FINDING OF NO SIGNIFICANT IMPACT

K BASINS SLUDGE STORAGE AT 221-T BUILDING

HANFORD SITE, RICHLAND, WASHINGTON

U.S. DEPARTMENT OF ENERGY

June 2001

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AGENCY: U.S. Department of Energy

ACTION: Finding of No Significant Impact

SUMMARY: The U.S. Department of Energy (DOE) has prepared an Environmental Assessment (EA), DOE/EA-1369, for storage of sludge from the K Basins in the 221-T Building canyon in the 200 West Area, Hanford Site, Richland, Washington. DOE has determined that the proposed action is not a major federal action significantly affecting the quality of the human environment, within the meaning of the *National Environmental Policy Act of 1969* (NEPA). Therefore, the preparation of an Environmental Impact Statement (EIS) is not required.

ADDRESSES AND FURTHER INFORMATION:

A single copy of the EA and further information about the proposed action is available from:

G. H. Sanders, Director
Waste Management Division
U.S. Department of Energy
Richland Operations Office
P. O. Box 550 H0-12
Richland, Washington 99352
(509) 372-1786

For further information regarding the DOE NEPA Process, contact:

Carol M. Borgstrom, Director
Office of NEPA Oversight
U.S. Department of Energy
1000 Independence Avenue, S.W.
Washington, D.C. 20585
(202) 586-4600 or (800) 472-2756

PURPOSE AND NEED: The U.S. Department of Energy requires cost effective and safe interim storage capacity in the 200 Areas for sludge currently in the K-East and K-West Basins (K Basins) in the 100 Area on the Hanford Site.

BACKGROUND: The K-East (KE) and K-West (KW) Basins in the 100-K Area of the Hanford Site were built in the early 1950's and have been used to store spent nuclear fuel (SNF) underwater. In 1992, the decision to deactivate the Plutonium-Uranium Extraction (PUREX) Plant left approximately 2,100 metric tons (2,300 tons) of SNF in the K Basins with no means for near-term processing. A substantial fraction of the SNF in the K Basins has become degraded due to cladding breaches during reactor discharge, and corrosion has continued during underwater storage.

The fuel in the KE Basin is stored in open top canisters, some of which have screened bottoms while others have closed bottoms. The open canisters release soluble fission products into the basin water and allow fuel corrosion products to combine with canister rack dust, concrete dust, and environmental particulate material. These materials settle to the basin floor as a fine sludge, and depths exceeding three feet have been measured in one of the pits in the KE Basin. The closed stainless steel canisters used at the KW Basin also contain corroded fuel. Some leakage of soluble fission products to the water in the KW Basin has occurred but at a much lower rate than at the KE Basin.

The KE Basin leaked up to 56.8 million liters (15 million gallons) of contaminated water to the soil in the 1970s and another 341,000 liters (90,000 gallons) in early 1993. Subsequently, repairs were made to the basins to prevent further leakage to the environment; however, the integrity of the basins continues to degrade with age, as does the condition of the SNF. The potential hazards associated with leaks of the sludge and basin water to the environment provide the impetus to remove the sludge from the basins as soon as possible.

In the early 1990s, the DOE determined that action was necessary to mitigate further SNF degradation releases from the K Basins. The *National Environmental Policy Act* (NEPA) *of 1969* process was used to evaluate alternatives for action and an environmental impact statement (EIS), *Management of Spent Nuclear Fuel from the K Basins at the Hanford Site, Richland, Washington*, was issued in January 1996. The alternatives analyzed in the EIS focused on managing the SNF, with secondary discussions on the sludge, water, and debris. The sludge alternative selected in the resulting 1996 NEPA Record of Decision (ROD) was to remove the K Basins sludge for transfer to either a tank farm or solid waste management facility in the 200 Areas.

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 (FFS), *Focused Feasibility Study for the K Basins Remedial Action*, was prepared in April 1999. The scope of the FFS included sludge treatment to meet waste acceptance criteria, removal from the basins, and transportation to the receiving facility. The analysis of environmental impacts related to the removal and transportation of the sludge included in the K Basins EIS was adopted into the FFS by reference. Environmental impacts were further discussed in the NEPA values section of the FFS.

