DOE/EA-0988

Environmental Assessment

Transfer of Plutonium-Uranium Extraction Plant and N Reactor Irradiated Fuel for Storage at the 105-KE and 105-KW Fuel Storage Basins, Hanford Site, Richland, Washington

U.S. Department of Energy
Richland, Washington

July 1995

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ENVIRONMENTAL ASSESSMENT

TRANSFER OF PLUTONIUM-URANIUM EXTRACTION PLANT AND N REACTOR IRRADIATED FUEL FOR STORAGE AT THE 105-KE AND 105-KW FUEL STORAGE BASINS

HANFORD SITE, RICHLAND, WASHINGTON

U.S. DEPARTMENT OF ENERGY

JULY 1995

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MASTER

Summary

The U.S. Department of Energy (DOE) needs to remove irradiated fuel from the Plutonium-Uranium Extraction (PUREX) Plant and N Reactor at the Hanford Site, Richland, Washington, to stabilize the facilities in preparation for decontamination and decommissioning (D&D) and to reduce the cost of maintaining the facilities prior to D&D.

DOE is proposing to transfer approximately 3.9 metric tons (4.3 short tons) of unprocessed irradiated fuel, by rail, from the PUREX Plant in the 200 East Area and the 105 N Reactor (N Reactor) fuel storage basin in the 100 N Area, to the 105-KE and 105-KW fuel storage basins (K Basins) in the 100 K Area. The fuel would be placed in storage at the K Basins, along with fuel presently stored, and would be dispositioned in the same manner as the other existing irradiated fuel inventory stored in the K Basins. The fuel transfer to the K Basins would consolidate storage of fuels irradiated at N Reactor and the Single Pass Reactors.

Approximately 2.9 metric tons (3.2 short tons) of single-pass production reactor, aluminum clad (AC) irradiated fuel in four fuel baskets have been placed into four overpack buckets and stored in the PUREX Plant canyon storage basin to await shipment. In addition, about 0.5 metric tons (0.6 short tons) of zircaloy clad (ZC) and a few AC irradiated fuel elements have been recovered from the PUREX dissolver cell floors, placed in wet fuel canisters, and stored on the canyon deck.

A small quantity of ZC fuel, in the form of fuel fragments and chips, is suspected to be in the sludge at the bottom of N Reactor's fuel storage basin. As part of the required stabilization activities at N Reactor, this sludge would be removed from the basin and any identifiable pieces of fuel elements would be recovered, placed in open canisters, and stored in lead lined casks in the storage basin to await shipment. A maximum of 0.5 metric tons (0.6 short tons) of fuel pieces is expected to be recovered. The recovery and storage of the fuel at the N Reactor is discussed in an approved environmental assessment for the deactivation of the N Reactor facilities.

The proposed action would load the fuel into fuel cask cars and transport the fuel from the PUREX Plant and N Reactor to the K Basins for storage. A maximum of three railcar shipments of fuel would be made, two shipments from the PUREX Plant and one from N Reactor. The K Basins operational limits on allowable packaging and uranium enrichment require that the ZC fuel from PUREX be transported to the 105-KW Basin. These fuel elements would be unloaded at the 105-KW Basin where the canisters would be purged, sealed, and stored with the existing fuel. The PUREX AC fuel elements could be shipped to either the 105-KE or 105-KW Basin where the fuel would be unloaded, packaged into canisters (at 105-KW Basin only), and placed with the other fuel already stored in the basin. The canisters of ZC fuel from N Reactor would be transferred to 105-KW Basins, unloaded, and stored with the existing fuel.

Several reasonable alternatives to the proposed action were identified and evaluated. These alternatives include the following:

- No-Action
- Process the Fuel in the PUREX Plant's Dissolver Cells
- Store the Fuel at a Hanford Location Other than the 105-KE and 105-KW Fuel Storage Basins.

The No-Action Alternative would leave the fuel elements stored at the PUREX Plant and N Reactor, and require that these facilities be maintained as fuel storage facilities. As a result, the reduction in the safety hazard classification, for N Reactor, and the other objectives of deactivation and stabilization would not be met. Processing the fuel in the PUREX Plant would require the restart of a portion of the PUREX Plant and would convert the fuel from a relatively small quantity of solid material to a relatively large quantity of high-level liquid waste, which would be transferred to underground storage tanks for storage. Storing the fuels in a Hanford location other than the K Basins would essentially require the transfer to T Plant, located in the 200 West Area, which has the only other onsite operational storage pool suitable for AC and ZC fuel storage. The T Plant facility would require extensive modification to accommodate the fuel.

A review of approved shipping containers for the onsite shipment of fuel indicates that there are no readily available alternatives to the irradiated fuel transfer cask cars which can handle the AC and ZC fuel.

The K Basins are currently the primary Hanford Site location for storage of 2,109 metric tons (2,324 short tons) of irradiated fuel from the retired production reactors. Requirements for the handling and storage of the irradiated fuel can be met by equipment and systems already in place.

No construction would be required for the proposed action. Therefore, no impacts to historic or archeological resources or plant and animal life would be expected. No critical habitat, floodplains, or wetlands would be affected. No socioeconomic or environmental justice impacts are expected.

The routine movement of irradiated fuel, by rail, between the PUREX Plant, N Reactor, and the K Basins, was performed on the Hanford Site for many years, and no rail accidents have occurred. The proposed action would not result in any discharge of liquids to the environment. Air emissions would occur over a short period of time during transport, and would be limited to exhaust gases and heat from the diesel locomotive used to transport the fuel, and a small quantity of radionuclide emissions from the enclosed tank on the rail cask cars used to transport the fuel. These radionuclide emissions from transporting the fuel and unloading it at the K Basins are estimated to result in a dose of 5.2×10^{-9} roentgen equivalent man (rem) effective dose equivalent (EDE) to the offsite maximally exposed individual (MEI). This is estimated to result in 2.6×10^{-12} latent cancer fatalities (LCF).

N Reactor and PUREX Plant workers involved in the preventive maintenance, loading and decontamination of the rail cask cars would receive an estimated dose of 0.8 person-rem, potentially resulting in 3.2×10^{-4} LCFs. The 105-KE and 105-KW workers involved with the unloading, fuel encapsulation (at KW Basin), and storage of the fuel would receive an estimated collective radiation dose of about 0.77 person-rem, potentially resulting in 3.1×10^{-4} LCFs. Workers outside the facilities and the offsite public would receive essentially no radiation exposure from this activity.

Two postulated accidents were analyzed for the transfers of irradiated fuel: (1) the derailment and overturning of the rail cask during rail transport with a loss of cooling water from the cask cars and casks onto the ground, and (2) the dropping of a fuel container either during the loading of fuel at the PUREX Plant and N Reactor or during the unloading at one of the K Basins in which the container overturns and spills fuel elements and the cover water on the staging area floor. Both postulated accidents assume an airborne release from radionuclides in the spilled cover water and from a rapid oxidation of uranium hydride and uranium metal on the fuel. These are considered upper bounding accidents. The probability of a rail accident at the Hanford Site during a fuel transfer is estimated to be 1 in 240 million, and the probability of a fuel container drop at the PUREX Plant, N Reactor, or the K Basins is estimated to be 1 in 10,000.

The dose consequences of greatest concern for the postulated accidents are for the postulated fuel container drop at one of the K Basins and N Reactor Basin. The estimated dose to the three immediately affected workers is 15.0 person-rem resulting in an estimated 6.0×10^{-3} LCFs, and an individual worker would have a probability of 1 in 500 of becoming an LCF should the accident occur. The onsite MEI would receive an estimated dose of 2.05 rem resulting in an estimated 8.0×10^{-4} LCFs, or a probability of about 1 in 1,220 of becoming an LCF should the accident occur.

The proposed action would not involve the use or shipment of hazardous chemicals, and there would be no risk of exposure to hazardous chemicals. No cumulative impacts of concern from the storage of a small incremental amount of irradiated fuel at the K Basins are expected.

No environmental impacts of concern were identified for the proposed action. No substantial releases of gaseous or particulate radioactive emissions to the atmosphere, and no unpermitted discharges of contaminated liquids to the environment would occur as a result of the action. Solid waste generated by the project action would be disposed of in existing Hanford Site waste management units in compliance with all applicable regulations.

Glossary

Acronyms and Initialisms

AC	aluminum clad
ALARA	As Low As Reasonably Achievable
D&D	decontamination and decommissioning
DOE	U.S. Department of Energy
EA	Environmental Assessment
EDE	effective dose equivalent
ICRP	International Commission on Radiological Protection
K Basins	105-KE/105-KW fuel storage basins
LCF	latent cancer fatality
MEI	maximally exposed individual
N Reactor	105 N Reactor
NOC	Notice Of Construction
PM	preventative maintenance
PUREX	Plutonium-Uranium Extraction
SPR	single-pass reactor
rem	roentgen equivalent man
UST	underground storage tank
WAC	*Washington Administrative Code*
ZC	zircaloy clad (a zirconium alloy metal)

Definition of Terms

Deactivation. Activities associated with removing facility systems and/or areas from operational service with the intent of being ready for facility transition to either convert the facility for another use or move to a permanent shutdown. These activities could include the removal of fuel, draining and/or de-energizing of systems, removal of accessible stored radioactive and hazardous materials and other actions to place the facility systems and/or areas in a safe and stable condition so that a surveillance and maintenance program will be able to most cost effectively prevent any unacceptable risk to the public or the environment until ultimate disposition of the facility. (Note: These activities are usually conducted during the facility transition phase.)

Decommissioning. The sequential phases for a facility, once a shutdown decision is made by DOE, beginning with facility transition, through surveillance and maintenance (S&M), and final facility disposition.

Decontamination. The removal of radioactive contamination from facilities or equipment by washing, chemical action, mechanical cleaning, or other techniques.

Dose, Radiation. In terms of public health and safety, radiation dose is a measure of the amount of ionizing radiation absorbed by the body or body tissue. Various forms of radiation have different impacts on tissues and different tissues have different responses in terms of overall impact on the body. The source of radiation may originate outside the body, or inside the body as a result of inhalation, ingestion, absorption, or injection. Absorbed dose by itself is generally not sufficient as a measure of detriment or impact. As a consequence, a total effective dose equivalent (TEDE) has been defined to take into account these differences and which yields a single risk-based value. As used in this EA, the TEDE includes the 50-year committed dose from radionuclides internal to the body and the radiation dose received from external sources.

Effective Dose Equivalent (EDE). A value used for estimating the total risk of potential health effects from radiation exposure. This estimate is the sum of the committed effective dose equivalent for internal deposition of radionuclides in the body and the effective dose equivalent from external radiation received during a year.

Encapsulation. The sealing of irradiated fuel into Mark II stainless steel canister by installing a lid, addition of a nitrite corrosion inhibitor, and purging the canister with an inert gas.

HEPA Filter. A HEPA filter is a high efficiency particulate air filter. Typically a HEPA filter will remove 99.95+% of airborne particulates per stage of filter. These filters are often used in series to obtain greater removal of radioactive material from air.

Latent Cancer Fatalities (LCF). The excess cancer fatalities in a population due to exposure to a carcinogen.

Maximally Exposed Individual (MEI). A hypothetical individual on or near the Hanford Site who, by virtue of location and living habits, could receive the highest possible radiation dose from radioactive effluents released from the Hanford Site.

Person rem. A population dose based on the number of persons multiplied by the radiation dose.

rem. Acronym for roentgen equivalent man; the special unit of dose equivalent that indicates the potential for impact on human cells.

Stabilization. The combination of steps or activities to secure, convert and/or confine radioactive and/or hazardous material within enclosures, exhaust ducts, and process equipment within a facility. These activities may include; removal of loose equipment items, draining process fluids to the maximum extent practicable, coating internal surfaces with a fixative coating, removal of waste materials, installing seals and blank flanges, termination of nonessential energy sources, and/or conversion of reactive residues to a stable form suitable for extended safe storage. (Note: Stabilization activities are usually performed during the facility transition phase, but may be performed before the transition phase as a best management practice for cost efficiency, as low as reasonably achievable [ALARA], and/or safety purposes.)

Scientific Notation Conversion Chart

Multiplier	Equivalent
10^{-1}	0.1
10^{-2}	.01
10^{-3}	.001
10^{-4}	.0001
10^{-5}	.00001
10^{-6}	.000001
10^{-7}	.0000001
10^{-8}	.00000001
10^{-9}	.000000001
10^{-10}	.0000000001
10^{-11}	.00000000001
10^{-12}	.000000000001

Metric Conversion Chart

If you know	Multiply by	To get
	Length	
centimeters	0.393	inches
meters	3.2808	feet
kilometers	0.62	miles
	Area	
square kilometers	0.39	square miles
	Temperature	
Celsius	multiply by 9/5ths, then add 32	Fahrenheit
	Mass	
Metric tons (1,000,000 grams)	1.1	Short tons (2,000 pounds)

Source: *CRC Handbook of Chemistry and Physics,* Robert C. Weast, Ph.D., 70th Ed., 1989-1990, CRC Press, Inc., Boca Raton, Florida.

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1.0 Purpose and Need for Agency Action

The U. S. Department of Energy (DOE) needs to remove irradiated fuel from the Plutonium-Uranium Extraction (PUREX) Plant and N Reactor to stabilize the facilities in preparation for decontamination and decommissioning (D&D) and to reduce the cost of maintaining the facilities prior to D&D.

1.1 Background

The PUREX Plant processed irradiated reactor fuel for recovery of uranium and plutonium for defense purposes. From 1956 to 1972, the plant processed aluminum clad (AC) fuel from the now retired eight production reactors (105-B, 105-C, 105-KE, 105-KW, 105-D, 105-DR, 105-F, and 105-H) located at the Hanford Site. From 1967 to 1972, the PUREX Plant also processed zircaloy clad (ZC) fuel from N Reactor then temporarily ceased operations in 1972. The PUREX Plant was restarted in 1983 and processed ZC N Reactor fuel until the plant was placed in standby mode in 1990. In December 1992, DOE directed the shutdown and deactivation of the PUREX Plant because it is no longer needed to support the nation's weapons grade plutonium production. At present, some irradiated fuel that was not processed remains in the facility.

In view of this deactivation decision, the PUREX Plant is being readied for D&D. The PUREX Plant will be deactivated and stabilized to place it in an environmentally safe and stable condition that requires minimal surveillance and maintenance. The facility will be maintained in this manner until final D&D.

N Reactor produced ZC fuel for processing at PUREX beginning in 1963 and continuing to 1987 when the reactor was placed in stand-down status for extensive maintenance and a safety enhancement program. In February 1988, the reactor was ordered into cold standby and achieved that condition by October 1990. In July 1991, DOE decided to proceed with activities leading to the deactivation of the facility.

DOE is proposing to place the N Reactor facilities in a radiologically and environmentally stable condition until D&D is initiated. A small quantity of irradiated ZC fuel, in the form of fuel fragments and chips, is suspected to be in the sludge remaining at the bottom of the fuel storage basin at N Reactor.

The activities involved with preparing the fuel for transport from the PUREX Plant and N Reactor are covered by other *National Environmental Policy Act of 1969* reviews and existing safety documentation. The PUREX Plant *Environmental Impact Statement: Operation of PUREX and Uranium-Oxide Plant Facilities, Hanford Site, Richland, Washington* (DOE 1983) discusses the handling of fuel in the PUREX Plant. The recovery of fuel fragments from N Reactor, and the temporary storage of the fuel within N Reactor has been addressed in an environmental assessment (EA) for N Reactor deactivation (DOE 1995a).

Future decisions on removal, stabilization, and interim storage of the fuel in the K Basins will be addressed in a draft EIS *Management of Spent Nuclear Fuel from the K-Basins*, DOE/DEIS-0245 (DOE 1995b).

