DOE/EA - 1005
Volume 1 of 2

ENVIRONMENTAL ASSESSMENT
DISPOSITION AND TRANSPORTATION
OF SURPLUS RADIOACTIVE LOW SPECIFIC ACTIVITY
NITRIC ACID

HANFORD SITE, RICHLAND, WASHINGTON

U.S. DEPARTMENT OF ENERGY

MAY 1995

MASTER

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DISPOSITION AND TRANSPORTATION OF RADIOACTIVE

LOW SPECIFIC ACTIVITY NITRIC ACID

HANFORD SITE, RICHLAND, WASHINGTON

U.S. DEPARTMENT OF ENERGY

FINDING OF NO SIGNIFICANT IMPACT

MAY 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-1005, to assess environmental impacts associated with the disposition and transportation of radioactive, low specific activity (LSA) nitric acid which is presently stored at the Plutonium-Uranium Extraction (PUREX) Plant located in the 200 East Area of DOE's Hanford Site near the City of Richland, Washington, to the British Nuclear Fuel private limited company's (BNF plc) B205 facility in Sellafield, England. Alternatives considered in the review process included: the No Action Alternative; the preferred alternative to transfer the nitric acid component to BNF plc's B205 facility; continued storage in a new or upgraded Hanford facility; consolidation of the LSA nitric acid with other DOE surplus acid; and processing the LSA nitric acid as waste.

DOE considered whether the proposed shipment of the nitric acid would be compatible with U.S. nonproliferation policy. In evaluating the nonproliferation policy aspects of the proposed shipment, DOE considered the facts that BNF plc has a readily available supply of nitric acid, which could be procured from any number of commercial sources. In addition, the proposed shipment appeared to be a case-specific solution to a material disposition problem, promoting waste minimization and reducing potential emissions to the environment. The export would not "...make a material contribution to the proliferation of weapons of mass destruction..." and would be consistent with Executive Order 12114, *Environmental Effects Abroad of Major Federal Actions*. These facts appeared to support the position that the transfer of nitric acid from the PUREX Plant was a policy-neutral decision, and did not set a precedent from either a technical or policy standpoint.

Based on the analysis in the EA, and considering preapproval comments from states, tribes and stakeholders, and comments during public meetings in Portsmouth, Virginia; Baltimore, Maryland; and Newark, New Jersey, DOE has determined that the proposed action is not a major federal action significantly affecting the quality of the human environment within the

meaning of the *National Environmental Policy Act of 1969* (NEPA), 42 U.S.C. 4321, et seq. Therefore, the preparation of an Environmental Impact Statement (EIS) is not required.

ADDRESSES AND FURTHER INFORMATION

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

Mr. James E. Mecca, Director
Transition Program Division
U.S. Department of Energy
Richland Operations Office
P. O. Box 550
Richland, Washington 99352
(509) 376-7471

For further information regarding the DOE NEPA process, contact:

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

PURPOSE AND NEED: The DOE needs to disposition surplus nitric acid as part of deactivating the PUREX Plant, to reduce the risk to the environment, to reduce the cost of long-term storage, and to assure regulatory compliance.

BACKGROUND: DOE is deactivating the PUREX Plant at the Hanford Site near Richland, Washington. The deactivation activities will result in placing the PUREX Plant in an environmentally safe and stable condition for long-term surveillance and maintenance. The successful deactivation of the PUREX Plant, which has received support from various stakeholder groups, will stabilize a portion of the Hanford Site's inventory of radioactive and hazardous materials. This will reduce the risk of exposure to both onsite workers and members of the general public. This also will reduce annual funding requirements from the current (approximately) \$34,000,000 per year to less than \$2,000,000 per year. One of the elements of complete deactivation of the PUREX Plant is the disposition of approximately 692,000 liters (183,000 gallons) of surplus low specific activity (LSA) nitric acid.