In July 1999, DOE-RL authorized a new path forward for the management of K Basins sludge, and a CERCLA ROD was issued by DOE-RL, EPA, and the Washington State Department of Ecology (Ecology) in September 1999. The new path forward and CERCLA decision triggered renegotiation of Tri-Party Agreement milestones, which established the K Basins sludge removal schedule currently specified in the Tri-Party Agreement milestones M-34-08 (Initiate Full Scale K-East Basin Sludge Removal – 12/31/2002) and M-34-10 (Complete Sludge Removal from K Basins – 8/31/2004).

Once the sludge is separated from the fuel and removed from the K Basins, the sludge would be managed as remote-handled transuranic (RH-TRU) waste. Due to the presence of poly-chlorinated biphenyls (PCBs), the sludge will be regulated under the Toxic Substances Control Act (TSCA).

The K Basins sludge would be retrieved and managed as two separate waste streams. The majority of the sludge volume, up to about 62 m^3 (2200 ft^3), would be packaged in larger, Type 1 containers. This sludge consists primarily of less reactive components (windblown sand and rocks, spalled concrete from basin walls, iron and aluminum corrosion products, ion exchange material, uranium oxides) along with a small quantity of uranium metal particles and fuel corrosion products.

The second sludge stream consists of up to about 8 m^3 (280 ft^3) of sludge and would be packaged in Type 2 containers. This sludge has a larger amount of reactive metallic uranium fragments and fuel corrosion products. This sludge stream is to be packaged in smaller diameter Type 2 containers, and might require underwater storage similar to current storage conditions at the K Basins.

Before the proposed action of storing the sludge in the 221-T Building of the T Plant Complex begins, the Shippingport fuel that currently resides in the 221- T Building canyon pool (Cell 2R) will be moved out of the pool to the Canister Storage Building, as described in the *Environmental Assessment* (EA) *Management of Hanford Site Non-Defense Production Reactor Spent Nuclear Fuel* (DOE/EA-1185). The proposed action is compatible with the land use designation of Industrial Exclusive Area as defined in the *Final Hanford Comprehensive Land-Use Plan Environmental Impact Statement* (DOE/EIS-0222F).

DOE issued a Notice of Intent to begin preparation of a draft Hanford Site Solid (Radioactive and Hazardous) Waste Program EIS (HSW-EIS) that examines the management of various waste volumes including, but not limited to, the interim storage and treatment of the current K Basins sludge. This EA for proposed storage of the sludge in the 221-T Building is an interim action to, and would not prejudice any alternatives considered or decisions that would be made in the HSW-EIS. The sludge would remain in storage until integrated into the plans for treating and disposing of the other RH-TRU waste located on the Hanford Site, in accordance with Tri-Party Agreement Milestone M-91-00. Treatment and disposal issues of the K Basins sludge would be addressed in future environmental documentation.

PROPOSED ACTION: DOE proposes to store the sludge in the 221-T Building canyon of T Plant Complex. Before sludge acceptance at T Plant Complex, the proposed action would include several modification upgrades to the 221-T and 271-T Buildings. The proposed action would offload sludge containers (Type 1 and Type 2 containers), which have been transferred in a shipping cask and transport system via truck and trailer, into the 221-T Building canyon. Trucks would arrive with one cask containing one container per transfer. The proposed action would be expected to store up to 70 m^3 (2,480 ft^3) of K Basins sludge depending upon the selected storage configuration.

Several determinations on specific activities within the proposed action would be made during final design involving: final container size and container storage system within the applicable cells, Type 2 container storage in the pool verses in dry cells, seismic upgrades as needed, and any fire protection requirements. A criticality alarm system is not required for operations involving the storage of the sludge in the 221- T Building per HNF-6435.

PROPOSED T PLANT COMPLEX UPGRADES

The following briefly describes the anticipated upgrade activities that would occur before sludge receipt and interim storage.