More detailed background information on the PUREX and N Reactor deactivation and stabilization is provided in Appendix A.

2.0 Description of the Proposed Action

The proposed action would involve the placement of irradiated fuel at the PUREX Plant and N Reactor into rail transport cask cars and the movement of cask cars to the 105-KE and 105-KW Basins in the 100 Area of the Hanford Site. The proposed action also would include fuel handling and fuel placement at the 105-KE and 105-KW Basins. The fuel would be stored along with the other irradiated fuel now being stored in these facilities. Background information on the activities leading to the action considered in this EA are included in Appendix A.

The target date for moving the fuel from the PUREX Plant to the K Basins is later in 1995, and the fuel from N Reactor would be transferred about mid 1997.

2.1 Irradiated Fuel Cask Car Loading At The PUREX Plant

The PUREX Plant's deactivation activities placed the 2.9 metric tons (3.2 short tons) of AC fuel into four buckets in the PUREX Plant canyon storage basin. The 0.5 metric ton (0.6 short ton) of ZC fuel elements from the dissolver cell floors is stored upright inside of four open Mark II canisters in the PUREX Plant canyon.

The hinged lids on two rail cars would be opened using a hand wheel mechanism which would provide access to six casks, three casks per car. The lids for four of the six casks would be removed using the PUREX Plant canyon crane and placed onto the PUREX Plant canyon deck. Each of the four AC fuel buckets in the storage basin would then be loaded into a separate cask, and the cask lids reinstalled using the PUREX Plant canyon crane. The hinged lid to the rail cars would then be closed using the hand wheel mechanism. The surfaces of the cask car would be surveyed for contamination and decontaminated as necessary. See Figures 1 and 2.

The water depth in the canisters of dissolver cell ZC fuel elements would be checked and raw water added as needed to fill the Mark II canisters. The Mark II canister lids would be installed in the PUREX Plant canyon using a PUREX Plant canyon crane lid tool. The hinged lid on the second rail car of AC fuel buckets or a third rail car if needed would be opened using the hand wheel mechanism. The lids for two casks would be removed using the PUREX Plant canyon crane and placed onto the PUREX Plant canyon deck. The Mark II fuel canisters would be loaded into the casks, up to three per cask, and the cask lids reinstalled. The hinged lid to the rail car would then be closed using the hand wheel mechanism. The surfaces of the cask car would be surveyed for contamination and would be decontaminated as necessary.

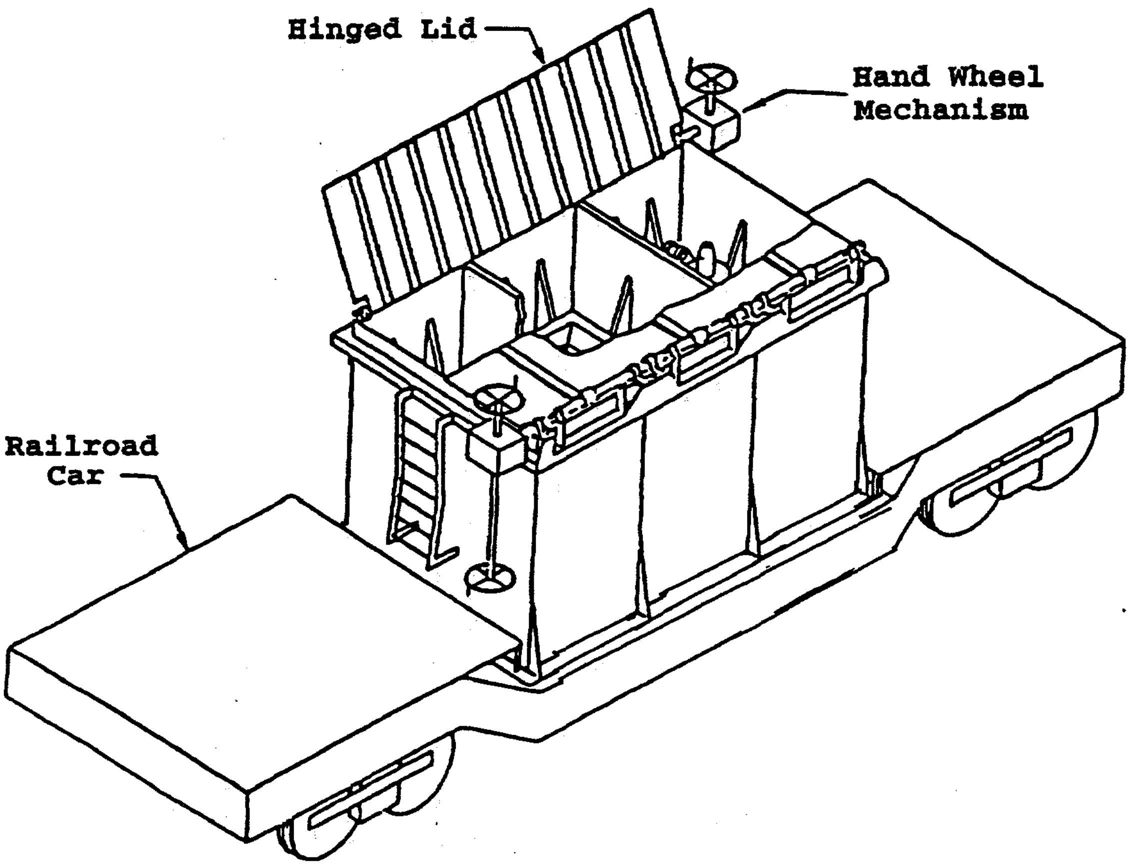

Figure 1. Three-Cask Rail Car for Fuel Transport.

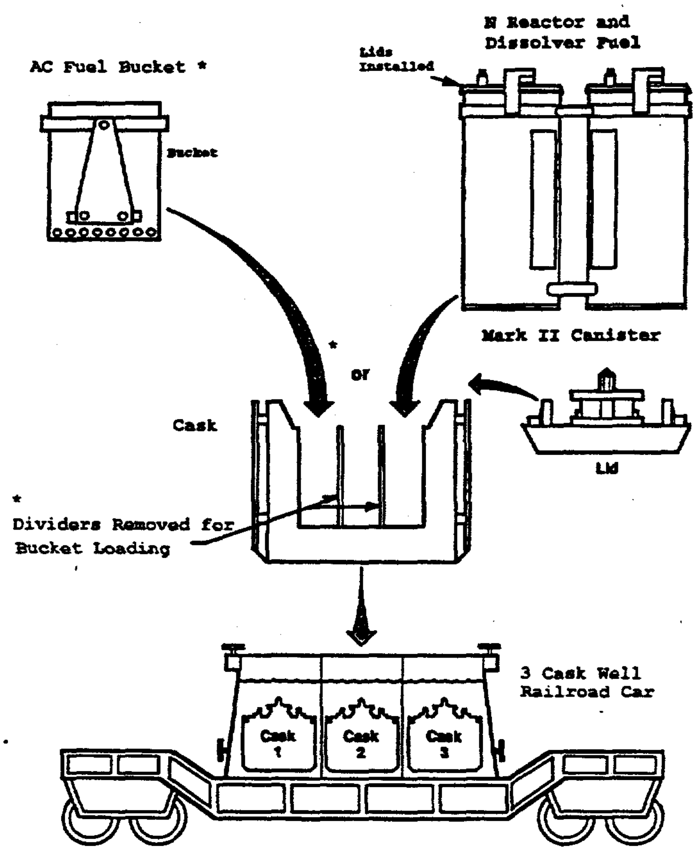

Figure 2. Schematic of Fuel Canisters, SPR Fuel Bucket, Transport Casks, and Cask Car.

2.2 Irradiated Fuel Cask Car Loading At N Reactor

The Mark II canisters of fuel at N Reactor would be encapsulated as described in the approved K Basin EA (DOE 1992). A rail cask car would be moved into the load out chute area and the hinged lid to the car would be opened using the hand wheel mechanism. A cask lid would be installed as an integral part of the task of lifting the cask out of the water. The cask would be lifted from the load out chute and placed into the cask car. The lid to the cask car would then be closed using the hand wheel mechanism. The surfaces of the cask car would be surveyed for contamination and decontaminated as necessary.

2.3 Fuel Transfer By Rail

The PUREX Plant fuel loaded in cask cars would be transferred either in a single shipment or separate shipments of AC fuel and ZC fuel. Shipment of N Reactor fuel would be in a one car shipment. Transportation of the fuel would use the existing rail routes. The route from the PUREX Plant to the K Basins is approximately 19.3 kilometers (12 miles) long, and the route from N Reactor to the K Basins is approximately 10.5 kilometers (6.5 miles). The routes traverse relatively flat desert terrain consisting of moderately compacted sandy soil (Figures 3 and 4). While a shipment is being made, no other train traffic would be allowed on the affected and intersecting portions of the Hanford Site Rail System, and the engine and cask car would have controlled use of the track between the point of origin and the destination through constant radio contact with the train dispatcher. An updated cask car safety evaluation document would be completed and approved prior to the fuel being transported.

The maximum operating speed for moving the cask car train would be 40 kilometers (25 miles) per hour under favorable operating conditions (good weather and visibility), and speeds would be reduced when conditions are less favorable. All of the major road crossings on the Hanford Site have flashing light and bell signals to warn traffic of approaching trains. The minor roads into the 100 N and 100 K Areas are marked with standard railroad crossing signs and have reduced speed signs. All necessary precautions would be taken to control road traffic during the fuel shipments, including manned barricades at road crossings while the train is passing. The rail route would be inspected within one week prior to a scheduled shipment.

2.4 Placement at the 105-KE and 105-KW Fuel Storage Basins

The rail cars containing the AC fuel from PUREX would be transferred to either of the 105 K Basins depending upon scheduling conflicts with existing planned activities. The ZC fuel cars would be transferred to the 105-KW Basin.

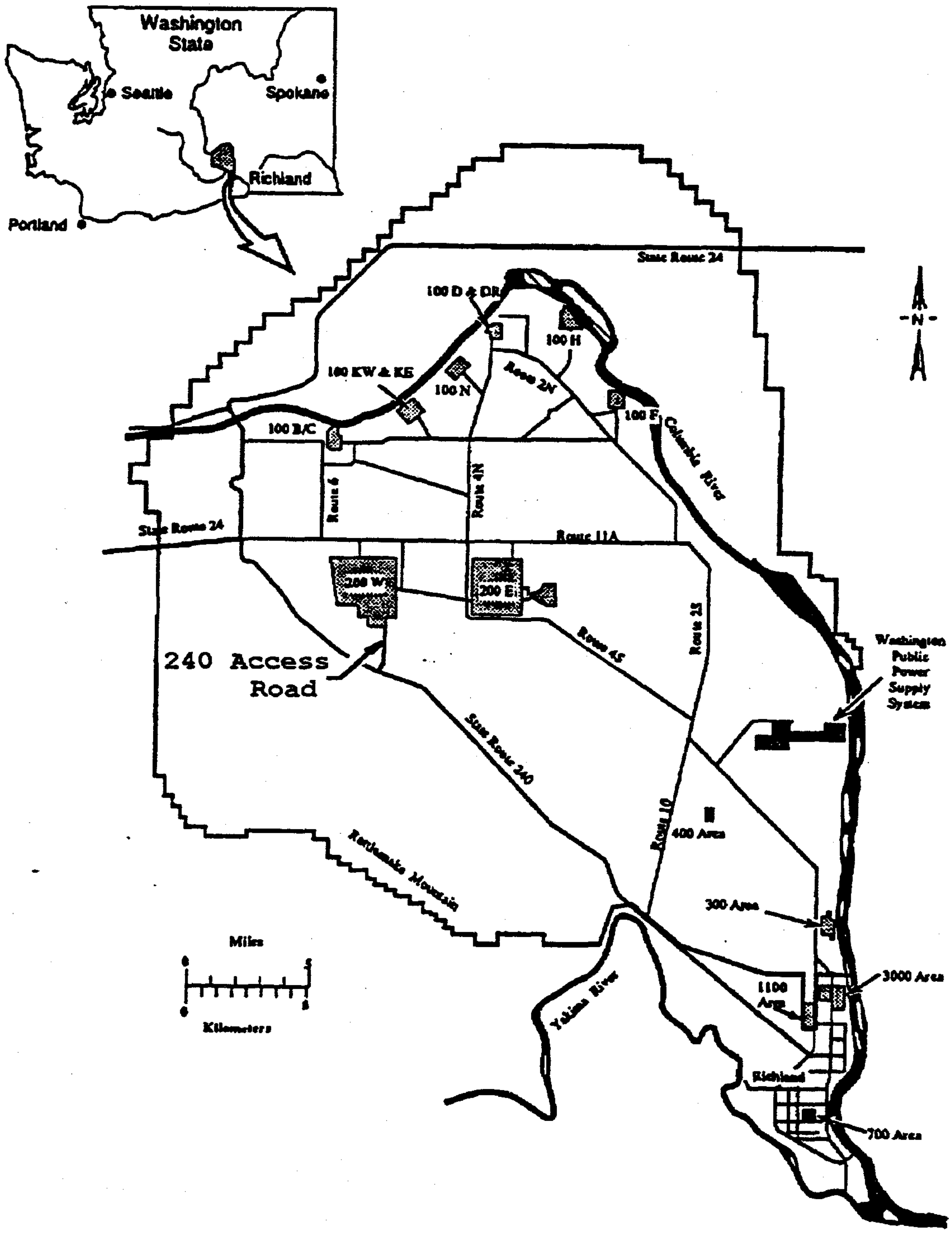

Figure 3. Hanford Site Location Map.

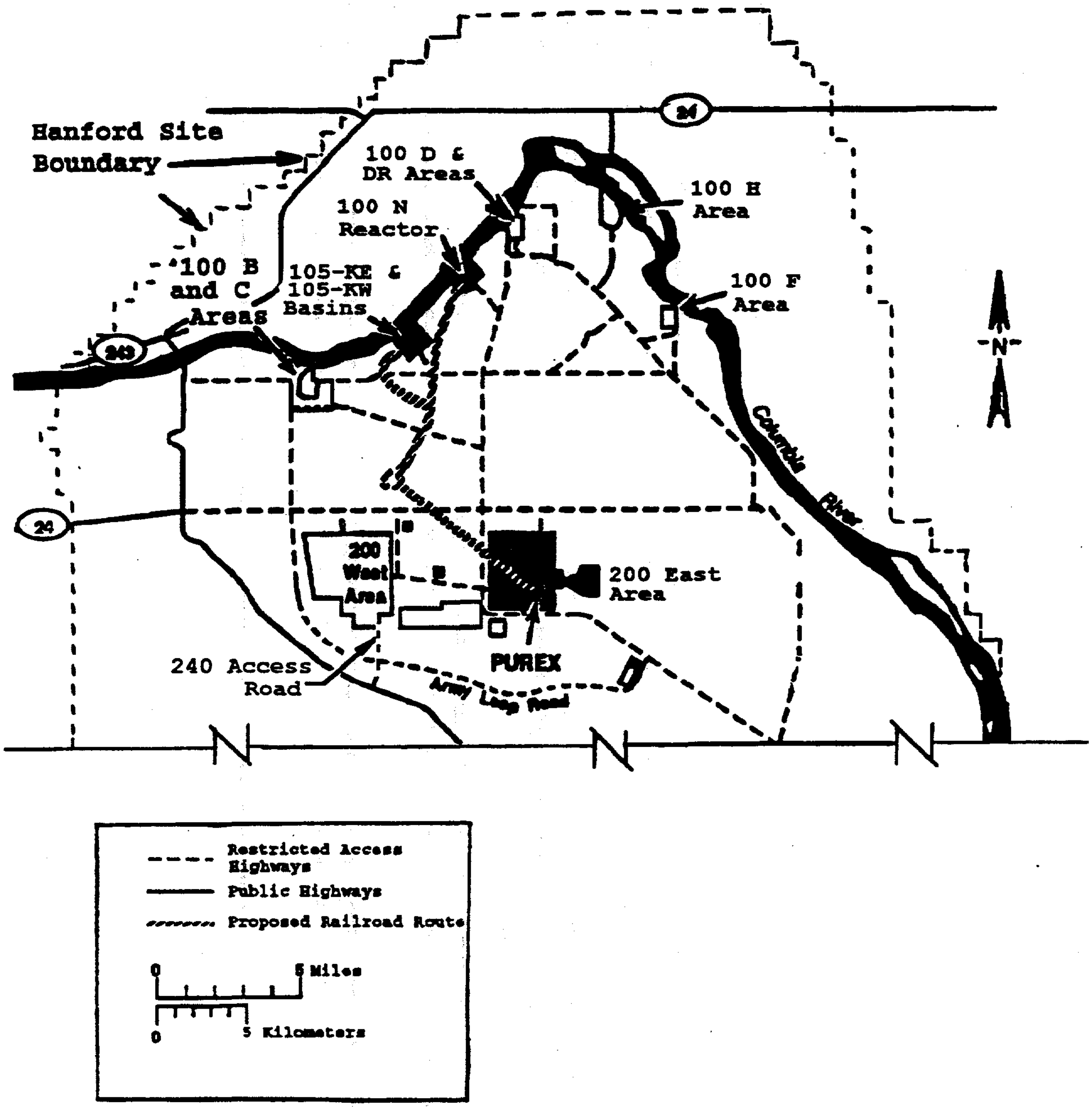

Figure 4. Rail Routes Between the PUREX Plant, N Reactor, and the K Basins.