Continued long-term storage of the LSA nitric acid in the current storage configuration at the PUREX Plant would not be in compliance with applicable *Resource Conservation and Recovery Act of 1976* requirements, as implemented by the State of Washington Department of Ecology (Ecology) pursuant to the Washington Administrative Code (WAC) 173-303, *Dangerous Waste Regulations*. Presently, the nitric acid is considered a product by DOE. This position has been discussed with Ecology, based on shipping the nitric acid offsite for use as a raw material. On that basis, Ecology has responded in writing, indicating that although not currently classified as a solid waste, the material is a hazardous substance and

should be managed in a manner which ensures that releases will not occur, and human health and the environment will be protected. Additionally, for this material to be excluded from regulation under the provisions of speculative accumulation (WAC 173-303), at least 75 percent of the material must be transferred for recycling within calendar year (CY) 1995.

Nitric acid is a common chemical used throughout industry. In 1993 alone, approximately 5.3×10^9 liters (1.4×10^9 gallons [1.4 billion gallons]) of nitric acid was produced and transported internationally. Historically, nitric acid was used at the Hanford Site's PUREX Plant to dissolve irradiated fuel elements, as part of separation of fission products from uranium, plutonium and neptunium in solvent extractions operations. The nitric acid was recovered and reused during processing of fuel at the PUREX Plant.

In December 1992, DOE directed that the PUREX Plant be shut down and deactivated because additional plutonium was not required to support national needs. A specific result of cessation of PUREX Plant operations is that excess chemicals are available, including the approximately 692,000 liters (183,000 gallons) of slightly radioactively contaminated nitric acid. The average concentration of the nitric acid is approximately 10 moles per liter (not more than 52 weight percent nitric acid in aqueous solution). The total quantity of plutonium (Pu) in the nitric acid is less than 0.3 grams (0.01 ounces). The total quantity of uranium (U) is approximately 7,400 kilograms (16,300 pounds).

With no DOE use for the surplus LSA nitric acid identified, private sector interest was solicited. An Expression of Interest was received from BNF plc, the sole respondent to the Commerce Business Daily request dated December 28, 1993. No other private enterprise, nationally or internationally, expressed any interest in purchasing the surplus LSA nitric acid.

PROPOSED ACTION: Transfer of the surplus nitric acid to BNF plc is considered the preferred alternative. A typical sequence of activities for material packaging and transportation would include several steps. The nitric acid would be transferred from its existing location in the PUREX Plant to transport containers designed and fabricated to appropriate specifications. The containers would be secured on a truck trailer and radiologically measured by trained personnel using prescribed procedures and equipment (e.g., hand-held radiation monitors) prior to release. Both the containers and trailers would undergo inspection prior to transport to ensure appropriate standards, specifications, and regulations, including U.S. Department of Transportation guidelines, and carrier security demands were met. Approximately 52 shipments from the Hanford Site to an east coast port would be required to transfer the entire inventory of nitric acid to BNF plc. Transport time from the Hanford Site to the east coast would be approximately four days for each shipment.

Three east coast ports (Portsmouth, Virginia; Baltimore, Maryland; and Newark, New Jersey) would be used to ship the nitric acid. The specific port for each shipment would depend on the carriers' shipping schedule. Once at the port, the containers would be unloaded to a dock holding station, pending transfer to an ocean carrier. Once in England, the containers would be off-loaded to an awaiting overland carrier and transported to BNF plc's B205 facility at Sellafield, England. Once at Sellafield, England, the nitric acid would be off-loaded to BNF plc tankage. The transport containers would be returned to the Hanford Site for reuse. The B205 facility is an International Atomic Energy Agency (IAEA)-safeguarded nuclear fuel processing facility operated by BNF plc. The facility recovers

fissionable isotopes of uranium and plutonium for use in fabricating fuel for domestic and commercial nuclear power reactors.