- Install new sludge storage containment system, sump pumps, leak detectors, instrumentation and controls in the 221-T Building canyon, as necessary. New floors constructed of self-leveling concrete might be added to the existing dry cells for storage of the containers.

- Install a new pool cover for the 2R Cell of the 221-T Building if it is decided to store Type 2 containers in the pool. In addition, a new container storage system would be installed in the pool, if necessary. Existing water conditioning systems (coolers, ion exchange columns, etc.) might be modified, replaced, or removed.

- Install a new fire alarm system in the 221-T Building, if necessary.

- Install a manual Class 3, or equivalent, dry standpipe system in the 221-T Building.
- Install a new radiation monitor and HEPA filter on the helium purge system in the 221-T Building tunnel.
- Install new door locks in the 221-T Building canyon in accordance with safeguards and security requirements.
- Develop a new remote-operated (by crane) water addition system for occasionally adding water to the containers as required.
- Provide seismic upgrades as necessary.
- Provide operational support for the proposed action by installing a new automatic sprinkler system throughout three floors of the 271-T Building.
- Install an alpha continuous air monitor (CAM) and reactivate the beta/gamma CAM to 291-T stack.

PROPOSED PROCESS FOR RECEIPT AND PLACEMENT OF SLUDGE CONTAINERS

The receipt and remote placement of the containers into interim storage at T Plant Complex is detailed as follows. Container movement within the 221-T Building would be performed remotely by crane, one container at a time.

- *Receive Sludge Containers.* The containers would arrive from K Basins via the transport vehicle (truck and trailer). Each transfer would consist of one shipping cask that would be inspected according to approved receipt methods.
- *Unload Sludge Containers and Place in Interim Storage.* Container unloading operations would be performed remotely using the canyon crane system. The cask would be vented and purged with helium. The shipping cask lid bolts would be removed, the lifting attachment connected to the cask lid, and the tunnel evacuated of personnel. The helium purge/venting system would include a radiation monitor to verify that the storage container maintained integrity during transport and would purge all hydrogen from the shipping cask. The crane operator would position the canyon crane, which would be outfitted with the appropriate cask lid grappling device, remove the cask lid, and place the lid on the trailer bed or lid stand. The crane would be repositioned and, with the appropriate container-lifting device, the container would be lifted out of the cask and moved into an interim storage location in the canyon pool or a dry cell, depending on container type.
- *Dry Storage Containers in 221-T Building Canyon Cells.* Once the containers (Type 1 and possibly Type 2) are placed in the interim dry storage location, continuing surveillance would be performed to ensure that safety, regulatory, and safeguards and security requirements are met. Water levels within the dry storage containers would be monitored, and water additions would be made remotely as necessary.
- *Wet Storage Containers in Pool (2R Cell).* Once the Type 2 containers are placed in the interim underwater pool storage location, if necessary, continuing surveillance would be performed to ensure

that safety, regulatory, and safeguards and security requirements are met. Pool storage conditions (water quality, water temperature, water level, and ion exchange column status) would be monitored and provisions would be made for remote water addition to the pool.

PROPOSED SLUDGE STORAGE CONFIGURATION

Based on final design results determined in criticality and heat rejection analysis, the size of the Type 1 and Type 2 containers will be designed to ensure a safe storage configuration. Final design would analyze maximum sludge loading and container sizing in an effort to minimize the number of shipments and number of containers needed. Both container types would be configured as right circular cylinders and would have lids with a minimum of two nozzles. During storage, one nozzle would be capped, or used to add water during storage life, and the other nozzle would function as a passive vent to prevent pressurization and allow the escape of hydrogen and other gasses that would be produced chemically and radiolytically during storage. For containers to be stored in the dry cells, the vent would be fitted with a NucFil®[1] filter. Containers that might be stored underwater would be fitted with a vent with a one-way valve to preclude ingress of water to the containers.

Sludge in containers would be overlaid by a layer of water to prevent the sludge from drying out in the containers. A void space would be retained at the top of the container to allow for small expansion of the sludge. These sludge and water filling levels would be determined during final design. Each container would have its own unique characteristics with regard to waste specifics and dose rate.