2.4.1 105-KE Basin

If the 105-KE Basin is selected for storage of the AC fuel, the rail cask cars containing the AC fuel in buckets from the PUREX Plant's slug storage basin would be sent to the 105-KE fuel storage basin, and positioned one at a time for unloading. The cask car's hinged lid would be opened and one cask would be removed by an overhead bridge crane and the casks transferred into the 105-KE Basin. The lid from each cask would be removed under water as the cask is positioned in the load out pit. The fuel bucket would then be removed and transferred to a temporary storage location. The cask lid would be installed, and the empty water filled cask lifted out and placed in the rail cask car. This activity would be repeated for each of the remaining loaded casks. After all the casks have been unloaded, the hinged lid then would be closed, the car surveyed, decontaminated as necessary, and readied for transfer out of the facility. The fuel buckets would be moved to a storage area within the basin.

2.4.2 105-KW Basin

The rail cask cars containing the ZC fuel from the PUREX Plant's dissolver cell floors (including the limited amount of AC fuel), the ZC fuel from N Reactor Basin, and possibly the AC fuel from PUREX would be sent to the 105-KW fuel storage basin, and positioned for unloading. The hinged lid would be opened, one cask would be removed by a crane and the cask transferred into the 105-KW Basin load out pit. The lid from each cask would be removed while under water in the basin, as the cask is positioned in the load out pit. The Mark II Canisters from the PUREX Plant or N Reactor would be removed and transferred to storage. The lid would be reinstalled on the cask, and the empty water filled cask lifted out and placed in the cask car. This activity would be repeated for each of the remaining loaded casks. The hinged lid would be closed and the cask car would be surveyed and decontaminated as necessary. If the AC fuel is transferred from PUREX, the fuel elements would be repackaged into Mark II canisters in the basin. All the Mark II canisters of fuel shipped from the PUREX Plant may be encapsulated in the basin as described in the approved *105-KE and 105-KW Basins Fuel Encapsulation and Repackaging* EA (DOE 1992).

3.0 Alternatives to the Proposed Action

Several reasonable alternatives have been identified for the proposed action of transferring the irradiated fuel out of the PUREX Plant and N Reactor. Alternatives for the fuel transfer container have also been evaluated.

3.1 Alternatives For Removal Of Fuel From The PUREX Plant And N Reactor

3.1.1 No-Action Alternative

The fuel would remain at the PUREX Plant and N Reactor. At the PUREX Plant, the fuel would remain in the process canyon in a storage location suitable for continued surveillance and monitoring. At N Reactor, the fuel would remain in the storage pool.

For this alternative, the removal of the fuel from the facilities would not be accomplished and deactivation and stabilization of the facilities may not occur. All or a major portion of the cost savings provided by deactivation and stabilization (WHC 1994d) would not be realized.

3.1.2 Process the Fuel in the PUREX Plant Dissolver Cells

The fuel would be processed through the existing PUREX Plant. The fuel pieces from N Reactor would be transported, by rail, to the PUREX Plant for processing. The process initially would be to remove the cladding either by chemical dissolution, an existing process; or mechanical breakdown, a new process. The exposed special nuclear material would then be dissolved using nitric acid. Because there is no present demand for the special nuclear material, the resulting solution would become a waste and most likely would be transferred to underground storage tanks (UST) in the waste tank farms. This waste would eventually be processed for disposal along with existing liquid high-level waste. The cladding removal solution or cladding material also would be handled as additional waste either transferred to USTs or solid waste containers. The plant also would generate additional process waste solutions from condensate or cooling water streams, which would be transferred to USTs or processed through the effluent treatment system.

This alternative would require a partial startup of a portion of the PUREX Plant, which would be very costly. The process would convert the fuel to approximately 100,000 gallons of high-level radioactive liquid waste which would be transferred to underground storage tanks and dispositioned along with the existing inventory of high-level radioactive waste.

This alternative would also require costly building modifications to meet waste process permitting regulations. This alternative would significantly delay the deactivation and stabilization of PUREX and the planned cost savings would not be realized. For these reasons, this alternative would not meet the Purpose and Need.

3.1.3 Store the Fuel at a Hanford Location Other than the 105-KE/105-KW Fuel Storage Basins

The fuel from the PUREX Plant and N Reactor would be transported to another location on the Hanford Site for storage. At the present time, only T Plant, in the 200 West Area, has a suitable operating storage pool which can store the AC and ZC fuel. This pool already contains relatively clean Shippingport Reactor fuel elements, and the storage pool design includes water chemistry and temperature control features sufficient to store this fuel. The ZC fuel is known to degrade in water storage and modifications would have to be made to the storage pool to isolate the different fuels within the basin. New or upgraded water chemistry and temperature control features would be required to allow storage of the ZC fuel. The fuel would be packaged at the PUREX Plant and N Reactor into acceptable storage containers, and then transferred to T Plant for storage.

The time and cost required for modifying T Plant and the loss of PUREX and N Basin deactivation cost savings while this occurs makes this an undesirable alternative.

3.2 Alternatives For Fuel Transfer And Storage Containers

At the present time, there are no suitable alternative transfer and storage containers available. However, a one time or limited use safety evaluation could be conducted which would identify acceptable administrative or design controls for the use of one or more potentially suitable containers. This would incur high costs for development of an acceptable package and packaging equipment at the PUREX Plant, N Reactor, and the K Basins. This would delay the facilities deactivation and stabilization schedules. In addition, the container would not have been used previously in the PUREX Plant, and possibly not within N Reactor and K Basins, and would have restrictive load limitations which would require more fuel transfer activities with an associated increased exposure to the workers.

3.3 Offsite Transfer Of Fuel

This alternative would transport the fuel offsite for storage or processing. At the present time, there are no suitable offsite fuel shipping containers which can be used to transfer N Reactor and AC fuel. A new or modified container could be developed; however, the PUREX and N Reactor facility deactivation and stabilization would be delayed and the cost savings involved would not be realized for several years. For this reason, the transfer of the fuel offsite would not meet the Purpose and Need.

4.0 Affected Environment

The Hanford Site is an area of approximately 1,450 square kilometers (560 square miles), located in the southeastern portion of the State of Washington. It is a semiarid region of rolling topography with some trees occurring along the Columbia River. Two topographical features dominate the landscape: Rattlesnake Mountain, a treeless 1,066-meter (3,500-foot) anticline located on the southwest boundary, and Gable Mountain, a small ridge 339 meters (1,112 feet) in height located on the central portion of the Hanford Site. The Columbia River flows through the northern part of the Hanford Site, and forms part of the eastern boundary (Figure 3).

The Hanford Site is characterized as having a mild climate with an average of about 15 to 17 centimeters (6 to 7 inches) of annual precipitation, and occasional high winds of up to 129 kilometers (80 miles) per hour. Tornadoes are extremely rare, and no destructive tornadoes have occurred in the region surrounding the Hanford Site. The probability of a tornado hitting any given facility on the Site is estimated be 1 in 100,000 during any given year. The region is categorized as one of low to moderate seismicity.

The PUREX Plant is located in the 200 East Area on the 200 Area plateau of the Hanford Site about 11 kilometers (7 miles) from the Columbia River. The nearest population center is Richland, Washington about 35 kilometers (22 miles) from the 200 Area. The PUREX Plant is not located within a wetland or in a 100- or 500-year floodplain.

N Reactor is located in the 100 Area near the Columbia River, and the K Basins are located in the 100 Area, near the Columbia River. Neither of these facilities is located in the 100-year floodplain of the Columbia River or within a wetlands area.

The existing rail route from the PUREX Plant to the K Basins is approximately 19.3 kilometers (12 miles) long, and from N Reactor to the K Basins is approximately 10.5 kilometers (6.5 miles). The routes traverses relatively flat desert terrain consisting of moderately compacted sandy soil. The entire rail route is within the Hanford Site boundaries and the closest public approach is 7.2 kilometers (4.5 miles) away on State Route 240 (Figure 4).

The vegetation along the rail routes between the PUREX Plant, N Reactor, and the KE and KW Areas is typical of the Hanford Site, which is a shrub-steppe community dominated by big sagebrush and rabbitbrush. The sagebrush, cheatgrass, and Sandberg's bluegrass communities are perhaps the most common. Extensive site development around the PUREX Plant, N Reactor, and the K Basins has removed most of the native vegetative cover.

Because there would be no construction activities and no modifications to existing buildings, no cultural resources reviews or biological surveys were performed.

Air quality in the Hanford Region is well within the state and federal standards for criteria pollutants, except that short-term particulate concentrations occasionally exceed the 24-hour PM10 standard as a result of naturally occurring dust storms.

Additional information about the Hanford Site can be found in the *Hanford Site National Environmental Policy Act (NEPA) Characterization* report (PNL 1994).

5.0 Environmental Impacts

5.1 Construction

The proposed action would not require any construction activities.

5.2 Operations

Since the proposed action would be carried out on existing rail lines and within existing buildings, no impacts to cultural resources or plant and animal life would be expected. No critical habitat, floodplains, or wetlands would be affected. All fuel loading, transfer, and unloading activities would be accomplished by the current Hanford Site workforce. Therefore, no socioeconomic impacts are expected.

5.2.1 Activities at PUREX Plant and N Reactor

Facility workers would receive a low radiation dose from the preventive maintenance work on the cask cars before loading at the PUREX Plant or N Reactor Basin and decontaminating the cars prior to each shipment. It is estimated that a crew of two operators would receive a dose of 0.2 person-rem for this work for each cask car, or a total of 0.8 person-rem worker exposure for all four cask cars.

Estimates may be made for the health effects resulting from the worker exposure in the form of latent cancer fatalities (LCF) using the estimated exposure and applying dose-to-risk conversion factors developed by the International Commission on Radiological Protection (ICRP) (ICRP 1991). The International Commission on Radiological Protection has determined that the nominal LCF coefficient for low dose, low dose-rate irradiation is approximately 4.0×10^{-4} LCF per person-roentgen equivalent man (rem) effective dose equivalent (EDE) for a worker population. The health effects are calculated by multiplying the calculated radiological dose by the ICRP conversion factor. From the estimated exposure to workers of 0.8 person-rem, the resulting health effect is estimated to result in 3.2×10^{-4} LCF. Therefore, no cancer fatalities among the onsite workers would be expected.

5.2.2 Rail Transport Environmental Impacts

Routine movement of irradiated fuel by rail was carried out at the Hanford Site for many years prior to PUREX shutdown in 1989. No accidents with adverse environmental impacts have occurred in past fuel shipment operations. Fuel has been transported from N Reactor to the K Basins, and from the K Basins to the PUREX Plant. Movement in the reverse direction (from the PUREX Plant to the K Basins) is similar in nature and operation. No adverse environmental impacts are anticipated from the proposed fuel transfers.

The proposed action would not result in any discharge of liquids to the environment. Air emissions would be limited to exhaust gases and heat over a short time period from the diesel locomotive used to transport the fuel, and particulate radionuclide emissions that might escape from within the covered rail cask car during transport as a result of air movements around the car.

During fuel shipments which occurred prior to 1980, contaminated water from leaking drain valves on the cask cars had dripped onto the railroad tracks. The cask cars have been modified to correct the drain valve problem so that leakage can no longer occur.

The potential radiation dose to the train crew during fuel transfer of the shielded casks in rail cask cars, would be minimized by the distance of the crew from the cask cars, operating procedures, and implementation of As Low As Reasonably Achievable (ALARA) principles. The train crew would not enter any facility zones with high dose rates. Radiation doses would be well within the limits for the Hanford Site allowed by DOE orders and contractor procedures. For these reasons, the train crew is assumed to receive no radiation dose.

An estimate of radionuclide emissions during transport of the rail cask cars to the K Basins, and offloading the fuel at the basins, was made by assuming emissions from the contaminated water in the cask cars would be similar to emissions from the 105-KE fuel storage basin and comparing the size of the tank on the cask cars to the size of the basin. The source of the radionuclide emissions is assumed to be at the water to wall interface around the perimeter of the basin and the tanks on the cask cars; therefore the emissions are assumed to be proportional to the perimeters. The radiation dose to the offsite maximally exposed individual (MEI) calculated by this method is estimated to be about 5.2×10^{-9} rem from the three fuel shipments to be made. The assumptions and the calculations are included in Appendix B.

Estimates may be made for the health effects resulting from radiation exposure in the form of LCF using the estimated dose and applying dose-to-risk conversion factors developed by the ICRP. The ICRP has determined that the nominal dose-to-risk conversion factor for low dose, low dose-rate irradiation is approximately 5.0×10^{-4} LCF per person-rem EDE for a population of all ages (ICRP 1991). The health effects are calculated by multiplying the estimated radiological dose by the ICRP conversion factor. The estimated dose to the offsite MEI from transporting the irradiated fuel is estimated to result in 2.6×10^{-12} LCF. Therefore, the offsite MEI would not be expected to be a cancer fatality.

5.2.3 105-KE and 105-KW Fuel Storage Basins Environmental Impacts

There would be a potential for a radiation dose to workers handling the irradiated fuel to be transferred to the K Basins. A three person K Basin team would unload each rail cask car and transfer the casks into the basins. It is estimated that two hours would be required to complete the transfer and return the empty casks to the cask car. This would result in 6 person-hours of radiation exposure for each shipment of a cask car.

The existing safety documentation (WHC 1993b) for the K Basins estimates a maximum dose rate in the transfer station in the 105-KE Basin of 50 millirems per hour and in the 105-KW Basin transfer station of 1 millirem per hour. Radiation surveys conducted within the 105-KE Basin show that the actual measured dose rate in the transfer area is about 5 millirem per hour. The more conservative dose rate in the safety documentation is used in this EA, and represents a bounding case.

The AC fuel may be transferred either to the 105-KE Basin or the 105-KW Basin. The maximum dose to the workers at the basins would result from the unloading of the two cask cars of ZC fuel at the 105-KW Basin and two cask cars of AC fuel at 105-KE. The dose to the workers in the 105-KE Basin is estimated to be 6 person-hours at 0.050 rem per hour times two cars or 0.60 person-rem. The maximum dose to the workers in the 105-KW Basin is estimated to be 6 person-hours at 0.001 rem per hour times two cars or 0.012 person-rem. The total for the four cask cars unloaded would be 0.612 person-rem.