As part of the BNF plc operations, the uranium contained in the PUREX Plant nitric acid (i.e., approximately 7,400 kilograms [16,300 pounds]) would be recovered and converted to solid uranium trioxide (UO_3). DOE will retain title to an amount of UO_3 that is equivalent to the amount recovered from the PUREX Plant nitric acid. The DOE owned UO_3 would be transferred to suitable storage containers and transferred to interim storage in an IAEA-safeguarded BNF plc storage facility. A typical container would be a 208-liter (55-gallon) drum. The UO_3 would be returned to the U.S. for storage at a DOE facility by April 1, 1997. Current plans are to return the material to the Hanford Site for storage with the existing inventory pending final disposition. The trace quantity of plutonium (i.e., less than 0.3 grams [0.01 ounces]) in the nitric acid would not be recovered for return to DOE, but would remain within the processing streams associated with routine BNF plc operations.

After the entire inventory of nitric acid is removed from the PUREX Plant, the storage tanks would be stabilized (e.g., rinsed and isolated) and placed into a condition suitable for long-term surveillance, pending decommissioning of the PUREX Plant. Rinse solutions would be transferred to existing waste management facilities at Hanford for treatment, storage, and/or disposal. The transport containers would be returned to the Hanford Site, decontaminated as necessary, and reused or dispositioned, as appropriate.

ALTERNATIVES CONSIDERED: The EA discussed a variety of alternatives as well as the No Action Alternative.

No-Action Alternative. Under the No-Action Alternative, the LSA nitric acid would remain in the existing PUREX Plant LSA nitric acid storage tanks. This alternative, although eliminating transportation impacts (both routine and accident scenarios), does not address the actual disposition of the material. The No-Action Alternative would continue to present the risks associated with the storage of large quantities of radioactive, aqueous nitric acid. Nitric acid is extremely corrosive. The existing tanks and retention basins in the 203-A area are approximately 40 years old, and could fail in the event of an earthquake.

If no action is taken, the material would be categorized as a mixed waste, subject to RCRA storage, treatment, and disposal requirements. The current storage configuration is not RCRA-compliant, and would require modifications and appropriate permits for continued storage. The No-Action Alternative would eliminate the potential to manage the material as a product. There would, in addition, remain the need to take future waste treatment and disposal action, with associated environmental impacts and costs.

Finally, the ultimate goal of deactivation of the PUREX Plant could not be achieved while nitric acid is stored in the U-Cell storage tanks. Deactivation requires the removal of major source terms (i.e., radioactive and hazardous materials) from the building, and the physical isolation of residual materials from the environment. The physical capabilities to allow future removal of the U-Cell nitric acid (e.g., external transfer routes, electrical power, and equipment) would have to remain in service in the No-Action Alternative.

A modification to the No-Action Alternative would be to transfer the U-Cell LSA nitric acid (approximately 94,500 liters [25,000 gallons]) to the existing 203A storage tanks or the 10

transport containers outside of the PUREX Plant canyon area. However neither the 203A storage tanks nor the transport containers are RCRA permitted or compliant storage units. Therefore, although transferring the U-Cell nitric acid to another storage location would eliminate the impacts to PUREX Plant canyon deactivation, the aforementioned risks and regulatory compliance issues associated with onsite storage of large volumes of nitric acid would remain.

Other Alternatives. Alternatives for disposition of the LSA nitric acid were considered including continued storage in a new or upgraded Hanford facility, consolidation of the LSA nitric acid with other DOE surplus acid, and processing the LSA nitric acid as waste. Those alternatives include options of continuing to deal with the material as a product, or various waste processing options. In general, the alternatives would not support the deactivation of the PUREX Plant, and would result in additional costs, environmental releases and substantial secondary waste streams.

ENVIRONMENTAL IMPACTS: Routine conduct of the proposed activity would not result in any significant increase in exposure to radiological or toxicological hazards at the Hanford Site or during transportation activities. Prior to initiation of any activities, administrative controls would be in place to maintain exposure to workers and other onsite personnel to within requirements established by DOE Orders and as low as reasonably achievable principles. The exposure received by onsite personnel is not expected to be greater than doses currently received from routine Hanford Site operations. Potential radiological doses to the public from routine operations would be extremely small and are not expected to result in any health effects. The risks to workers from chemical exposures, noxious vapors, burns, and other common industrial hazards are expected to be low, and would be minimized by training and the use of appropriate personal protective equipment.