The Type 1 container would have a range of an outer diameter of approximately 61 to 152 centimeters (24 to 60 inches) and a height of approximately 1.5 to 4 meters (5 to 13 feet). The nominal stainless steel wall thickness for the Type 1 containers is expected to be between one and 3 centimeters (1/4 to one inch). Based on anticipated sludge stream volumes, up to 140 Type 1 narrow container size or up to 40 Type 1 wide container size would be needed.

The second container is designated a Type 2 container with an approximate inner diameter of 25 centimeters (10 inches) and a height of approximately 4 meters (13 feet). The stainless steel wall thickness for the Type 2 containers would be approximately one to 3 centimeters (1/4 to 1 inch). Based on updated sludge stream volumes, less than 76 Type 2 containers would be needed.

The Type 2 sludge stream has a higher reactivity than the Type 1 stream. Depending on results of final heat transfer analysis, type 2 containers might need to be stored underwater. If the Type 2 containers are stored in the 2R Cell (pool), the containers would not require the addition of water during storage because underwater storage would minimize evaporation of water that initially is loaded with the sludge. Type 2 containers also may incorporate a diagonal bar or other passive feature to preclude large, spanning gas bubbles from forming and causing a sludge plug to rise to the top of the container, which would plug the vent.

A storage container system would be designed specifically to hold Type 1 containers for use in the dry cells. The storage container system for the Type 1 narrow container design would be arranged in an array, conservatively spaced about 64 centimeters (25 inches) center-to-center, with the spacing maintained by the storage racks. Up to 8 dry cells would have a capacity to hold a maximum of 33 Type 1 containers of

[1] NucFil is a registered trademark of Nuclear Filter Technology, 741 Corporate Circle, Suite R, Golden, Colorado 80401, USA.

narrow design or 5 to 6 Type 1 wide containers with the maximum 152 centimeters (60 inches) diameter design.

A similar design would be used for the sludge storage container system to hold the smaller Type 2 containers for use either in a dry cell or the pool. Type 2 containers would be spaced about 33 centimeters (13 inches) edge-to-edge with the 25 centimeters (10 inches) inside diameter design. Up to 3 dry cells would have a capacity to hold a maximum of 35 Type 2 containers. The pool, if used, would hold a maximum of 76 Type 2 containers.

ALTERNATIVES CONSIDERED: No-Action: The No Action Alternative to the proposed action would involve the continued storage of K Basins sludge in the existing KE and KW Basins for up to 40 years with no modifications except for maintenance, monitoring, and ongoing safety upgrades. This would result in the sludge remaining in the K Basins, which were not designed for a 90-year life (50 years to date and up to an additional 40 years). This alternative would require increasing maintenance of aging facilities with associated potential for increased radiological impacts on personnel and would not preclude leakage of radionuclides to the soil beneath the basins and near the Columbia River. The T Plant Complex would not be upgraded and would not receive and store sludge.

Alternative to Store Sludge in Double-Shell Tanks: This alternative would store the K Basins sludge on an interim basis in the double-shell tanks (DST) farms in the 200 East Area, and was the preferred alternative in DOE/EIS-0245F. The requirements for processing K Basin sludge for acceptance into the DST farms would result in excessive costs and delays for safe storage of the sludge, and is inconsistent with the CERCLA record of decision for DOE/RL-98-66.

Alternative to Store Sludge in the Waste Encapsulation and Storage Facility (WESF): This alternative for interim storage of K Basins sludge in the pool cell of WESF in the 200 East Area was considered. In order to get sludge into WESF with Type 1 or Type 2 containers, WESF would have to be greatly modified and the pool would have to be significantly expanded. If very small sludge containers (10 centimeters or 4 inches) were used for storage of sludge in WESF, then more than twice as many of these small containers compared to the number of strontium and cesium containers currently residing in the WESF pool cell would have to be made to contain all of the K Basins sludge. In any case, modifications to WESF and container additions would not provide adequate capacity for K Basins sludge storage without a significant addition to the WESF pool cell.

Alternative to Store Sludge in a New Facility: An alternative to build a new storage facility for interim storage of the sludge currently in the 100-K Area was considered. However, this alternative would require the need to construct and operate a relatively expensive storage facility.