A total exposure of 11.6 person-rem was estimated for the preparation and repackaging of 1,773 canisters of fuel in the 105-KW Basin. The 1.0 metric ton of ZC fuel from the PUREX Plant and N Reactor would be contained in seven to ten fuel canisters. If the 2.9 metric tons of PUREX AC fuel is transferred to the 105-KW Basin, the fuel would be contained in an additional 10 to 15 Mark II canisters. This number of Mark II canisters would be 0.014 times the number of Mark II canisters to be handled by the formerly proposed encapsulation program (DOE 1992), with the exposure to workers from encapsulating the additional ZC fuel estimated to be 0.16 person-rem. This is conservative because the ZC fuel from the PUREX Plant and N Reactor already would be in Mark II canisters which would only require purging and tightening of the lids; fuel elements would not be re-encapsulated.

The combined maximum 105-KE and 105-KW Basin worker exposure to unload the fuel, complete encapsulation of the fuel at 105-KW Basin, and to move the fuel to a basin storage location, is 0.77 person-rem. The source of the worker exposure would be direct radiation and there would be no direct source of exposure to workers outside the facilities.

Estimates may be made for the health effects resulting from the worker exposure in the form of LCF using the estimated exposure and applying dose-to-risk conversion factors developed by the ICRP for a worker population. The health effects are calculated by multiplying the calculated radiological dose by the ICRP conversion factor.

The combined estimated exposure to K Basin workers of 0.77 person-rem is estimated to result in 3.1×10^{-4} LCF. Therefore, no cancer fatalities to the K Basin worker would be anticipated. A summary of the estimated impacts on the Hanford workers from fuel loading, transfer, and unloading activities is shown in Table 1.

Table 1 Summary of Health Impacts On Hanford Workers From Transfer of Irradiated Fuel To K Basins

Activity And Number Of Containers Handled	Workers Involved	Dose Rate	Dose Received	Calculated LCF
PUREX And N Basin				
Loading 4 Cask Cars	2 Workers	0.2 person-rem per car	0.8 person-rem	3.2×10^{-4}
Rail Transport				
Transfer 4 Cask Cars	4 Workers	None	none	none
K Basins				
Unloading Fuel - 2 Cask Cars at KE and 2 Cask Cars at KW	3 Workers	KE - 0.3 person-rem per car KW - 0.006 person-rem per car	0.6 person-rem 0.012 person-rem	2.4×10^{-4} 4.8×10^{-6}
Encapsulation and Storage Of 25 Canisters Of Fuel	50 Person Workforce	11.6 person-rem per 1,773 canisters loaded	0.16 person-rem	6.4×10^{-5}
		Total K Basins Exposure	0.77 person-rem	3.1×10^{-4}
Total Hanford Worker Exposure			1.6 person-rem	6.3×10^{-4}

5.2.4 Accident Risk

The potential exists for an accidental discharge of radionuclides to the environment during the loading of the fuel at the PUREX Plant or N Reactor, during transport of irradiated fuel from the PUREX Plant and N Reactor to the K Basins, or during the unloading of the fuel at the K Basins. This could result in radiation exposure to workers and the public. Two types of postulated accidents were considered: (1) a derailment of the rail cask car(s) during rail transport to the K Basins, and (2) a drop of a single cask either during the loading of the fuel at the PUREX Plant and N Reactor, or during unloading at the K Basins. The consequences of a rail accident and a K Basin accident are much higher in that there are no barriers between the source and the environment. An accident within the PUREX Plant or N Reactor would occur in an area with single stage High Efficiency Particulate Air filtration which significantly reduces the release to the environment.

During the period of wet storage of the irradiated fuel, and the time the ZC fuel has resided on the dissolver cell floors in the PUREX Plant, some corrosion of the uranium metal fuel has occurred. The corrosion occurred where the fuel cladding is damaged or separated from the uranium metal. When the exposed uranium metal contacts the water, a layer of uranium oxide with some uranium hydride (UH_3) forms. The uranium hydride normally converts to oxide when exposed to water or air, but can become trapped under the uranium oxide coating or in cracks under the cladding. If the fuel is disturbed during handling operations, the hydride may be exposed and reacts with water or oxygen. Uranium hydride becomes unstable with the potential to rapidly oxidize when allowed to dry. This potential is considered in the accident analyses, and the upper bounding accident analyses conservatively assumes a rapid oxidation of the hydride on the fuel following an accident in which the water covering the fuel is lost.

A thermal analysis was completed to evaluate the potential for an ignition of the uranium metal in the fuel elements following the postulated accidents because of the potential for the hydride to rapidly oxidize and produce heat (FAI 1994). The main conclusions from the analysis are: the ignition temperature of the uranium metal fuel at about 300° C (572° F) would not be reached by either the AC fuel elements or the ZC fuel elements in Mark II canisters; the heatup time interval for the fuel metal to reach peak temperatures following an accident and drying of the fuel would be about two days; and the maximum temperatures reached in the fuel would be 97° C (207° F) in AC fuel elements and 47° C (117° F) in ZC fuel elements.

5.2.4.1 Rail Accident.

The postulated upper bounding accident during transport is a derailment of the rail cask car or cars resulting in a spill of the water inside the cask car tanks and the casks onto the ground (WHC 1994a). For the upper bounding accident, it is assumed that all the fuel from PUREX would be transported in a single shipment of three cask cars. Two cask cars would carry the AC fuel in four shipping casks while the ZC fuel would be transported in separate cask car containing three shipping casks. The rail cars are assumed to turn over during the derailment and the cooling water from the tanks and casks is assumed to quickly drain out. The radionuclides in the water outside the casks are then assumed to be released to the air by wind entrainment. It is further assumed that the cask lids remain in place and no fuel elements are spilled on the ground; however, it is assumed that the uranium hydride and adjacent metal would begin to rapidly oxidize following the loss of the water. The combined airborne release would be the air entrained radionuclides from the water spill and the emissions from the rapidly oxidizing uranium hydride and adjacent metal.

The probability of a fuel transportation rail accident at the Hanford Site has been estimated based on national rail statistics and factored for the special controlled conditions. (WHC 1993a). The roll-over accident frequency is estimated to be 4.2 x 10^{-9} per mile traveled at the Hanford Site, or once every 20,000,000 shipments covering 19.3 kilometers (12 miles) each. The probability of this accident occurring would be in the incredible range.

This postulated upper bounding accident was analyzed (WHC 1994a), and radiological dose calculations for emissions resulting from the accident were made for both the AC and ZC fuel shipments. The Hanford Site standard dosimetry GENII Computer Code (PNL 1988) was used to determine the radiological doses. The estimated doses for the ZC fuel are slightly higher.

The resulting 50-year committed doses were calculated for the onsite and offsite MEI receptors and the maximally exposed offsite population. The maximum offsite population dose would result from an accident near the K Basins.

The estimated doses resulting from the postulated upper bounding accident are shown in Table 2.

Table 2. Resulting Doses for the Postulated Upper Bounding Rail Accident Near the K Basins.

Receptor	50 Year Dose (rem) EDE
Onsite MEI 100 meters east	7.9
Offsite MEI Hanford Site Boundary 13.0 kilometers west	0.02
Offsite ME Population West Sector, 100K (Population 97,689)	31.8 person-rem

The dose to the individual train crew members following the postulated accident is conservatively assumed to be about the same as to the onsite MEI, or 7.9 rem at a distance of 100 meters, and the train crew of four would receive a dose of about 31.6 person-rem as a result of the postulated accident.

5.2.4.2 105-KE/105-KW Fuel Storage Basins Accident.

The postulated upper bounding accident for the receipt, handling and storage of the irradiated fuel from the PUREX Plant or N Reactor at the K Basins is a crane failure, and the drop of a fully loaded shipping cask onto the floor of the fuel transfer area from a height of 4.6 meters (15 feet) or more. This is postulated to take place while a cask is being unloaded from a rail cask car. This is the postulated maximum credible accident identified in the existing safety documentation (WHC 1992a, WHC 1993b). It is assumed that the cask would overturn and the cask lid would come off, causing the irradiated fuel and the water in the cask to spill out.

It is further assumed that the uranium hydride on the fuel dries out in the ventilation air and a 1-millimeter (0.039-inch) layer of uranium hydride and adjacent uranium metal oxidizes producing airborne emissions. There would not be enough heat to ignite uranium metal. It is assumed that the water from the cask also dries out and the radionuclides from the corrosion products carried out in the water are entrained in the ventilation air.

This upper bounding accident is judged to be extremely unlikely, with an estimated probability of occurrence of 1 in 10,000 (WHC 1993b).

The radiation doses for the postulated accident were determined by using the rail accident dose and adjusting for the quantity of fuel in one cask rather than all the fuel in the cask car. On this basis, the estimated dose for the drop of a cask of AC fuel would be one fourth of the dose from a rail accident involving all the AC fuel in four casks, and the estimated dose for the drop of a cask of ZC fuel would be one half of the dose from a rail accident involving two casks of ZC fuel (WHC 1995). Since a rail accident involving the ZC fuel would result in a higher estimated dose than the accident involving the AC fuel, the upper bounding cask drop accident in K Basins would be the drop of a cask of ZC fuel. The resulting estimated radiation doses from the airborne release would be one half of the estimated doses in Table 1 or 2.0 rem to the onsite MEI, 0.004 rem to the offsite MEI, and 8.3 person-rem to the offsite maximally exposed population. These doses are higher than those presented in the K Basin Safety Assessment (WHC 1994c) and therefore represent a bounding conservative analysis.

The shipping cask drop, as described for the postulated accident, would result in a high radiation alarm requiring immediate evacuation of personnel directly working in the area. Based on a similar experience at N Reactor, and considering the age of the fuel, personnel exposed to unshielded irradiated fuel from a cask drop would receive a radiation dose estimated to not exceed 5 rem (WHC 1994c). A K Basin crew of three workers would be involved in unloading and transferring the fuel casks into the basins. The exposure to the immediately affected workers as a consequence of the accident would be a maximum of 15 person-rem.

5.2.4.3 N Reactor Basin Accident

The postulated upper bounding accident for the loading of the cask car at N Reactor is a crane failure resulting in the drop of a fully loaded shipping cask onto the floor of the fuel transfer area from a height of 4.6 meters (15 feet) or more. It is assumed that the cask would overturn and the cask lid would come off, causing the irradiated fuel and the water in the cask to spill out. It is further assumed that the uranium hydride on the fuel dries out in the ventilation air and a 1-millimeter (0.039-inch) layer of uranium hydride and adjacent uranium metal oxidizes producing airborne emissions. There would not be enough heat to ignite uranium metal. It is assumed that the water from the cask also dries out and the radionuclides from the corrosion products carried out in the water are entrained in the ventilation air.

This upper bounding accident is judged to be extremely unlikely, with an estimated probability of occurrence of 1 in 10,000 (WHC 1993b).

The radionuclide release from the upper bounding accident for N Reactor would be the same as the K Basin accident, which would result in one half of the estimated release from a rail accident involving two casks of ZC fuel. The ventilation system for N Reactor includes a single stage high efficiency particulate filtration with a 99.9 per cent removal rate. The resultant estimated radiation doses from the airborne release is given in Table 3.

Table 3. Resulting Doses for the Postulated Upper Bounding Accident In N Reactor (ZC Fuel).

Receptor	50 Year Dose (rem) EDE
Onsite MEI 100 meters east	0.002
Offsite MEI Hanford Site Boundary 12.0 kilometers west	0.0000043
Offsite ME Population W Sector, 100K (Population 97,689)	0.0083 person-rem

The shipping cask drop, as described for the postulated accident, would result in a high radiation alarm requiring immediate evacuation of personnel directly working in the area. Personnel exposed to unshielded irradiated fuel from a cask drop would receive a radiation dose estimated to not exceed 5 rem (WHC 1994c). A crew of three workers would be involved in loading the fuel cask. The exposure to the immediately affected workers as a consequence of the accident would be a maximum of 15 person-rem.

5.2.4.4 PUREX Plant Accident

The postulated upper bounding accident for the loading of the cask car at the PUREX Plant is a crane failure resulting in the drop of a single canister of fuel containing 0.7 metric ton (0.77 short ton) of AC fuel onto the floor of the PUREX Plant's rail tunnel from a height of 4.6 meters (15 feet) or more. It is assumed that the canister lid would come off, causing the irradiated fuel and the water in the canister to spill out. It is further assumed that the uranium hydride on the fuel dries out in the ventilation air, and a 1-millimeter (0.0 39-inch) layer of uranium hydride and adjacent uranium metal oxidizes producing airborne emissions. There would not be enough heat to ignite uranium metal. It is assumed that the water from the cask also dries out, and the radionuclides from the corrosion products carried out in the water are entrained in the ventilation air.

This upper bounding accident is judged to be extremely unlikely, with an estimated probability of occurrence of 1 in 10,000 (WHC 1993b).

The radionuclide release from upper bounding accident for the PUREX Plant would be one fourth of the release from a rail accident involving four casks of AC fuel (WHC 1995). The ventilation system for the PUREX Plant rail tunnel routes all flow to the process canyon ventilation, which includes a high efficiency particulate filtration with a 99.9 per cent removal rate. The resultant estimated radiation doses from the airborne release is given in Table 4.

Table 4. Resulting Doses for the Postulated Upper Bounding Accident In The PUREX Plant (AC Fuel).

Receptor	50 Year Dose (rem) EDE
Onsite MEI 100 meters east	0.0018
Offsite MEI Hanford Site Boundary 13.0 kilometers west	0.0000017
Offsite ME Population SE Sector, (Population 114,734)	0.0075 person-rem

All fuel loading operations within the PUREX Plant are conducted remotely using an overhead canyon crane. The crane controls are located in the crane cab which has a six foot thick concrete shielding wall. The shipping cask drop, as described for the postulated accident, would therefore not impact any workers.

5.2.4.5 Accident Cleanup

After the postulated cask car derailment, trained radiation workers would use a crane and remote handling equipment to right the cask car or cars, and place it back on the tracks. The equipment would be decontaminated, and the soil contaminated by the water spilled out of the casks would be cleaned up and transported to existing onsite waste disposal or storage facilities.

Similarly, trained radiation workers would clean up following the postulated cask drop accident at the K Basins, N Reactor, or the PUREX Plant. Fuel elements and canisters would be retrieved and placed in the storage basin either in the cask, at K Basins or N Reactor, or in the fuel containers, at the PUREX Plant. The spill area then would be decontaminated. Shielding and remote handling equipment would be used as necessary.

Radiation workers would wear the proper protective clothing and equipment, including respiratory protection. Only direct radiation would be received, and Hanford Site ALARA principles would be implemented to minimize direct radiation exposure. Radiation workers wear dosimeters to measure radiation dose, and these badges are monitored monthly. The average Hanford Site radiation worker received a dose of 0.065 rem during Calendar Year 1993 (WHC 1993c). Assuming that a crew of 20 radiation workers would be involved in the cleanup of the postulated accidents, and conservatively assuming that each worker receives a dose equivalent to the average full year dose for 1993, the total dose to the cleanup workers is estimated to be 1.3 person-rem should any of the accidents occur.

5.2.4.6 Health Effects From Postulated Accidents

Estimates may be made of the health effects in the form of LCF, resulting from radiation exposure that would be a consequence of the postulated accidents. This is determined by using the calculated doses and applying dose-to-risk conversion factors developed by the ICRP as described in Sections 5.2.1 and 5.2.2.

The health effects estimated from the dose calculations and the ICRP dose-to-risk conversion factors for the postulated accidents are summarized in Table 5.

