 50 cubic meters (1,800 cubic feet) of sludge, containing radionuclides and miscellaneous materials, have accumulated on the floor of KE. KE has leaked water and radionuclides to the soil beneath the basin.

whether a supplemental EIS is required, DOE will prepare a SA to support a DOE determination with respect to the criteria of 40 CFR 1502.9(c).

BACKGROUND

The environmental impacts of the disposition of K Basins SNF were analyzed in the K Basins EIS. The following is extracted from the NEPA ROD:

> *"The preferred alternative is referred to in the FEIS as 'drying/passivation (conditioning) with dry vault storage'. In addition to construction of a staging/storage building at the Canister Storage Building (CSB) site, the proposed series of operations to achieve the preferred alternative is presented below. The details of the processes and perhaps their order are expected to change somewhat as the designs evolve and as the results of ongoing testing become available. However, the impacts of the following steps bound those necessary to place the K Basins SNF in safe dry storage:*
>
> - *Continue K Basin operations until the removal of SNF, sludge and debris, and disposition of the water is completed. Make modifications to the K Basins, as necessary, for maintenance, monitoring and safety, and provide systems necessary to support the activities described below*
> - *Remove K Basin SNF from existing canisters, clean and desludge*
> - *Repackage the SNF into fuel baskets designed for multi-canister overpack (MCO) dimensions, that would include provision for water removal, SNF conditioning requirements, and criticality control*
> - *After loading SNF into the MCOs and draining the MCOs, dry the SNF under vacuum at approximately 50°C (120°F), flood the MCOs with inert gas, seal penetrations, and place in transportation casks*
> - *Transport the SNF (in MCOs) in these casks via truck to the Canister Storage Building (CSB) site in the 200 East Area, and provide for temporary vented staging as necessary."*

Subsequent process design analyses and characterization data resulted in a re-assessment of the SNF drying process. The aforementioned information was addressed in DOE/EIS-0245/SA1, *Supplement Analysis of Environmental Effects of Changes in DOE's Preferred Alternative for Management of Spent Nuclear Fuel from the K Basins at the Hanford Site, Richland, Washington* (August 1998). Included therein is a provision that at the CSB, MCOs will be removed from the transportation casks, weld-sealing a final cover on the MCOs containing the SNF in an inert gas, and placing the MCOs in dry interim storage in a vault for up to 40 years.

One of the alternatives analyzed in the K Basins EIS (but not selected in the ROD) was the 'Enhanced K Basins Storage Alternative', which involved consolidation of the SNF in KW for long-term, wet storage. One component of this alternative was the transfer of containerized fuel from the KE to KW. That is, existing canisters of KE SNF could be repackaged at KE after installation of appropriate equipment at KE. The containerized fuel would be placed within MCOs, loaded into a shipping cask, and transferred approximately 0.4 kilometer (0.3 mile) to KW.

Since the NEPA ROD was issued, the K West Fuel Removal System has been constructed and operated, successfully transferring SNF from KW to the CVDF and CSB. Ongoing evaluations aimed at reducing personnel exposure and cost and schedule have prompted DOE to reconsider SNF consolidation at KW.

DESCRIPTION OF PROPOSED KE BASIN TO KW BASIN SNF TRANSFER

The following is a summary of the proposed alternate fuel transfer, which is shown schematically in Figure 1.

As shown in Figure 1, sludge in SNF canisters in KE would be removed via vacuum and placed into containers and stored for eventual transport to T Plant[2]. The SNF canisters would be moved to the KE loadout location and placed into a cask. The cask would be loaded (and unloaded) underwater. For conservatism, it is assumed that the capacity of the transfer cask is 10 canisters of SNF (representing approximately 400 transfers to move all the KE SNF canisters to KW). The cask would be decontaminated to the degree practicable. The cask would be placed into a contamination boundary overpack to provide containment of contamination during transfers.

The cask/overpack would be transferred to an appropriate transfer vehicle (e.g., lowboy trailer). The cask/overpack would be moved overland approximately 0.4 kilometer (0.3 mile) to KW. The cask would be removed from the overpack and transferred to the receiving location in KW, where the SNF canisters would be removed and placed within KW for storage.

The process essentially would be reversed to decontaminate and remove the cask/overpack from KW and return the cask, empty, to KE for reuse.

It is expected that a substantial quantity of KW SNF will have been transferred to CVDF/CSB before initiation of the KE SNF transfers, thereby providing sufficient space to accommodate the KE SNF in KW. Consideration would be given to prioritizing the transfer of KE SNF to CVDF/CSB.