Alternative to Store Sludge in the Canister Storage Building (CSB): This alternative would store the sludge in the Canister Storage Building (CSB). However, the storage tubes in the CSB are sealed and would not allow venting of the sludge container during storage. Wet storage of the sludge is incompatible with conditions that must be maintained for the storage of dry SNF in the CSB. In addition, the dry storage of the SNF removed from the K Basins and other Hanford facilities would leave insufficient capacity for storage of K Basins sludge.

Alternative for Offsite Storage: An alternative for offsite storage was considered. If this alternative were chosen, the storage of the sludge might be similar to the proposed action, but the cost for storage of the sludge would be more expensive due to shipping costs. In addition, no certified packaging in compliance with U.S. Department of Transportation regulations currently exists to transport the sludge offsite, and there would be increased transportation risks of shipping the K Basins sludge offsite.

ENVIRONMENTAL IMPACTS: Small quantities of gaseous, particulate, or thermal discharges might occur from typical construction upgrade activities within the tunnel and canyon. Sources could include welding and indoor construction equipment. The containers stored in dry cells would remain with cover blocks in-place during upgrades and storage of the containers. Each container would be vented and particulate releases that may occur would be mitigated by capture in a NucFil®[2] filter before entering the ventilation system. The containers that might be stored under water in the pool cell would have a one-way valve, which only allows gasses to vent directly to canyon air. The water would capture any potential particulates. Typical operation activities would not be affected greatly by the proposed action of K Basin sludge storage in the canyon. Only minor radionuclide contamination air releases through the HEPA filtered air system are expected. Under conditions that would be in effect, no substantial increases in overall emissions are envisioned from the proposed action.

It is expected that there would be no adverse effects on cultural resources from the proposed action. In addition, no Federal or State-listed, proposed, candidate, threatened, or endangered species are expected to be affected.

Safety Impacts: No significant impacts are expected. Any work in the T Plant Complex would be performed in compliance with as low as reasonably achievable (ALARA) principles, applicable federal and state regulations, and DOE Orders and guidelines. Personnel radiation protection during both upgrades and operation would be provided through the use of engineering controls and remote operations. The potential radiation received by personnel during the proposed action would be less than the typical exposure that occurs during current 221-T Building canyon cleanout of contaminated equipment operations and removal of the Shippingport fuel, because less contaminated material and fewer radiation sources would be present during the proposed action. Radiation exposures would be controlled administratively below DOE limits established in 10 CFR 835, "Occupational Radiation Protection" and the *Project Hanford Radiological Control Manual*. Those limits require that individual radiation exposure be controlled below an annual total effective dose equivalent (TEDE) of 5 rem.

The following section contains mitigated accident consequences for two selected representative accident scenarios: Type 1 Container Failure Due to Impact (low consequence, high frequency) and Type 2 Container Failure Due to Hot Overpressure (high consequence, low frequency). All radiological dose consequences provided are 50-year TEDE in rems.

Type 1 Container Failure Due to Impact

The failure of one or more narrow Type 1 containers (61 centimeters [24 inches] outside diameter) because of impact could result from the drop of a dry cell cover block into a cell containing sludge containers in a storage container system. This scenario assumes, as a worst case, that a cover block is dropped end first into a dry cell containing a full rack of Type 1 containers such that eight of the sludge containers in dry storage are damaged. Each damaged container is assumed to immediately leak its complete sludge inventory onto the bottom of the storage container system. Since no event that could result in failure of the canyon exhaust system as well as a cover block drop has been identified, credit is taken for the high-efficiency particulate air (HEPA) filtration in the canyon exhaust system. Because cell cover block drops

[2] NucFil is a registered trademark of Nuclear Filter Technology, 741 Corporate Circle, Suite R, Golden, Colorado 80401, USA.

have occurred on the Hanford Site, this accident initially has been assigned a frequency category of Anticipated (10^{-2} to 10^{-1}/year).