The dose consequences of greatest concern in terms of health effects from the postulated cask car derailment are to the onsite MEI and the four immediately affected onsite workers. The calculated LCF of 3.2×10^{-3} for the onsite MEI and the calculated LCF of 1.3×10^{-2} for the immediately affected onsite workers means that the onsite MEI would have a probability of about 1 in 312 and an immediately affected worker would have a probability of about 1 in 310 of becoming an LCF should the accident occur. The offsite MEI would have a probability of about 1 in 250,000 of becoming an LCF. An average individual in the maximally exposed offsite population of 97,689 would have a probability of about 1 in 12 million of becoming an LCF.

The dose consequences of greatest concern for the postulated cask drop at one of the K Basins are to the onsite MEI and the immediately affected workers. The calculated LCF for the onsite MEI of 8.0×10^{-4} means that the affected workers would have a probability of 1 in 1,200 of becoming an LCF. The calculated LCF for the immediately affected workers of 6.0×10^{-3} means that the three workers would have a probability of 1 in 500 of becoming and LCF should the accident occur.

The dose consequences of greatest concern for the postulated cask drop at N Reactor are to the onsite MEI and the immediately affected workers. The calculated LCF for the onsite MEI of 8.1×10^{-7} means that the worker would have a probability of about 1 in 1.1 million of becoming an LCF. The calculated LCF for the immediately affected workers of 6.0×10^{-3} means that the three workers would have a probability of about 1 in 500 of becoming an LCF should the accident occur.

The dose consequences of greatest concern for the postulated fuel drop at the PUREX Plant are to the onsite MEI and the accident cleanup workers. The calculated LCF for the onsite MEI of 7.1×10^{-7} means that onsite MEI would have a probability of about 1 in 1.4 million of becoming an LCF. The calculated LCF for the individual accident cleanup workers of 5.2×10^{-4} means the cleanup workers would have a probability of about 1 in 38,000 of becoming an LCF should the accident occur.

Table 5. Summary of Estimated Health Effects Resulting From Postulated Accidents.

Postulated Upper Bound Rail Accident		
Receptor	50 Year Dose EDE	Calculated LCF
Onsite MEI	7.9 rem	3.2×10^{-3}
Offsite MEI	0.02 rem	1.0×10^{-5}
Maximally Exposed Offsite Population	31.8 person-rem	1.6×10^{-2}
Immediately Affected Workers	31.6 person-rem	1.3×10^{-2}
Accident Cleanup	1.3 person-rem	5.2×10^{-4}
Postulated Upper Bound K Basins Accident		
Receptor	50 Year Dose EDE	Calculated LCF
Onsite MEI	2.0 rem	8.2×10^{-4}
Offsite MEI	0.004 rem	2.0×10^{-6}
Maximally Exposed Offsite Population	8.3 person-rem	4.15×10^{-3}
Immediately Affected Workers	15.0 person-rem	6.0×10^{-3}
Accident Cleanup	1.3 person-rem	5.2×10^{-4}
Postulated Upper Bound N Reactor Accident		
Receptor	50 Year Dose EDE	Calculated LCF
Onsite MEI	2.0×10^{-3} rem	8.1×10^{-7}
Offsite MEI	4.3×10^{-6} rem	1.7×10^{-8}
Maximally Exposed Offsite Population	8.3×10^{-3} per-rem	3.3×10^{-6}
Immediately Affected Workers	15.0 person-rem	6.0×10^{-3}
Accident Cleanup	1.3 person-rem	5.2×10^{-4}
Postulated Upper Bound PUREX Plant Accident		
Receptor	50 Year Dose EDE	Calculated LCF
Onsite MEI	1.8×10^{-3} rem	7.1×10^{-7}
Offsite MEI	1.7×10^{-6} rem	8.5×10^{-10}
Maximally Exposed Offsite Population	7.5×10^{-3} per-rem	3.0×10^{-5}
Immediately Affected Workers	0.0 person-rem	0.0
Accident Cleanup	1.3 person-rem	5.2×10^{-4}

5.3 Hazardous Chemicals

The proposed fuel transfer would not be considered a hazardous material shipment and would not involve the use of hazardous chemicals; therefore, there would be no potential for release of hazardous chemicals to the environment, exposure to workers, or the public resulting from the transportation and handling of the fuels or from the postulated accidents.

5.4 Environmental Justice Impacts

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. DOE is in the process of developing official guidance on the implementation of the Executive Order.

Distributions of minority and low income population groups have been identified for the Hanford Site (DOE 1994a). Offsite environmental impacts analyzed in this EA are expected to be minimal; therefore, no adverse health effects are expected to occur in any offsite community. No socioeconomic impacts are expected and no disproportionate impacts on any subgroups of the public including minority and low-income populations are expected.

5.5 Cumulative Impacts

No cumulative impacts of concern are expected from the transportation to and storage of a small additional amount of irradiated fuel at the K Basins. The quantity of fuel added to the existing fuel in the K Basins would increase the inventory by less than 0.2 percent which is within the existing capacity of the facility. The fuel would be stored in new stainless steel canisters, and no contact with basin cooling water would take place during storage. Potential radiation exposure to workers at the PUREX Plant and N Reactor would decrease when the irradiated fuels are transferred to the K Basins.

6.0 Permits and Regulatory Requirements

The revised Washington State Department of Health (DOH) regulations, *Washington Administrative Code* (WAC) 246-247, became effective on April 7, 1994 and regulates radioactive air emissions. The DOH has been briefed on the fuel transfer activities. A white paper discussing the fuel transfer impact on the existing 105-KE Basin Notice of Construction (NOC) was prepared per DOH request to cover the receipt and handling of the AC fuel elements at the 105-KE Basin (DOE 1995c). A new NOC will be submitted to the DOH to cover the receipt and encapsulation of the AC and ZC fuel elements at the 105-KW Basins. The requirements of WAC 246-247 would be met before the fuel transfer would take place.

7.0 Agencies Consulted

No outside agencies or persons were consulted for the preparation of this document. However, it was sent to the National Park Service, The States of Washington and Oregon, the Yakama Indian Nation, the Confederated Tribes of the Umatilla Indian Reservation, the Nez Perce Tribe, and the Wanapum for preapproval review. Preapproval review was also solicited from Columbia River United, the Government Accountability Project, Heart of America Northwest, Physicians for Social Responsibility, Hanford Watch, and the Hanford Education Action League. Responses were received from the State of Washington and the Nez Perce Tribe. Comments received were considered in preparing the final EA. The comments and DOE responses to these comments are provided in Appendix C.

8.0 References

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Appendix A

BACKGROUND INFORMATION

PUREX Plant Background

The PUREX Plant processed irradiated reactor fuel for recovery of uranium and plutonium for defense purposes. From 1956 to 1972, the plant processed aluminum clad (AC) fuel from the now retired eight production reactors (105-B, 105-C, 105-KE, 105-KW, 105-D, 105-DR, 105-F, and 105-H) located at the Hanford Site. From 1967 to 1972, the PUREX Plant also processed zircaloy clad (ZC) fuel from N Reactor. The PUREX Plant was restarted in 1983 and processed ZC N Reactor fuel until the plant was placed in standby in 1990. In December 1992, DOE directed the shutdown and deactivation of the PUREX Plant because it is no longer needed to support the nation's weapons grade plutonium production. In view of this deactivation decision, the PUREX Plant is being readied for D&D. The PUREX Plant will be deactivated and placed in an environmentally safe and stable condition that requires minimal surveillance and maintenance. The facility will be maintained in this manner until final D&D (WHC 1994d).

The PUREX Plant presently contains approximately 2.9 metric tons (3.2 short tons) of AC single pass reactor fuel elements. The AC fuel has been stored in four fuel baskets, 0.43 meter (17 inches) square and 0.5 meter (20 inches) tall, under water in the PUREX Plant slug storage basin.

This fuel was shipped to the PUREX Plant in 1972, and was not processed. This fuel has a higher plutonium-240 content and lower uranium-235 content than typical irradiated ZC and AC fuels. These composition differences have been considered in the environmental impacts in Section 5.0. Recent video inspections indicate the fuel is in relatively good condition. Samples of the water in the storage basin did not contain significant levels of contamination, indicating that the aluminum cladding is intact.

The PUREX Plant dissolver cell floors contained about 0.5 metric ton (0.6 short ton) of mostly ZC fuel with only a few AC fuel elements. These fuel elements were accidently dropped on the floors of the dissolver cells during fuel loading into the dissolvers and remained on the cell floors exposed to cell floor conditions for several years, including intermittent wetting by water and process solutions from dissolver upsets. Inspections of the fuel on the floors have shown areas of cladding attack, but the fuel is mostly whole.

Fuel which has damaged cladding and is subsequently stored in water (AC fuel elements at the PUREX Plant and ZC fuel at N Reactor) or a moist environment (ZC fuel at the PUREX Plant) will slowly oxidize at the exposed uranium metal surfaces. A small layer of uranium hydride may also form under the oxide layer when the metal is exposed to the hydrogen released from the metal oxidation. This uranium hydride will convert to uranium oxide when exposed to water or oxygen. If sufficient quantities of uranium hydride are exposed to air, the oxidation reaction can become pyrophoric. Both of the fuels at the PUREX Plant are considered low risk for hydride formation due to the condition of the fuel cladding (AC Fuel) or long term exposure of the fuel to an air environment (ZC Fuel). To avoid the potential for a rapid oxidation reaction, all activities connected with the AC and ZC fuel transfer would maintain a water cover.

The deactivation of the PUREX plant has prepared both the AC and ZC fuels for loading into irradiated fuel cask cars. The AC fuel baskets were overpacked into open top buckets, 0.58 meter (23 inches) by 0.69 meter (27 inches) by 0.71 meter (28 inches), which will ensure the fuel will stay underwater during fuel transfer operations. These buckets are now stored underwater on the floor of the slug storage basin. The dissolver cell ZC fuel whole elements and larger pieces have been recovered from the cell floors, rinsed with water, placed into Mark II canisters filled with water and stored in the canyon deck. The Mark II canisters are constructed as a pair of open top pipe containers 23 centimeters (8 inches) in diameter and 66 centimeters (26 inches) tall (Figure 1)[1]. A lid can be installed on these canisters to provide a sealed container; however, the lids will not be placed on the canisters at the PUREX Plant which will allow for the addition of cover water and the release of the gas generated from fuel oxidation to the PUREX Plant canyon ventilation. The dissolver cell AC fuel was recovered and added to the fuel buckets in the slug storage basin.

N Reactor Background

N Reactor produced ZC fuel for processing at PUREX beginning in 1963 and continuing to 1987 when the reactor was placed in standown status for extensive maintenance and a safety enhancement program. In February 1988, the reactor was ordered into cold standby and achieved that condition by October 1990. In July 1991, DOE decided to proceed with deactivation of the facility.

DOE is proposing to place N Reactor facilities in a radiologically and environmentally stable condition until D&D is initiated. A small quantity of irradiated ZC fuel, in the form of fuel fragments and chips, is suspected to be in the sludge remaining at the bottom of the fuel storage basin at N Reactor. As part of N Reactor's required stabilization activities, this sludge will be removed from the basin, and any identifiable pieces of fuel elements will be recovered from the sludge. This fuel will be placed into open Mark II canisters and the canisters will be placed in an existing lead lined cask in the fuel storage basin. All of the activities involved with the transfer of fuel inside N Reactor are discussed in an approved environmental assessment for N Reactor stabilization.

Irradiated Fuel Cask Cars Background

The irradiated fuel cask cars to be used for the fuel transfer between the PUREX Plant, N Reactor, and the K Basins, are three compartment cask rail cars that are the standard for transporting ZC and AC reactor fuel on the Hanford Site. The cask cars contain a large water tank with internal dimensions of 2.2 meters (7.2 feet) wide by 5.2 meters (17.5 feet) long by 2.1 meters (7 feet) high, divided into three sections, or wells, to hold a total of three lead lined

[1] All Figures are located in the main text of the document

casks. The fuel casks are large, heavily shielded containers made of steel plate with 25.4 centimeter (10-inch) thick lead shielding. The internal area of each cask is separated into three sections using steel plate dividers. Each cask has an internal area, 0.6 meter (25 inches) wide by 0.76 meter (30 inches) long by 0.74 meter (29 inches) high, capable of holding three Mark II canisters or one bucket of fuel elements (Figure 2). These dividers allow for the storage of the canisters and prevent tipping during loading and unloading operations. The dividers will be removed to accommodate the transfer of the AC fuel buckets (See Figure 1). Several one inch diameter penetrations in the sides and top of the casks allow circulation of the cask and tank water. These penetrations were initially intended to supply cooling for short cooled fuel but are not needed for the AC and ZC fuel. The water also provides additional 23 centimeters (9 inches) of radiation shielding external to the cask.

The irradiated fuel cask cars will be prepared for use at the PUREX Plant during deactivation activities. The water in the cask cars will be drained and replaced with clean raw water and a leak test will be performed. Preventive maintenance checks including brake, air valve and running gear checks, will also be conducted on the rail cars.

The activities involved with loading fuel into cask cars and release of the irradiated fuel cask cars from the PUREX Plant and N Reactor are covered by other NEPA reviews and existing safety documentation. The PUREX Plant EIS discusses the handling of fuel in the PUREX Plant which is shipped using the irradiated fuel cask car(s). The recovery of fuel fragments from N Reactor Basin, and the temporary storage of the fuel within N Reactor are addressed in an EA for N Reactor Stabilization.

105 K Basins Background

The 105-KE and 105-KW Basins presently contain 2,108 metric tons (2,320 short tons) of irradiated fuel. The fuel at the K Basins is currently stored under water in reinforced concrete basins. Each basin is 38 meters (125 feet) long and 20 meters (67 feet) wide. Fuel canisters are stored in racks in the basins and water levels are maintained at a minimum of 3 meters (10 feet) above the canisters to cool the fuel and provide radiation shielding for personnel working in the facilities. The water in each basin is recirculated through a closed water cooling system. In addition, filters and ion exchange systems maintain water clarity and remove radionuclides.

The 105-KW Basin presently contains ZC irradiated fuel with an operational limit for an enrichment which may exceed 0.95 percent 235U. In the late 1970's, the 105-KW Basin was emptied, decontaminated, and the basin walls were coated with an epoxy. The 105-KW Basin was placed back into operation in 1981, and all fuel stored within the basin has been encapsulated in sealed canisters to prevent contamination spread from exposed degrading fuel. The 105-KE Basin presently stores both AC and ZC fuel in open containers with an operational fuel enrichment limit for the receipt and handling of irradiated fuel of less than or equal to 0.95 percent 235U. Approved safety specifications and operating limits for fuel storage at the K Basins, including criticality considerations, can be found in the operation safety requirements for the basins.

K Basins storage locations for fuel canisters and containers are approximately 98 percent full. The additional 20 to 25 canisters of fuel from PUREX and N Reactor could be stored in the available storage locations.

APPENDIX B

Air Emissions During Fuel Shipments from the Plutonium-Uranium Extraction Plant and the 105 N Reactor Fuel Storage Basins

Since the source term is largely contained (i.e., fuel cladding on aluminum clad, single-pass fuel, and canisters of zircaloy clad 105 N Reactor fuel), the fuels would not contribute to air emissions during the proposed shipments to the K Basins. Contamination is present on the inner surfaces of the rail car and casks. Clean water would be provided for the shipping casks and rail car, so the water would not be a significant contributor to air emissions. The emissions most likely would be a result of existing contamination on the rail car and shipping casks. A similar situation exists at the 105-KE fuel storage basin, where air emissions are thought to be mostly related to contamination near the water to wall interfaces.