POTENTIAL ENVIRONMENTAL CONSEQUENCES OF THE PROPOSED ACTION

Estimates of the potential environmental impacts associated with management of SNF at the 105-K Basins are included in Chapter 5.0 ("Environmental Consequences") of the K Basin EIS.

[2] Additional details regarding sludge are found in the aforementioned CERCLA ROD and in DOE/EA-1369, *Environmental Assessment, K Basins Sludge Storage at 221-T Building, Hanford Site, Richland, Washington* (June 2001).

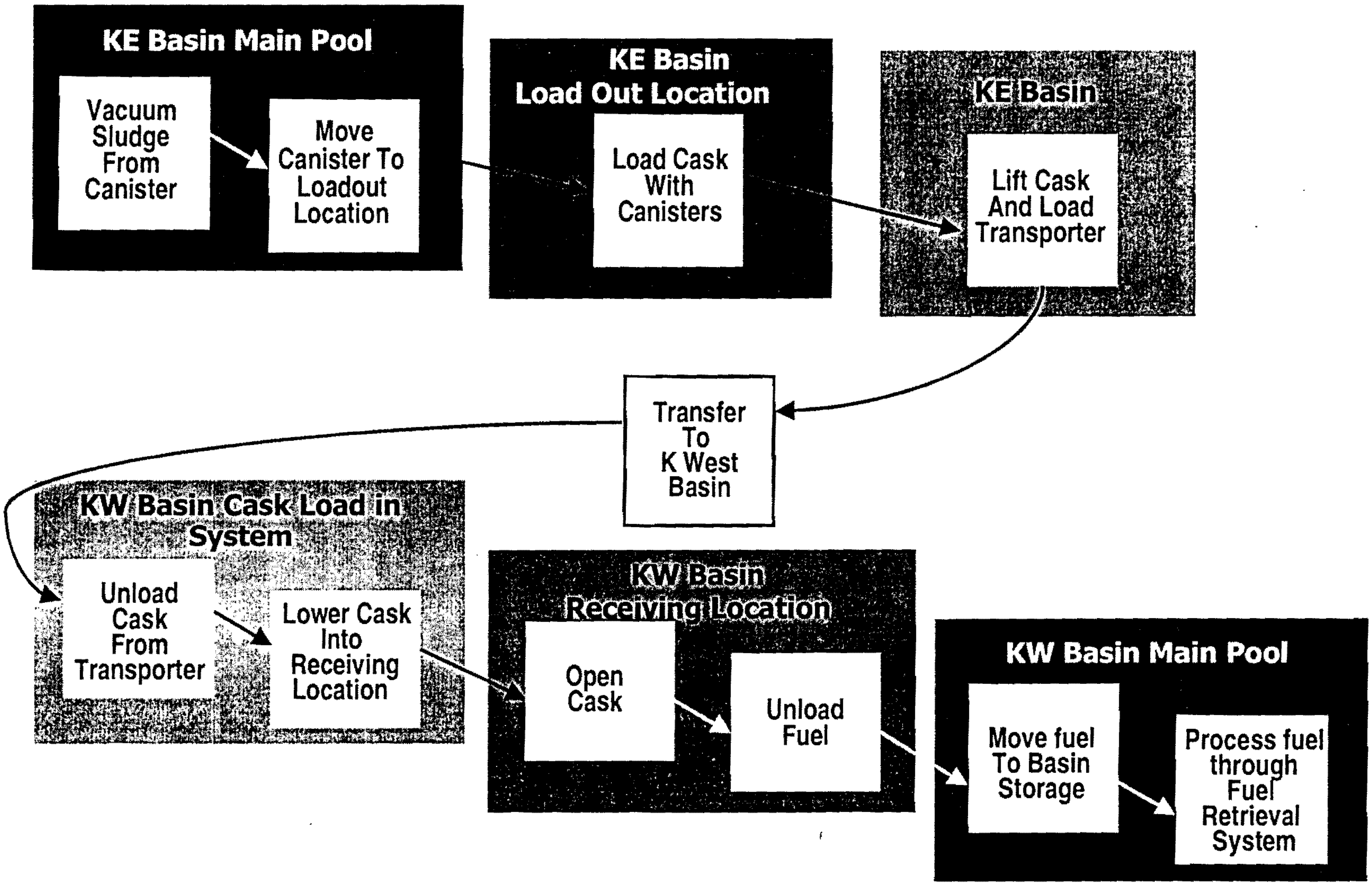

Figure 1. Proposed Alternate Fuel Transfer.