The risk to the directly involved person (i.e., an individual in the immediate vicinity during a cover block drop) is highly dependent on the specific location of the person and the nature of the accident. Many of the routine activities in the 221-T Building canyon, including the movement of the cover blocks, are performed remotely, and personnel are generally not expected to be in the canyon during cover block movement.

Collective dose to the offsite population within approximately 80 kilometers (50 miles) from a filtered release resulting from the Type 1 container failure due to impact was calculated to be 3.6 E-03 person-rem. Based on a dose-to-risk conversion factor of 5.0 E-4 latent cancer fatality per person-rem, this dose equates to 1.8 E-06 latent cancer fatalities (LCF). The temporary emergency exposure limits (TEEL) for uranium, airborne concentrations of uranium at all receptor locations are several orders of magnitude less than TEEL-0, below which most people would experience no appreciable risk of health effects. All Type 1 container accident consequences are bounded be the Type 2 accident described in the following section.

Type 2 Container Failure Due to Hot Over Pressure

Type 2 container failure due to hot over pressure could be caused by gas formation within the container or by an overheated condition of the sludge. Temperature increases within the container might result from either an unexpected degree of heating in a dry-stored container or from loss of water from the pool in the case of the pool-stored containers. In either case, the container vent also must become plugged for this accident to occur. In the bounding representative accident scenario, one Type 2 container is assumed to breach in air because of high internal pressure, leading to a flashing spray of the entire contents of the container. Based on the multiple failures that would have to occur to produce this accident, it has been assigned a frequency category of Unlikely (10^{-4} to 10^{-2}/year). Since no event that could result in failure of the canyon exhaust system as well as hot over pressure of a container has been identified, credit is taken for the HEPA filtration in the canyon exhaust system.

In the event of a spray release resulting from hot over pressurization of a Type 2 container, it is assumed that any personnel that might be in the work area immediately would evacuate the area. Evacuation time to that location would be measured in minutes.

Collective dose to the offsite population within approximately 80 kilometers (50 miles) from a filtered release resulting from hot over pressurization of a Type 2 container was calculated to be 2.2 person-rem. Based on a dose-to-risk conversion factor of 5.0 E-4, this dose equates to 1.1 E-03 LCF. The TEELs for uranium, the airborne concentration of uranium at all receptor locations is less than TEEL-0. TEEL-0 represents the threshold concentration below which most people would experience no appreciable risk of health effects. This accident scenario bounds the maximum size containers that would be evaluated during detailed design.

Nonradiological risks to workers from occupational illness or injury are based on statistics for DOE and DOE contractor experience. The lost work day rate is 63 per 200,000 hours of construction work. The fatality rate is close to zero per 200,000 hours of work. About two lost work day and no fatalities would be expected during the construction upgrades. Public health and safety will not be affected because the area is closed to the general public. Typical construction hazards would exist; however, the risk of severe accidents would be small.

Socioeconomic Impacts: Temporary construction and existing Hanford Site and operations personnel would be used during construction and operations, therefore no socioeconomic impacts are expected from the proposed action.

Environmental Justice: Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, requires that federal agencies identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of their programs and activities on minority and low-income populations. Minority and low income population groups are present near the Hanford Site. The analysis of the impacts in this EA indicates that there will be minimal impacts to both the offsite population and potential workforce by implementing the proposed action, because the proposed action will occur predominately on the Hanford Site and the offsite environmental impacts from the proposed action in this EA are expected to be minimal. Therefore, it is not expected that there will be any disproportionate impacts to any minority or low-income portion of the community.

Cumulative Impacts: Cumulative environmental impacts were considered but no significant cumulative impacts are expected from implementation of the proposed action.

DETERMINATION: Based on the analysis contained in the EA, and considering the pre-approval comments of the Oregon Office of Energy and Harold Heacock, I conclude that the proposed action to allow cost-effective and safe interim storage for the K Basins sludge in the 221-T Building canyon of T Plant Complex does not constitute a "major federal action significantly affecting the quality of the human environment" within the meaning of NEPA. Therefore, an EIS is not required.

Issued at Richland, Washington, this 20th day of June, 2001.

Keith A. Klein
Manager
Richland Operations Office

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