A very conservative estimate of the rail car release to the environment can be made by assuming the rail cars have the same level of contamination as the 105-KE fuel storage basin. The source of the radionuclide emissions from the KE Basins is assumed to originate at the water to wall interface around the perimeter of the basin. The release rate from the cars can be estimated by multiplying the KE Basin release rate by the ratio of the perimeters. Emissions have been projected for encapsulation at the 105-KE fuel storage basin, based on actual data taken during periods of sludge disturbance (DOE 1993). These projected emissions are assumed to be similar to those expected during shipment, provided that the geometric factors are similar. This should be a conservative assumption, given the continuing dissolution and dispersal of fuel ongoing in the 105-KE fuel storage basin water verses the constant source in the rail car.

The 105-KE fuel storage basin is 38 meters (125 feet) long by 20 meters (67 feet) wide, with several islands and adjoining pit areas. The linear footage around the basin perimeter, excluding islands and pit areas, is approximately 117 meters (384 feet). The rail car internal dimensions are approximately 5.1 meters (16.8 feet) long by 2.0 meters (6.5 feet) wide. The linear footage around the three well perimeter is therefore 14.2 meters (47 feet). Based on the perimeters, the emissions from a rail car can be projected to be 47/384 = 12 percent of those from 105-KE fuel storage basin encapsulation (on an annual basis).

Emissions are assumed to occur over a five day period; one day to transport the rail car to the Plutonium-Uranium Extraction Plant or N Reactor, one day during the shipment, and for up to three days following for unloading into one of the K Basins and retrieving the casks. There would be a total of four cask cars shipped.

The total emissions which will occur during the transfer and unloading of the fuel can be estimated using the following equation.

The total emissions from the four cask cars shipped would equal the annual emission rate x the time for each cask car transport and unloading x the four cars.

Total Emissions (Rail Cars) = KE Basin Emissions/Year X 1 Year/365 Days X Duration Of Shipment X Ratio Of Perimeters X Number of Cars Shipped

OR

Total Emissions (Rail Cars) = KE Basin Emissions/Year X 1/365 X 5 X .12 X 4
= KE Basin Emissions/Year X 0.0066 (0.66%)

Projected emissions from the 105-KE fuel storage basin encapsulation, per *Notice of Construction for the 105-KE Encapsulation Activity*, (DOE 1993) equals 1.3 curies per year. A breakdown is provided in the reference, as well as a projected dose of 7.9×10^{-4} millirem per year committed effective dose equivalent (EDE) to the offsite maximally exposed individual (MEI), 9.9 kilometers (6.2 miles) west of 100 Area. Therefore the total emissions resulting from the shipment and unloading at the K Basins can be estimated to be less than 0.66 percent of those projected for encapsulation. On this basis, a projected dose of 5.2×10^{-6} millirem or 5.2×10^{-9} rem per year committed EDE to the offsite MEI, 9.9 kilometers (6.2 miles) west of 100 Area would occur. Thus, no health effects would be expected to occur as a result of the proposed action.

Appendix C

EA Comments and Responses

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
P.O. Box 47600 • Olympia, Washington 98504-7600 • (206) 407-6000 • TDD Only (Hearing Impaired) (206) 407-6006

May 5, 1995

Mr. Paul F. X. Dunigan, Jr.
Department of Energy
PO Box 550
Richland WA 99352

Dear Mr. Dunigan:

Thank you for the opportunity to comment on the environmental assessment (EA) for the Transfer of Plutonium-Uranium Extraction Plant and N Reactor Irradiated Fuel for Storage at the 105-KE and 105-KW Fuel Storage Basins (DOE/EA-0988D). We have reviewed the document and have the following comments.

General Comments

1) The EA should describe: a) how the transfer and consolidation of this fuel will or will not impact the accelerated path forward for removal of fuel from K-Basins by December 1999, and b) how this EA effects the proposed environmental impact statement (EIS) yet to be completed for K-Basin fuel removal.

2) The EA fails to clearly describe how the sludge in N Reactor will be managed. It is recommended that this sludge be treated in a manner consistent with management of the sludge in K-Basins. The document should be revised by adding a description as to how the N Reactor fuel fragments and chips will be separated from the sludge and that the sludge will be managed in a manner consistent with K-Basin sludge.

3) The EA describes T-Plant as the only other operational fuel storage facility on site suitable for aluminum clad (AC) or zircaloy clad (ZC) fuel. If fuel is currently stored at T-Plant, has USDOE considered consolidating that fuel to K-Basins as well as the PUREX fuel? Please provide additional information which discusses these concerns.

Specific Comments

1. On page ES-2, second paragraph, the sentence reads "The K Basins operational limits on allowable packaging and uranium enrichment require that the be transported to the 105-KW Basin." and should be corrected.

Paul F. X. Dunigan
May 5, 1995
Page 2

2. On page G-2, the glossary definition of the Path Forward for Spent Nuclear Fuel refers to a Westinghouse Hanford Company (WHC) recommendation. Please provide a document title and revision number for the recommended approach cited.

If you have any questions, please call Mr. Tom Tebb with our Nuclear Waste Program at (509) 736-3020.

Sincerely,

Barbara J. Ritchie

Barbara J. Ritchie
Environmental Review Section

BJR:ri
95-2676

cc: Tom Tebb, Nuc
Ron Effland, Nuc
Geoff Tallent, Nuc

Nez Perce

ENVIRONMENTAL RESTORATION & WASTE MANAGEMENT

P.O. BOX 365 · LAPWAI, IDAHO 83540-0365 · (208) 843-7375 / FAX: 843-7378

April 26, 1995

Mr. Paul F. X.. Dunigan, Jr.
U.S. Department of Energy
Richland Operations Office
P.O. Box 550
Richland, Washington 99352

Dear Mr. Dunigan:

The Nez Perce Tribe Department of Environmental Restoration and Waste Management (ERWM) has received and reviewed a copy of **ENVIRONMENTAL ASSESSMENT: TRANSFER OF PLUTONIUM-URANIUM EXTRACTION PLANT AND N REACTOR IRRADIATED FUEL FOR STORAGE AT THE 105-KE AND 105-KW FUEL STORAGE BASINS, DOE/EA-0988D**. Enclosed, for your consideration, are the ERWM's specific comments and suggestions on that document.

The Nez Perce Tribe recognizes the need to remove irradiated fuel from the Purex Plant and N Reactor to facilitate the deactivation and stabilization of the facilities in preparation for decontamination and decommissioning. ERWM acknowledges the complexity of the ultimate disposition of this irradiated fuel and fully supports this plan. However, we have some concerns that may affect the health and safety of members and employees of our Tribe as well as workers handling this irradiated fuel. Hereunder are our general comments:

a) In this case, the Nez Perce ERWM faces a classical "Hobson's Choice". The alternative to not place radioactive material into deteriorated storage basins near the Columbia River is to delay the decontamination and decommissioning of the N Reactor and Purex Plant. Nez Perce ERWM recognizes no final decisions have yet been made, but we recognize the seriousness of moving irradiated fuel into the nearly full K Basins.

b) Since the material to be moved is irradiated fuel and not spent nuclear fuel, does this fuel have a commercial use or value? Has the option of recycling this fuel been considered? How costly and time consuming is the construction of shipment canisters to move the irradiated fuel to an off-site location.

c) It is unclear from this Environmental Assessment if the AC fuel can be safely stored at the T Plant without modifying the T Plant. The T Plant's location in the 200 Area is preferable to that of the K Basins since the K Basins are within 500 feet of the Columbia River. If the T Plant can accept the 2.9 metric tons of AC fuel, then this fuel should not be relocated at the bank of the Columbia River. The remaining metric ton of ZC fuel and AC and ZC fuel fragments could be stored in the 105 KW Basin.

d) Based on environmental concerns and worker safety, none of this fuel should be stored in the 105-KE Basin. The 105-KE Basin has a history of leaking, is not epoxy lined, and contains nuclear materials that are not encapsulated. The radiation hourly dose rate to workers in the 105-KE Basin is 5 to 50 times greater than in the 105-KW Basin.

e) The estimated costs of the alternatives are not reported in this environmental assessment. What are the estimated costs and time periods for the various alternatives?

f) The Nez Perce Tribe prefers to see the option of storing the AC fuel in the T Plant fully explored as it removes long-lived radionuclides from close proximity to the Columbia River. Although this alternative may be more costly in the short run, we believe it is prudent to lessen this long term threat to the Columbia River and biota dependent upon the river as much as reasonably possible.

The Nez Perce ERWM Office appreciates the opportunity to provide comments on the **ENVIRONMENTAL ASSESSMENT: TRANSFER OF PLUTONIUM-URANIUM EXTRACTION PLANT AND N REACTOR IRRADIATED FUEL FOR STORAGE AT THE 105-KE AND 105-KW FUEL STORAGE BASINS, DOE/EA-0988D.**

If you wish to discuss Nez Perce ERWM's comments further, then please contact Dr. Stanley M. Sobczyk or Dr. Rico O. Cruz at 208-843-7375 or 208-843-7378 (fax).

Sincerely,

Donna L. Powaukee

Donna L. Powaukee
ERWM Manager

In Concurrence: Samuel N. Penney
Charles H. Hayes
for Chairman

cc: John Wagoner, DOE-RL, Site Manager
Kevin Clarke, DOE-RL, Indian Programs Manager
Steve Alexander, Ecology, Perimeter Areas Section Manager
Douglas Sherwood, EPA, Hanford Project Manager

3

RESPONSE TO

ENVIRONMENTAL ASSESSMENT
TRANSFER OF PLUTONIUM-URANIUM EXTRACTION PLANT AND N REACTOR IRRADIATED FUEL FOR STORAGE AT THE 105-KE AND 105-KW FUEL STORAGE BASINS
DOE/EA-0988D

Comments Prepared By:

Nez Perce Tribe
Department of Environmental Restoration and Waste Management Staff

April 26, 1995

4

THE NEZ PERCE TRIBE
DEPARTMENT OF ENVIRONMENTAL RESTORATION AND WASTE MANAGEMENT

COMMENTS ON THE ENVIRONMENTAL ASSESSMENT TRANSFER OF PLUTONIUM-URANIUM EXTRACTION PLANT AND N REACTOR IRRADIATED FUEL FOR STORAGE AT THE 105-KE AND 105-KW FUEL STORAGE BASINS DOE/EA-0988D

Since 1855, reserved treaty rights of the Nez Perce Tribe in the Mid-Columbia have been recognized and affirmed through a series of federal and state actions. These actions protect the interests of the Nez Perce to exploit their usual and accustomed resources and resource areas in the Hanford Reach of the Columbia River and elsewhere. Accordingly, the Nez Perce Tribe Department of Environmental Restoration and Waste Management (ERWM) has support from the U.S. Department of Energy (DOE) to participate in and monitor certain DOE activities. The Nez Perce Tribe Department of Environmental Restoration and Waste Management Program responds to documents calling for public comment from the U.S. Department of Energy. The Program critically reviews and comments on papers in an objective and straight forward manner. Each document review is usually provided in a format that lists the Page number, Paragraph number, Sentence number: Comment. Following are specific comments on the **ENVIRONMENTAL ASSESSMENT: TRANSFER OF PLUTONIUM-URANIUM EXTRACTION PLANT AND N REACTOR IRRADIATED FUEL FOR STORAGE AT THE 105-KE AND 105-KW FUEL STORAGE BASINS (DOE/EA-0988D).**

SPECIFIC COMMENTS

Page ES-2, Paragraph 2, Sentence 3

Due to a typographical error, the meaning of this sentence is unclear: "The K Basins operational limits on allowable packaging and uranium enrichment require that the be transported to the 105-KW Basin." Can the canisters of ZC fuel be purged, sealed, and stored only in the 105 KW Basin?

Page ES-3, Paragraph 1, Last Sentence

What is the cost and time frame to modify the T Plant facility so that it could accommodate AC and ZC fuels?

Page ES-3, Paragraph 3

Do the K Basins currently store irradiated fuel, spent nuclear fuel, or both?

5

Page ES-4, Paragraph 2, Last Sentence

How was the probability of a 1 in 10,000 of a fuel container drop at the PUREX Plant, N Reactor, or the K Basins determined? Does the estimate that about 0.5 metric tons of irradiated fuel elements were dropped at the PUREX Plant during operations match the 1 in 10,000 scenario referenced in WHC, 1993b?

Page 3.2, 3.1.3 Store the Fuel at a Hanford Location Other than the 105-KE/105-KW Fuel Storage Basins, Paragraph 1

While the T Plant can not be used to store the ZC fuel without modification, can the T Plant store both the Shippingport Reactor fuel elements and AC fuel without modification?

Page 3.2, 3.1.3 Store the Fuel at a Hanford Location Other than the 105-KE/105-KW Fuel Storage Basins, Paragraph 2

What is the cost and time frame to modify the T Plant so that it could safely store AC fuel, ZC fuel, and Shippingport Reactor fuel elements? What is the savings to deactivate the PUREX and N Basin without waiting for the T Plant to be modified? Does the time and money saved out weight the risk associated with storing this fuel in a deteriorating facility near the Columbia River?

Page 4-1, 4.0 Affected Environment, Paragraph 4

Are neither the K Basins or the N Reactor located in the 100-year floodplain of the Columbia River? Would the K Basins fulfill the requirements of WAC 173-303-282 Siting Criteria?

Page 5-1, 5.2.2 Rail Transport Environmental Impacts, Paragraph 1, Sentence 1

Has any radioactive waste and irradiated fuel been moved by rail since the PUREX shutdown in 1989? Are site workers familiar and experienced in the rail movement of radioactive waste?

Page 5-3, 5.2.3 105-KE and 105-KW Fuel Storage Basins Environmental Impacts, Paragraph 2

Workers in the 105-KE Basin receive a dose rate of .05 to .005 rem/hour. This rate is 5 to 50 times the dose rate to workers in the 105-KW Basin. Therefore, it is preferable to store all of the irradiated fuel in the 105-KW Basin.

Page 5-6, 5.2.4.2 105-KE/105-KW Fuel Storage Basins Accident, Paragraph 3

According to this Environmental Assessment, the Purex Plant's disssolver cell floors hold about 0.5 metric tons (0.6 short tons) of dropped fuel rods. These dropped fuel rods indicate the possibility of a real safety issue for the workers involved.

Page 5-11, Table 5, Postulated Upper Bound Rail Accident, Row 3, Column 3

6

The number 1.6 x 15^{-2} is a typographical error and should be changed to 1.6 x 10^{-2}.

Page A-3, Irradiated Fuel Cask Cars Background, paragraph 2

What is the ultimate disposition of water drained from the cask car? Is this water a potential health hazard?

United States Department of the Interior

NATIONAL PARK SERVICE
Pacific Northwest Region
909 First Avenue
Seattle, Washington 98104-1060

IN REPLY REFER TO:

L7619(PNR-RP)
Hanford Reach, WA-W&S

APR 1 2 1995

Paul F. X. Dunigan, Jr.
Department of Energy
Richland Operations Office
Mail Stop IN A5-15
Post Office Box 550
Richland, Washington 99352

Dear Mr. Dunigan:

We have reviewed the environmental assessment on Transfer of Plutonium-Uranium Extraction Plant and N Reactor Irradiated Fuel for Storage at the 105-KE and 105-KW Fuel Storage Basins. As proposed, we do not believe the action would have any significant negative impacts on the proposed wild and scenic river designation, or the establishment of a national wildlife refuge.

Thank you for consulting with the National Park Service. If you have any questions, please contact Dan Haas at (206) 220-4120.