Environmental Impacts

Overall, no substantial changes in environmental impacts (as described in the K Basin EIS, Chapter 5.0, for the 'Enhanced K Basins Storage Alternative') are anticipated for the following: land use, socioeconomics, cultural resources, aesthetic and scenic resources, geologic resources, air quality and related consequences, water quality and related consequences, ecological resources, noise, transportation, site services, waste management, cumulative impacts including past and reasonably foreseeable actions, adverse environmental impacts that cannot be avoided, the relationship between short-term uses of the environment and the maintenance and enhancement of long-term productivity, irreversible and irretrievable commitment of resources, potential mitigation measures, environmental justice, and the estimated 40-year storage and life-cycle costs. Specific impacts associated with construction, routine operations, and accident scenarios are addressed as follows.

- Construction

It is expected that construction activities at KE and KW to support the proposed action would be limited to minor modifications to existing equipment, or fabrication of similar fuel handling tools used at KW for use at KE. Modifications to the KE and KW crane/monorail systems and ancillary equipment would be required to ensure load capacity. Modifications and equipment fabrications have been, and are being, conducted routinely on the Hanford Site and at 105-K Basins. These are typical commercial industrial activities, and would not be expected to provide substantial adverse environmental impacts beyond those addressed in the aforementioned K Basin EIS. In fact, the proposed action would eliminate the need for installation of a K East Fuel Removal System and K East Cask Loadout System, and would reduce the projected personnel dose. Preliminary engineering evaluation (SNF-7279, *Engineering Study of Alternative Fuel Transfer Strategy*) indicates that a potential personnel dose for construction activities associated with the proposed action could range between 32 person-rem and 64 person-rem.

A cask/overpack specifically designed for moving SNF between KE and KW would be constructed. The new cask would be designed to minimize the number of cask transfers, thereby minimizing operational dose.

- Routine Operations

Potential consequences from routine operations to the offsite individual, onsite personnel, and KE and KW personnel associated with the proposed action have been evaluated.

Offsite and onsite personnel

Radiological gaseous effluents from KE SNF removal and transfer were calculated in the K Basins EIS. As discussed therein (Section 5.7.1, specifically for fuel removal and transfer to the KW Basin in the 'Enhanced K Basins Storage Alternative'), the potential dose and consequences to the offsite resident and onsite personnel from containerization and removal of the entire inventory of SNF from KE were projected to be small.

For current operations, potential radiological airborne emissions from the K Basins have been documented in two approved air operating permits; i.e., notices of construction (NOC): DOE/RL-96-101, *Radioactive Air Emissions Notice of Construction Fuel Removal for 105-KE Basin* and DOE/RL-97-28, *Radioactive Air Emissions Notice of Construction Fuel Removal for 105-KW Basin*. Because KW has less sludge and overall lower levels of smearable contamination, the particulate emission estimates for KW was bounded by adopting the emission estimates associated with KE, even though the SNF in KW is in closed canisters versus the open canisters in KE. In the referenced NOCs, the resultant estimated abated total effective dose equivalent to the maximally exposed offsite individual was calculated as 2.6 x 10-3 millirem/year (the sum of KE and KW, current baseline). This dose was based on a total release of 4.8 x 10-3 curies[3], less tritium and krypton-85 that contribute less than one percent of the offsite dose. The proposed action would not result in an increase in estimated radioactive releases to the environment, and therefore, potential offsite doses would remain small and below regulatory guidelines.

K Basins Personnel

Total projected facility worker dose as presented in the K Basins EIS ranged from approximately 900 – 1500 person-rem, depending upon the alternative. Specifically, in the 'Drying/Passivation Alternative,' a range of radiological exposure to workers was estimated to be approximately 960 -1,200 person-rem. A portion of the total dose (approximately 365.6 person-rem) was attributed to KE/KW facility operations, fuel retrieval, fuel drying and fuel loading/transport. Those doses are summarized in Table 1, as extracted from WHC-SD-SNF-TI-013, *K Basins Environmental Impact Statement Technical Input.*

Table 1. Partial facility worker dose (person-rem) for specific activities associated with the 'Dry Storage Conditioning Alternative'*

Activity	KE	KW
Operations	40.6	2.0
Fuel retrieval	33.8	0.6
Load fuel into MCO	168.2	113.6
Transport fuel	3.4	3.4
Total facility worker dose	246.0	119.6

* Extracted from WHC-SD-SNF-TI-013, *K Basins Environmental Impact Statement Technical Input.*

For the proposed action discussed in this SA, preliminary K Basins personnel dose consequences associated with routine operations have been estimated. As discussed in SNF-7279, the K Basins personnel dose during operations could range between 86 and 133 person-rem. Therefore, as shown in Table 2, the maximum total estimated dose to K Basins personnel (construction plus retrieval/consolidation operations) for the proposed action is approximately 197 person-rem (the aforementioned 64 person-rem plus 133 person-rem). Additionally, packaging the KE SNF into MCOs (once at KW) and transferring to the CVDF would result in a maximum estimated K Basins personnel dose of 203 person-rem.