The proposed action would result in the generation of insignificant amounts of hazardous materials. These materials will be removed or stabilized, and would be managed and reused, recycled, or disposed of in accordance with applicable federal and state regulations.

The 200 East Area, and the proposed transportation routes, are developed, highly disturbed areas. No sensitive or critical plant or animal habitat would be affected. There are no animal species of special concern which are known to use the area (including the transportation corridors) exclusively. The proposed action is not expected to impact air or water quality, or have socioeconomic impacts.

Transportation Impacts. Potential impacts during transportation of the LSA nitric acid were evaluated. The handling (including transportation) of hazardous liquid chemicals occurs daily in the continental U.S. In 1993 alone, approximately 5.3×10^9 liters (1.4×10^9 [1.4 billion] gallons) of nitric acid was produced and transported internationally without substantial incident. In the same calendar year, there were 22 accidents in the U.S. involving the release of concentrated nitric acid during shipment. Only two accidents involved bulk tanker-truck shipments, with a maximum release of about 39 liters (10 gallons). None of the 22 accidents involved a hospitalization or lost work day. The total damages associated with the 22 accidents (which include damage to the carrier, property and cleanup costs) was \$15,904. The damages associated with the two tanker-truck accidents were \$165.

The proposed shipment of LSA nitric acid would involve the use of containers which were designed using the most stringent requirements from all governing bodies, including DOT-51 specification 51 (DOT-51; DOT records indicate that a DOT-51 container has never lost its entire contents in an accident). These requirements then were increased to provide for an added margin of safety. These transport containers are nearly three times thicker than most tanks currently used to transport hazardous materials. The LSA nitric acid transport containers are designed without bottom fittings. Further, the DOE will be using the TRANSCOM satellite tracking system to provide an additional margin of safety during all shipments.

A rigorous transportation analysis indicated that the total dose to truck crews (workers) would amount to less than 0.5 person-rem for all of the shipments to any specific east coast port. Based on the projected 52 shipments, the total radiation exposure to the driver(s) would be less than 0.01 person-rem per shipment. For perspective, a single tooth x-ray provides an individual exposure of approximately 0.01 person-rem.

Total public doses (attributable to the projected 52 shipments) were calculated to be less than 3 person-rem (predominantly from exposures received during truck stops). There are no excess latent cancer fatalities predicted to result from routine doses from the LSA nitric acid shipments.

Cumulative Impacts. The proposed action is not expected to contribute substantially to the overall cumulative impacts from operations on the Hanford Site or along the transportation route. Standard Operating Procedures will provide sufficient personnel protection such that exposure to radiological and chemical materials will be kept below DOE and contractor guidelines. No significant exposure to the public is expected from the routine transportation of the LSA nitric acid overland (via truck) to the east coast, or during transport from the east coast to the Sellafield facility.

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. This proposed action would occur within the Hanford Site boundaries and along the transportation corridor(s) to the east coast, with the eventual destination of Sellafield, England. The analysis in this EA disclosed no high and adverse health or environmental impacts resulting from implementation of the proposed action. Therefore no disproportionate impacts are expected to any low-income or minority populations.

Impacts From Postulated Accidents. In addition to environmental impacts that were postulated from routine operations, the EA discussed a range of reasonably foreseeable accident scenarios that could lead to environmental impacts. Scenarios were related to material handling and transportation. These events include both high consequence and low probability and low consequence and high probability scenarios for the onsite worker and the general public.

The Maximum Reasonably Foreseeable Accident is postulated to deal with a spill of the entire inventory of LSA nitric acid during a seismic event at the Hanford Site. These events

are high consequence/low probability scenarios. The seismic event has a probability of about once every 3,000 years (i.e., a safety class 2 earthquake [DOE-RL 1989]). The event would not be expected to result in a latent cancer fatality due to radiation exposure. A spill during transportation would be bounded by the release of the entire inventory of LSA nitric acid.