Sincerely,

Richard L. Winters
Associate Regional Director
Recreation Programs and Professional Services

Enclosure

Department of Energy
Richland Operations Office
P.O. Box 550
Richland, Washington 99352

JUL 11 1995

95-PUREX-050

Ms. Barbara J. Ritchie
Environmental Review Section
State of Washington
Department of Ecology
P.O. Box 47600
Olympia, Washington 98504-7600

Dear Ms. Ritchie:

RESPONSE TO COMMENTS ON ENVIRONMENTAL ASSESSMENT (EA) DOE-EA-0988: TRANSFER OF PLUTONIUM-URANIUM EXTRACTION PLANT AND N REACTOR IRRADIATED FUEL FOR STORAGE AT THE 105-KE AND 105-KW FUEL STORAGE BASINS

The U.S. Department of Energy, Richland Operations Office wishes to thank you for your comments dated May 5, 1995, on the subject draft EA. Responses to the comments are enclosed, and changes to the EA are noted.

If you have any questions, please call me on (509) 376-6667.

Sincerely,

Paul F. X. Dunigan, Jr.

Paul F. X. Dunigan, Jr.
NEPA Compliance Officer

TPD:LER

Enclosure

Enclosure

Response to Comments on Environmental Assessment DOE-EA-0988

General Comments

1. The EA should describe: a) how the transfer and consolidation of this fuel will or will not impact the accelerated path forward for removal of fuel from the K Basins by December 1999, and b) how this EA affects the proposed environmental impact statement (EIS) yet to be completed for K Basin fuel removal.

   Both the accelerated path forward and the proposed EIS for K Basins fuel removal include the PUREX and N Basin fuel within the 105 K Basins inventory. This EA is not expected to impact the EIS.

2 The EA fails to clearly describe how the sludge in N Reactor will be managed. It is recommended that this sludge be treated in a manner consistent with management of sludge in K Basins. The document should be revised by adding a description as to how the N Reactor fuel fragments and chips will be separated from the sludge and that the sludge will be managed in a manner consistent with the K Basin sludge.

   The N Reactor fuel transfer was added to this fuel transfer EA to support the deactivation work at N Reactor. The handling and disposition of the sludge and the separation of fuel fragments and chips from the sludge are addressed in the EA for N Reactor deactivation (DOE/EA-0984). At the present time, there are no plans to transfer the N Reactor sludge to the 105 K Basins.

3. The document describes T-Plant as the only other operational fuel storage facility on site suitable for aluminum clad (AC) or zircaloy clad (ZC) fuel. If fuel is currently stored at T-Plant, has USDOE considered consolidating that fuel to K Basins as well as the PUREX fuel? Please provide additional information which discusses these concerns.

   There is no AC or ZC fuel currently stored at T-Plant. The transfer of the Shippingport Reactor fuel in T Plant to K Basins has not been considered because the fuel is now stored at T Plant in a satisfactory manner with proper water chemistry and temperature control and there is no need to transfer the fuel.

Specific Comments

1. On page ES-2, second paragraph, the sentence reads "the K Basins operational limits on allowable packaging and uranium enrichment require that the be transported to the 105-KW Basin." and should be corrected.

   This sentence will be modified to state " The K Basins operational limits on allowable packaging and uranium enrichment require that the ZC fuel be transported to the 105-KW basin."

2. On page G-2, the glossary definition of the Path Forward for Spent Nuclear Fuel refers to a Westinghouse Hanford Company (WHC) recommendation. Please provide a document title and revision number for the recommended approach cited.

   Due to the changing nature of the "Path Forward" documentation which is still being modified at this time, all references will be excluded from the EA: however, a revised document containing the present planning will be issued later in 1995. The version of the document issued last fall is "Hanford Spent Nuclear Fuel Project Recommended Path Forward - Volume I", WHC-EP-0830, Westinghouse Hanford Company, Richland, Washington.

Department of Energy
Richland Operations Office
P.O. Box 550
Richland, Washington 99352

JUL 11 1995

95-PUREX-051

Ms. Donna L. Powaukee, Manager
Environmental Restoration and Waste Management
Nez Perce Tribe
P.O. Box 365
Lapwai, Idaho 83540-0365

Dear Ms. Powaukee:

RESPONSE TO COMMENTS ON ENVIRONMENTAL ASSESSMENT (EA) DOE-EA-0988: TRANSFER OF PLUTONIUM-URANIUM EXTRACTION PLANT AND N REACTOR IRRADIATED FUEL FOR STORAGE AT THE 105-KE AND 105-KW FUEL STORAGE BASINS

The U.S. Department of Energy Richland Operations Office wishes to thank you for your comments dated April 26, 1995, on the subject draft EA. Responses to the comments are enclosed, and changes to the EA are noted.

If you have any questions, please call me on (509) 376-6667.

Sincerely,

Paul F. X. Dunigan, Jr.
Paul F. X. Dunigan, Jr.
NEPA Compliance Officer

TPD:LER

Enclosure

Enclosure

Response to Comments on Environmental Assessment DOE-EA-0988

Responses to comments in the letter

1. In this case, the Nez Perce ERWM faces a classical "Hobson's Choice". The alternative to not place radioactive material into deteriorated storage basins near the Columbia River is to delay the decontamination and decommissioning of the N Reactor and PUREX Plant. Nez Perce ERWM recognizes no final decisions have yet been made, but we recognize the seriousness of moving irradiated fuel into the nearly full K Basins.

   DOE believes the best alternative is to transfer a small additional amount of fuel to the K Basins to be dispositioned with the existing large K Basins fuel inventory, allowing the timely deactivation and stabilization of PUREX and the N Reactor.

2. Since the material to be moved is irradiated fuel and not spent nuclear fuel, does this fuel have a commercial use or value? Has the option of recycling this fuel been considered? How costly and time consuming is the construction of shipment canisters to move the irradiated fuel to an offsite location?

   At this time, the fuel has no commercial use or value. Processing the fuel in the PUREX Plant dissolver cells is one of the alternatives considered in the EA. Offsite shipment and processing was not considered because the irradiated fuel at PUREX is not compatible with existing commercial reactors either in form or enrichment. Shipping cask costs and schedules have not been determined.

3. It is unclear from this Environmental Assessment if the AC fuel can be safely stored at the T Plant without modifying the T Plant. The T Plant's location in the 200 Area is preferable to that of the K Basins since the K Basins are within 500 feet of the Columbia River. The remaining metric ton of ZC fuel and AC and ZC fuel fragments could be stored in the 105 KW Basin.

   Alternative 3.1.3 in the EA states that modifications would have to be made to the storage pool at T Plant to isolate the different fuels within the basin. New or upgraded water chemistry and temperature control features would also be required.

   The storage of the AC fuel at the T Plant would require the development of a new packaging system (i.e. buckets in an overpack system) and storage area within the T Plant fuel storage pool. This would protect the existing Shippingport fuel from contamination and assist in preventing SPR fuel degradation. Additional modifications to the T Plant water conditioning systems may also be required to ensure adequate heat removal capacities and water quality to protect the aluminum cladding.

4. Based on environmental concerns and worker safety, none of this fuel should be stored in the 105-KE Basin. The 105-KE Basin has a history of leaking, is not epoxy lined, and contains nuclear materials that are not encapsulated. The radiation hourly dose rate to workers in the 105-KE Basin is 5 to 50 times greater than in the 105-KW Basin.

   In order to maintain flexibility in case of operating or scheduling conflicts, the EA provides for unloading and storage of the AC fuel in either of the basins; however, the present plans are to transfer all of the fuel to 105 KW Basin.

5. The estimated costs of the alternatives are not reported in this environmental assessment. What are the estimated costs and time periods for the various alternatives?

   The estimated completion times and a rough order of magnitude (ROM) cost for the alternatives are given below.

Alternative	*Completion Time*	*ROM Costs*
Store At K Basins	*1 Year*	*\$0.6M*
Process Fuel In PUREX[1]	*3 Years*	*\$11M*
Store Fuel Elsewhere (T Plant)	*2 Years*	*\$6.6M*

6. The Nez Perce tribe prefers to see the option of storing the AC fuel in the T Plant fully explored as it removes long-lived radionuclides from close proximity to the Columbia River. Although this alternative may be more costly in the short run, we believe it is prudent to lessen this long term threat to the Columbia River and biota dependent on the river as much as reasonably possible.

   Because it is the most cost effective and timely alternative, DOE believes transfer of the fuel to the K Basins for storage is the best alternative. The K Basins irradiated fuel inventory would be increased by only 0.2 percent and fuel transferred to the 105-KW basin would be in canisters. This small amount of additional fuel would add very little to the long term threat to the Columbia River and biota due to the anticipated removal of all K Basins fuel in the future.

[1] This estimate is based on the condition of the plant in 1992. The cost would now be much higher.

Responses to specific comments in the attachment to the signed letter

Page ES-2, Paragraph 2, Sentence 3

Due to a typographical error, the meaning of this sentence is unclear. "The K Basins operational limits on allowable packaging and uranium enrichment require that the be transported to the 105-KW Basin". Can the canisters of ZC fuel be purged, sealed, and stored only in the 105-KW Basin?

The typographical error will be corrected in the EA. The sentence will be modified to read "...uranium enrichment require that the ZC fuel be transported to the 105 KW Basin." Because of the operational limits this is where the canisters of ZC fuel would have to be placed. Canisters of fuel can be purged and sealed in either basin.

Page ES-3, Paragraph 1, Last Sentence

What is the cost and time frame to modify the T Plant facility so that it could accommodate AC and ZC fuels?

Please see item 5. above.

Page ES-3, Paragraph 3

Do the K Basins currently store irradiated fuel, spent nuclear fuel, or both?

Fuel from production reactors that has been irradiated for a relatively short time to produce special nuclear materials is usually called irradiated fuel while fuel that has been irradiated in a power reactor through the useful life of the fuel to produce electricity is referred to as spent fuel. By this definition, the stored fuel is irradiated fuel. The fuel stored in the K Basins is commonly called irradiated fuel.

Page ES-4, Paragraph 2, Last Sentence

How was the probability of a 1 in 10,000 of a fuel container drop at the PUREX Plant, N Reactor, or the K Basins determined? Does the estimate that about 0.5 metric tons of irradiated fuel elements were dropped at the PUREX Plant during operations match the 1 in 10,000 scenario referenced in WHC, 1993b?

The 1 in 10,000 probability is for a postulated accident and corresponds to the failure of a crane while the fuel is being lifted into or out of the cask cars, as outlined in WHC, 1993b, "Safety Analysis Report Handling and Storage of Irradiate N Reactor Fuel in 105-KE and 105-KW Fuel Storage Facilities", WHC-SD-WM-SAR-062. The drop of fuel elements into the dissolver cells occurred during dissolver charging operations. This is not comparable to the fuel handling operations discussed in this EA.

Page 3.2, 3.1.3 Store The Fuel at a Hanford Location Other Than The 105-KE/105-KW Fuel Storage Basins, Paragraph 1.

While the T plant can not be used to store the ZC fuel without modification, can the T Plant store both the Shippingport Reactor fuel elements and AC fuel without modification?

See item 3. above.

Page 3.2, 3.1.3 Store The Fuel at a Hanford Location Other Than The 105-KE/105-KW Fuel Storage Basins, Paragraph 2.

What is the cost and time frame to modify the T Plant so that it could safely store AC fuel, ZC fuel, and Shippingport Reactor fuel elements? What is the savings to deactivate the PUREX and N Basin without waiting for the T Plant to be modified? Does the time and money saved outweigh the risk associated with storing this fuel in a deteriorating facility near the Columbia River?

See items 5. and 6. above. The deactivation of the PUREX Plant will result in approximately $100K per day savings. The N Basin fuel transfer is planned for a later date and would probably not be impacted by waiting for the T Plant alternative. As previously stated, the small incremental fuel addition adds very little to the risk of K Basin storage but results in substantial cost savings at PUREX.

Page 4-1, 4.0 Affected Environment, Paragraph 4

Are neither the K Basins or the N Reactor located in the 100 year flood plain of the Columbia River? Would the K Basins fulfill the requirements of WAC 173-303-282 Siting Criteria?

As stated in Section 4.0 of the EA, neither the K Basins or the N Reactor are in the 100 year flood plain. The K Basins are not being regulated as a TSD unit under WAC 173-303 and therefore are not subject to the siting criteria of the State of Washington Dangerous Waste Regulations.

Page 5-1, 5.2.2 Rail Transport Environmental Impacts, Paragraph 1, Sentence 1

Has any radioactive waste and irradiated fuel been moved by rail since the PUREX shutdown in 1989? Are site workers familiar and experienced in the rail movement of radioactive waste?

There have been no shipments of fuel since the transfer of fuel between PUREX and the K Basins in 1989. There are experienced workers at both facilities and with the train crew who have been involved with previous fuel transfers. The operators and train crews will be trained on the procedures for the fuel loading, rail transfer and unloading of fuel prior to conducting the fuel transfer.

Page 5-3, 5.2.3, 105-KE and 105-KW Fuel Storage Basins Environmental Impacts, Paragraph 2

Workers in the KE Basin receive a dose rate of .05 to .005 rem/hour. This rate is 5 to 50 times the dose rate to workers in the 105-KW Basin. Therefore, it is preferable to store all of the irradiated fuel in the 105-KW Basin.

The present plans are to transfer all of the PUREX fuel to 105-KW Basin. However, the option for the transfer of the SPR fuel to 105-KE will remain open as an alternative to be used if basin scheduling activities would impact PUREX deactivation.

Page 5-6, 5.2.4.2, 105-KE/105-KW Fuel Storage Basins Accident, Paragraph 3

According to this Environmental Assessment, the PUREX Plant's dissolver cell floors hold about 0.5 metric tons (0.6 short tons) of dropped fuel rods. These dropped fuel rods indicate the possibility of a real safety issue for the workers involved.

The drop of fuel elements into the dissolver cells occurred during dissolver charging operations. This is not comparable to the fuel handling operations discussed in this EA. The recovery of the dropped fuel from the PUREX dissolver cell floors has now been successfully completed. The postulated accident for the drop of fuel elements due to a crane failure does present a risk to the K Basins operators and the estimated dose to the workers is presented. If an accident were to occur, the operators would immediately leave the area and a recovery plan would be initiated which would use remote technology to isolate the worker from the dropped elements. The probability of this accident is only 1 in 10,000.

Page 5-11, Table 5, Postulated Upper Bound Rail Accident, Row 3, Column 3

The number 1.6×15^{-2} is a typographical error and should be changed to 1.6×10^{-2}.

The error will be corrected in the EA.

Page A-3, Irradiated Fuel Cask Cars Background, paragraph 2

What is the ultimate disposition of water drained from the cask car? Is this water a potential health hazard?

The water from draining the cask cars will be collected in a PUREX canyon tank, sampled for characterization, neutralized, and transferred to an underground waste storage tank. The water will contain radionuclides, but Hanford Site procedures for waste handling will be followed and will minimize any potential health hazard.

FINDING OF NO SIGNIFICANT IMPACT

FOR

TRANSFER OF PLUTONIUM-URANIUM EXTRACTION PLANT AND

N REACTOR IRRADIATED FUEL

FOR STORAGE AT THE 105-KE AND 105-KW

FUEL STORAGE BASINS

U.S. DEPARTMENT OF ENERGY

RICHLAND, WASHINGTON

JULY 1995

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-0988, to assess environmental impacts associated with the transfer of approximately 3.9 metric tons (4.3 short tons) of unprocessed irradiated fuel from the Plutonium-Uranium Extraction (PUREX) Plant in the 200 East Area and the 105 N Reactor (N Reactor) fuel storage basin in the 100 N Area to the 105-KE and 105-KW fuel storage basins (K Basins) in the 100 K Area. The fuel will be placed in storage at the K Basins, along with fuel presently stored. Alternatives considered in the review process were: the No Action alternative; Process the Fuel in the PUREX Plant dissolver cells; Store the Fuel at a Hanford Location Other than the K Basins; and the proposed action.