[3] Radionuclides included in the aforementioned NOC dose calculations are cobalt-60, strontium-90, ruthenium-106, cesium-137, plutonium-238, plutonium 239/240, plutonium-241, and americium-241.

Table 2. Projected Total K Basins Facility Worker Dose (Person-Rem) for Transferring KE Spent Nuclear Fuel to the Cold Vacuum Drying Facility.*

Activity	Baseline	Proposed alternative fuel transfer
Construction		
• 105 KE Basin Modifications**	250	64
Operations		
• Retrieve KE SNF, repackage SNF in MCOs in KE, transfer to CVDF	75	--
• Retrieve KE SNF, place existing canisters into cask, transfer to KW		133
• Retrieve KE SNF that was transferred to KW, repackage SNF in MCOs in KW, and transfer to CVDF		6
Total Estimated Construction and Operations Dose	325	203

*Extracted from SNF-7279, *Engineering Study of Alternative Fuel Transfer Strategy*.
**Facility worker dose from 105 KW modifications to support KE SNF transfer is not included in the construction impacts. Preliminary calculations indicate facility worker dose would be negligible (i.e., ~0.4 person-rem).

For comparison, the projected K Basins personnel dose associated with transfer of KE SNF to CVDF under the current baseline also is shown in Table 2. The baseline assumptions include modifying KE for MCO loading capability, and transferring loaded MCOs to the CVDF. The total estimated K Basins personnel dose (construction and operations) under baseline conditions is 325 person-rem.

Thus, while the K Basins personnel dose during operations is higher for the proposed alternate fuel transfer when compared to the current baseline, the total K Basins personnel dose is substantially smaller as a result of less construction. Further, the projected K Basins personnel dose of 203 person-rem for the proposed action is bounded by projected doses analyzed in the K Basins EIS (see Table 1).

SNF Transfer

SNF transfer impacts associated with routine operations would be bounded by those presented in the K Basins EIS. As stated therein (Section 5.11.1), for all SNF handling options, the expected number of fatalities, for both truck and rail, would be less than 4.8×10^{-7} (onsite) for the entire campaign. Current planning does not consider rail movement.

- Accident Scenarios

Accident scenarios were considered in the K Basins EIS for SNF removal. As stated in the aforementioned K Basins EIS, bounding plausible accidents for fuel removal from the K Basins are similar to those discussed in the no action alternative, except that larger quantities of fuel might be handled in a single operation when transferring the fuel in MCOs. In the K Basin EIS (Section 5.15.5), a crane failure accident with a loaded MCO was evaluated, wherein an MCO in the process of placement or retrieval is dropped by lifting equipment or human failure. The MCO falls to the floor of the storage area. The drop causes a release of MCO contents (fuel, sludge, and water) to the staging area floor, resulting in an airborne release. The consequences of this accident in terms of dose and risk of latent cancer fatalities in the exposed population were calculated. In this scenario, the maximum individual dose is 0.78 rem for onsite personnel. The collective dose to the offsite population (i.e., 2,400 person-rem using 95 percent meteorology) would result in at most two latent cancer fatalities if the accident occurred. It would be expected that this accident scenario would bound potential consequences associated with the proposed action.

Additionally, an accident could occur during overland transfer between KE and KW. As stated in the K Basins EIS (Section 5.11.1), the onsite radiological impacts for both truck and rail are less than 3.0×10^{-4} latent cancer fatalities for the entire campaign. Further, the calculated dose to the maximally exposed individual [located 100 meters (328 feet) from the accident location] was 2.8 rem (1.1×10^{-3} latent cancer fatalities). The calculated dose to the maximally exposed individual onsite located 750 meters (2,460 feet) from the accident site was 0.9 rem (3.6×10^{-4} latent cancer fatalities). Nonradiological transportation impacts from accidents also were presented in the K Basin EIS (Section 5.11.1). These impacts, expressed as onsite fatalities, were calculated to be less than 6.6×10^{-5} for the entire campaign.

DETERMINATION

Based on the information presented in this Supplement Analysis, I determine that the proposed action does not constitute a substantial change in actions previously analyzed in the K Basins EIS, and that there are no significant circumstances or new information relevant to environmental concerns associated with the proposal. Therefore, no additional NEPA review is required.

Issued at Richland, Washington, this 01 day of August, 2001.

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