Of greater concern are the toxicological consequences of a nitric acid release. The calculated onsite concentration of 30 parts per million oxides of nitrogen (NO_x) is slightly above the airborne concentration where nearly all individuals could be exposed for up to one hour without experiencing or developing irreversible or other serious health effects or symptoms which could impair an individual's ability to take protective action (25 parts per million). Personnel working near aqueous nitric acid storage facilities would be well aware of the hazards and response procedures, and would evacuate and remain clear of any plume coming from a NO_x release. Based on the extremely low probability of occurrence, even if the consequences of such an event are as calculated for the onsite worker, the extremely low probability of occurrence and administrative training and controls make the risks of a NO_x release from the proposed action small.

The calculated toxicological consequences for such an event, even under worst-case weather conditions, were below the levels that could result in acute health effects. That is, the maximum calculated concentration of NO_x (18 parts per million) occurred at 100 meters (330 feet). Exposures at this level could cause temporary discomfort (e.g., irritation of the eyes and skin). However, such exposure on a daily basis would not adversely affect a worker's health. At 200 meters (660 feet), the calculated concentration of NO_x (0.61 parts per million) likely would be undetectable by humans. The calculated concentration of NO_x at 1,000 meters (3,300 feet) was 0.041 parts per million.

The calculated offsite toxicological consequences of 5.9×10^{-2} parts per million NO_x fall well below the concentration where nearly all individuals could be exposed for up to one hour without experiencing other than mild transient adverse health effects or perceiving a clearly defined objectionable odor. These impacts bound those postulated for any potential transportation accident involving a single container of LSA nitric acid.

A transportation accident, should it occur, would involve a maximum container volume of 15,100 liters (4,000 gallons). The maximum exposure in the immediate vicinity (i.e., 100 meters [330 feet]) to radiological contaminants would be expected to be substantially less than that projected (0.036 rem [1.5×10^{-5} LCFs]) for the release of the entire inventory of 692,000 liters (183,000 gallons) of LSA nitric acid at the Hanford Site. Therefore, no health effects to an individual in the immediate vicinity of a postulated accident would be expected from the radioactive constituents in the LSA nitric acid.

Further, the results indicate that the total transportation accident risks to the general public from the maximum foreseeable accident during continental U.S. (overland truck) LSA acid shipments are, conservatively, 16 person-rem. This equates to no LCFs (calculated as 0.008 LCFs). This represents the total risk (accident frequency times the collective dose) to all individuals in urban, suburban, and rural population zones along the entire route for all 52 shipments. The transportation impacts (accident risks) are dominated by a shipment from the PUREX Plant to the east coast port, primarily because of the long overland shipping distance from the PUREX Plant to the east coast (about 4,200 kilometers [2,600 miles]), compared with the relatively short overland distance on English soil.

NONPROLIFERATION: DOE considered whether the proposed shipment of the nitric acid would be compatible with U.S. nonproliferation policy. In evaluating the nonproliferation policy aspects of the proposed shipment, DOE considered the facts that BNF plc has a readily available supply of nitric acid, which could be procured from any number of U.S. or commercial sources, and that interested parties such as the State of Washington Department of Ecology, the U.S. Environmental Protection Agency (Region 10), the Yakama Indian Nation, and the Confederated Tribes of the Umatilla Indian Reservation do not object to the shipments. In addition, the proposed shipment appeared to be a case-specific solution to a material disposition problem, promoting waste minimization and reducing potential emissions to the environment. The export would not "...make a material contribution to the proliferation of weapons of mass destruction..."¹ and would be consistent with Executive Order 12114, *Environmental Effects Abroad of Major Federal Actions*. These facts appeared to support the position that the transfer of nitric acid from the PUREX Plant was a policy-neutral decision, and did not set a precedent from either a technical or policy standpoint.

DOE considered the proposed nitric acid transfer in terms of maintaining existing commitments with regard to European civil plutonium programs. Specific consideration was given to the perception that the transfer of the surplus nitric acid might be inconsistent with the U.S. policy on nonproliferation because it would constitute encouragement of civil plutonium stockpiling by providing a necessary chemical ingredient for reprocessing spent fuel.