Based on the analysis in the EA, and considering preapproval comments from the State of Washington and the Nez Perce Tribe, 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* (NEPA) *of 1969*. Therefore, the preparation of an Environmental Impact Statement (EIS) is not required.

ADDRESSES AND FURTHER INFORMATION:

Single copies of the EA and further project information about the proposed action are available from:

Mr. J. E. Mecca, Director
Transition Program Division
U.S. Department of Energy
Richland Operations Office
Richland, Washington 99352
(509) 376-7471

For further information regarding the DOE NEPA process, contact:

Ms. Carol M. Borgstrom, Director
Office of NEPA Policy and Assistance
U.S. Department of Energy
1000 Independence Avenue, S.W.
Washington, D.C. 20685
(202) 586-4600 or (800)-472-2756

PURPOSE AND NEED: DOE needs to take action to remove irradiated fuel from the PUREX Plant and N Reactor at the Hanford Site, Richland, Washington, to support the deactivation and stabilization of the facilities in preparation for decontamination and decommissioning (D&D) and to reduce the cost of maintaining the facilities prior to D&D.

BACKGROUND: The PUREX Plant processed irradiated reactor fuel for recovery of uranium and plutonium for defense purposes. From 1956 to 1972, the plant processed aluminum clad (AC) fuel from the now retired eight production reactors (105-B, 105-C, 105-KE, 105-KW, 105-D, 105-DR, 105-F, and 105-H) located at the Hanford Site. From 1967 to 1972, the PUREX Plant also processed zircaloy clad (ZC) fuel from N Reactor. The PUREX Plant was restarted in 1983 and processed zircaloy clad N Reactor fuel until the plant was placed in standby mode in 1990. In December 1992, DOE directed the shutdown and deactivation of the PUREX Plant because it is no longer needed to support the nation's weapons grade plutonium production. The PUREX Plant is being deactivated and stabilized to place it in an environmentally safe and stable condition that requires minimal surveillance and maintenance. The facility will be maintained in this manner, until final D&D.
At the present, some irradiated fuel that was not processed remains in the facility. Approximately 2.9 metric tons (3.2 short tons) of single-pass production reactor, AC irradiated fuel were stored in four fuel baskets in the PUREX Plant's slug storage basin. Additionally, the PUREX Plant's dissolver cell floors held about 0.5 metric tons (0.6 short tons) of ZC and a few AC irradiated fuel elements that were dropped during the process of loading fuel into the dissolvers. As part of the PUREX Plant deactivation, the existing four baskets containing the AC fuel were placed into new overpack buckets and stored in the PUREX Plant slug storage basin to await shipment. The AC and ZC fuel elements on the dissolver cell floors were recovered, placed in wet fuel canisters and stored on the canyon deck.

The N Reactor produced ZC fuel for processing at PUREX beginning in 1963 and continuing to 1987 when the reactor was placed in stand-down status for extensive maintenance and a safety enhancement program. In February 1988, the reactor was ordered into cold standby and achieved that condition by October 1990. In July 1991, DOE decided to proceed with activities leading to the ultimate D&D of the Facility.

DOE is planning to place the N Reactor facilities into a radiologically and environmentally stable condition until D&D is initiated. A small quantity of irradiated ZC fuel, in the form of fuel fragments and chips, is suspected to be in the sludge remaining at the bottom of the fuel storage basin at the N Reactor. As part of the stabilization activities at the N Reactor, this sludge will be removed from the basin and any identifiable pieces of fuel elements will be recovered, placed in open canisters, and stored in lead lined casks in the storage basin to await shipment. A maximum of 0.5 metric tons (0.6 short tons) of fuel pieces is expected to be recovered.

PROPOSED ACTION: DOE is proposing to transfer approximately 3.9 metric tons (4.3 short tons) of unprocessed irradiated fuel, by rail, from the PUREX Plant and the 105 N Reactor to the 105-KE and 105-KW fuel storage basins (K Basins) in the 100 K Area. The fuel will be placed in storage at the K Basins, along with fuel presently stored, and will eventually be dispositioned in the same manner as the other existing irradiated fuel inventory stored in the K Basins. The fuel transfer to the K Basins will consolidate storage of fuels irradiated at the N Reactor and the Single Pass Reactors.

The proposed action will include loading the fuel into irradiated fuel cask cars and transporting the fuel from the PUREX Plant and the N Reactor to the K Basins for storage. A maximum of three railcar shipments of fuel will be made, two shipments from the PUREX Plant and one from N Reactor. The K Basins operational limits on allowable packaging and uranium enrichment require that the PUREX ZC fuel be transported to the 105-KW Basin. These fuel elements will be unloaded at the 105-KW Basin where the canisters will be purged, sealed, and stored with the existing fuel. The PUREX AC fuel elements could be shipped to either the 105-KE or 105-KW Basin where the fuel will be unloaded, packaged into canisters (at 105-KW Basin only), and placed with the other fuel already stored in the basin. The canisters of ZC fuel from N Reactor will be transferred to 105-KW Basins, unloaded, and stored with the existing fuel.

ALTERNATIVES CONSIDERED: No-Action Alternative: The fuel would remain at the PUREX Plant and the N Reactor. At the PUREX Plant, the fuel would remain in the process canyon in a storage location suitable for continued surveillance and monitoring. At the N Reactor, the fuel would remain in the storage pool. For this alternative, the removal of the fuel from the facilities would not be accomplished and deactivation and stabilization of the facilities may not occur. All or a major portion of the cost savings provided by deactivation and stabilization would not be realized.

Process the Fuel in the PUREX Plant Dissolver Cells: The fuel would be processed through the existing PUREX Plant. The fuel pieces from the N Reactor would be transported by rail to the PUREX Plant for processing. The process would remove the fuel cladding either by chemical dissolution or mechanical breakdown. The exposed fuel would then be dissolved using nitric acid. The resulting process solutions would become waste and would be transferred to underground storage tanks in the waste tank farms. This waste would eventually be processed for disposal along with existing liquid high-level waste. The plant also would generate additional process waste solutions from condensate or cooling water streams.

This alternative would require a partial startup of the PUREX Plant, which would be very costly. The process would convert the fuel to approximately 100,000 gallons of high-level radioactive liquid waste which would be transferred to underground storage tanks. This alternative would significantly delay the deactivation and stabilization of PUREX and the planned cost savings would not be realized. For these reasons, this alternative would not meet the Purpose and Need.

Store the Fuel At a Hanford Location Other Than the K Basins: The fuel from PUREX and N Reactor would be transported to another location on the Hanford Site for storage. At the present time, only T Plant, in the 200 West Area, has a suitable operating storage pool which can store the AC and ZC fuel. This pool already contains relatively clean Shippingport Reactor fuel elements, and the storage pool design includes water chemistry and temperature control features sufficient to store this fuel. Modifications would have to be made to the storage pool to isolate the different fuels within the basin. New or upgraded water chemistry and temperature control features would be required to allow storage of the ZC fuel. The fuel would be packaged at PUREX and N Reactor into acceptable storage containers, and then transferred to T Plant for storage. The time and cost required for modifying T Plant and the loss of PUREX and N Basin deactivation cost savings while this occurs makes this an undesirable alternative.

ENVIRONMENTAL IMPACTS: Construction Impacts: The proposed action will not require any construction activities; therefore, no adverse environmental impacts from construction operations will occur. No cultural resources, plant and animal life, critical habitat, floodplains, or wetlands will be affected.

Operational Impacts: Workers will receive a low radiation dose from the preventive maintenance work on the cask cars before loading at PUREX or N Reactor and decontaminating the cars prior to each shipment. An estimated worker exposure of 0.8 person-rem for maintenance on four cask cars is expected.

Rail transport of the fuel will not result in any discharge of liquids to the environment. Air emissions will be limited to exhaust gases and heat over a short time period from the diesel locomotive used to transport the fuel, and particulate radionuclide emissions that might escape from within the covered rail cask cars during transport as a result of air movements around the cars. The potential radiation dose to the train crew during fuel transfer will be minimized by the distance of the crew from the cask cars, operating procedures, and implementation of As Low As Reasonably Achievable principles. For these reasons, the train crew is assumed to receive no radiation dose.

An estimate of offsite radionuclide emissions resulting from transport of the rail cask cars to the K Basins, and offloading the fuel at the basins was made. The radiation dose to the offsite maximally exposed individual (MEI) is estimated to be about 5.2×10^{-9} rem from the three fuel shipments to be made, estimated to result in 2.6×10^{-12} LCF. Therefore, the offsite MEI would not be expected to be a cancer fatality.

There will be a potential for a radiation dose to workers handling the irradiated fuel transferred to the K Basins. A three person K Basin crew will unload each rail cask car and transfer the casks into the basins. The AC fuel may be transferred either to the 105-KE Basin or the 105-KW Basin. The maximum dose to the workers at the basins would result from the unloading of the two cask cars of ZC fuel at the 105-KW Basin and two cask cars of AC fuel at 105-KE. The total estimated worker dose for the four cask cars unloaded

would be 0.612 person-rem. Handling and encapsulation of the fuel in the basins is estimated to result in an additional worker exposure of 0.16 person-rem. The combined maximum 105-KE and 105-KW Basin worker exposure to unload the fuel, complete encapsulation of the fuel at 105-KW Basin, and to move the fuel to a basin storage location, is estimated to be 0.77 person-rem. The source of the worker exposure is direct radiation and there will be no direct source of exposure to workers outside the facilities.
A summary of the estimated dose to the workers from cask car maintenance, fuel loading, rail transfer, and unloading and encapsulation activities at K Basins shows an estimated total worker exposure of 1.6 person-rem, resulting in an estimated 6.3×10^{-4} LCF. Therefore, no cancer fatalities to the onsite workers are expected.

Potential Accidents: Routine movement of irradiated fuel by rail was carried out at the Hanford Site for many years prior to PUREX shutdown in 1989. No accidents with adverse environmental impacts have occurred in past fuel shipment operations. The potential exists for a discharge of radionuclides to the environment should an accident occur during the loading of the fuel at the PUREX Plant or N Reactor, during rail transport of irradiated fuel from the PUREX Plant and N Reactor to the K Basins, or during the unloading of the fuel at the K Basins. This could result in radiation exposure to workers and the public.

Two types of postulated accidents were considered: (1) a derailment of the rail cask car(s) during rail transport to the K Basins, and (2) a drop of a single, loaded fuel cask either during the loading of the fuel at the PUREX Plant and the N Reactor, or during unloading at the K Basins.

During the period of wet storage of the irradiated fuel, and the time the ZC fuel has resided on the dissolver cell floors in the PUREX Plant, some corrosion of the uranium metal fuel has occurred with possible formation of uranium hydride (UH_3). The upper bounding accident analyses conservatively assume a rapid oxidation of the hydride on the fuel following an accident in which the water covering the fuel is lost.

The postulated upper bounding accident during rail transport is a derailment of the rail cask car or cars resulting in a spill of all of the water inside the cask car tanks and the casks onto the ground. It is assumed that the cask lids remain in place and no fuel elements are spilled on the ground. The radionuclides in the water outside the casks are assumed to be released to the air by wind entrainment. The uranium hydride and adjacent uranium metal would begin to rapidly oxidize following the loss of the water. The combined airborne release would be the air entrained radionuclides from the water spill and the emissions from the rapidly oxidizing uranium hydride and metal. The probability of a fuel transportation rail accident at the Hanford Site involving a roll-over is estimated to be 4.2×10^{-9} per mile or once every 20,000,000 shipments, which is in the incredible range.

The postulated rail accident would result in an estimated dose of 7.9 rem to the maximally exposed onsite individual resulting in an estimated 3.2×10^{-3} LCF. The immediately affected workers would be the train crew of four who would receive an estimated dose of 31.6 person-rem resulting in an estimated 1.3×10^{-2} LCF. The maximally exposed offsite individual would receive an estimated dose of 0.02 rem resulting in an estimated 1.0×10^{-5}

LCF. The maximally exposed offsite population would receive an estimated dose of 31.8 person-rem resulting in an estimated 1.6 x 10^{-2} LCF in a population of about 100,000.

The postulated upper bounding accident for the loading of a cask car at the PUREX Plant is a crane failure resulting in the drop of a single canister of fuel containing 0.7 metric ton (0.77 short ton) of AC fuel onto the floor of the PUREX Plant's rail tunnel. The postulated upper bounding accident for the loading of the cask car at N Reactor is a crane failure resulting in the drop of a fully loaded shipping cask of ZC fuel onto the floor of the fuel transfer area. The postulated upper bounding accident for the receipt, handling and storage of the irradiated fuel at the K Basins is also a crane failure and the drop of a fully loaded shipping cask of ZC fuel onto the floor of the fuel transfer area.

These postulated accidents are all similar and differ only in the type and quantity of fuel involved. It is assumed that in each case the cask would overturn and the cask lid would come off, causing the irradiated fuel and the water in the cask to spill out. It is further assumed that the uranium hydride on the fuel dries out in the ventilation air and uranium hydride and adjacent uranium metal oxidizes producing airborne emissions. It is assumed that the water from the cask also dries out and the radionuclides from the corrosion products carried out in the water are entrained in the facility ventilation air. These upper bounding accidents are judged to be extremely unlikely, with an estimated probability of occurrence of 1 in 10,000.

The cask drop accident with the greatest consequences would be at the K Basins. The resulting dose to the maximally exposed onsite individual is estimated to be 2.0 rem resulting in an estimated 8.2 x 10^{-4} LCF. The dose to the immediately affected workers is estimated to be 15 person-rem resulting in an estimated 6.0 x 10^{-3} LCF. The dose to the maximally exposed offsite individual is estimated to be 0.004 rem resulting in an estimated 2.0 x 10^{-6} LCF. The dose to the maximally exposed offsite population is estimated to be 8.3 person-rem resulting in an estimated 5.15 x 10^{-2} LCF in a population of about 100,000.

For either the postulated rail accident or the cask drop accident in a facility, the dose to the accident cleanup crew is estimated to be 1.3 person-rem resulting in 5.2 x 10^{-4} LCF to the 20 worker crew.

Hazardous Chemicals: The proposed fuel transfer would not be considered a hazardous material shipment and would not involve the use of hazardous chemicals; therefore, there would be no potential for release of hazardous chemicals to the environment, exposure to workers, or the public resulting from the transportation and handling of the fuels or from the postulated accidents.

Socioeconomic Impacts: All fuel loading, transfer, and unloading activities would be accomplished by the current Hanford Site workforce. Therefore, no socioeconomic impacts are expected.

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. DOE is in the process of developing official guidance on the implementation of the Executive Order. Distributions of minority and low income population groups have been identified for the Hanford Site. The offsite environmental impacts analyzed in this EA are expected to be minimal, therefore no adverse health effects are expected to occur in any offsite community. No socioeconomic impacts are expected. No disproportionate impacts on any subgroups of the public including minority and low-income populations are expected.

Cumulative Impacts: No cumulative impacts of concern are expected from the transportation to and storage of a small additional amount of irradiated fuel at the K Basins. The quantity of fuel added to the existing fuel in the K Basins will increase the inventory by less than 0.2 percent which is within the existing capacity of the facility. Potential radiation exposure to workers at the PUREX Plant and the N Reactor would decrease when the irradiated fuels are transferred to the K Basins.

DETERMINATION: Based on the analysis in the EA, and after considering the preapproval review comments of the State of Washington and the Nez Perce tribe, I conclude that the proposed action to transfer Plutonium-Uranium Extraction Plant and N Reactor irradiated fuel for storage at the 105-KE and 105-KW Fuel Storage Basins does not constitute a major federal action significantly affecting the quality of the human environment within the meaning of NEPA. Therefore, an EIS for the proposed action is not required.

Issued at Richland, Washington, this 12 day of July 1995.

John D. Wagoner
Manager
Richland Operations Office