DOE also considered the views of citizens groups such as Greenpeace, Snake River Alliance, and Physicians for Social Responsibility who have objected to the shipments based on nuclear nonproliferation concerns. Specifically, one comment was that a sale would not appear to be a firm consistent step to lessen the global proliferation threats. However, nitric acid is widely available from various commercial sources. Therefore, this nitric acid sale would neither encourage nor discourage civil plutonium stockpiling. Another comment was that a sale would conflict with nuclear nonproliferation policies. However, these policies place no prohibitions on government or commercial entities providing nitric acid to BNF plc.

After weighing these and other concerns, the Secretary of Energy authorized consideration of the transfer of the surplus nitric acid to BNF plc as an alternative to disposition of the material. The Secretary indicated that, if upon completion of the *National Environmental Policy Act of 1969* process the shipment of the nitric acid from Hanford to BNF plc is found to be appropriate, shipment could commence contingent upon receipt of an export license approved by the U.S. Nuclear Regulatory Commission. The export license (XSNM02827) has been issued.

¹ The White House, Office of the Press Secretary, "Fact Sheet, Nonproliferation and Export Control Policy," September 27, 1993.

DETERMINATION: Based on the analysis in the EA, and after considering the preapproval review comments of the states, tribes, and stakeholders, I conclude that the proposed disposition and transportation of the radioactive LSA nitric acid, presently stored at the Hanford Site's PUREX Plant, 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 15th day of May, 1995.

John D. Wagoner
Manager
Richland Operations Office

1.0 Purpose and Need for Agency Action

The U.S. Department of Energy (DOE) needs to disposition surplus nitric acid as part of deactivating the Plutonium-Uranium Extraction (PUREX) Plant, to reduce the risk to the environment, to reduce the cost of long-term storage, and to assure regulatory compliance.

DOE is deactivating the PUREX Plant at the Hanford Site near Richland, Washington. The deactivation activities will result in placing the PUREX Plant in an environmentally safe and stable condition for long-term surveillance and maintenance. The successful deactivation of the PUREX Plant, which has received support from various stakeholder groups, will stabilize a portion of the Hanford Site's inventory of radioactive and hazardous materials. This will reduce the risk of exposure to both onsite workers and members of the general public. This also will reduce annual funding requirements from the current (approximately) \$34,000,000 per year to less than \$2,000,000 per year. One of the elements of complete deactivation of the PUREX Plant is the disposition of approximately 692,000 liters (183,000 gallons) of surplus low specific activity (LSA) nitric acid.

Also, continued long-term storage in the current storage configuration at the PUREX Plant would not be in compliance with applicable *Resource Conservation and Recovery Act of 1976* requirements, as implemented by the State of Washington Department of Ecology (Ecology) pursuant to the Washington Administrative Code (WAC) 173-303, *Dangerous Waste Regulations*. Presently, the nitric acid is considered a product by DOE. This position has been discussed with Ecology, based on shipping the nitric acid offsite for use as a raw material. On that basis, Ecology has responded in writing, indicating that although not currently classified as a solid waste, the material is a hazardous substance and should be managed in a manner which ensures that releases will not occur, and human health and the environment will be protected. Additionally, for this material to be excluded from regulation under the provisions of speculative accumulation (WAC 173-303), at least 75 percent of the material must be transferred for recycling within calendar year (CY) 1995.

2.0 Background

Historically, nitric acid was used at the Hanford Site's PUREX Plant to dissolve irradiated fuel elements, as part of separation of fission products from uranium, plutonium and neptunium in solvent extractions operations. Nitric acid is a common chemical used throughout industries. In 1993 alone, approximately 5.3×10^9 liters (1.4×10^9 gallons [1.4 billion gallons]) of nitric acid was produced and transported internationally. At the Hanford Site, the nitric acid was recovered and reused during processing.

In December 1992, DOE directed that the PUREX Plant be shut down and deactivated because additional plutonium is not required to support any national needs. The scope of the deactivation involves many activities necessary to place the PUREX Plant in an environmentally safe and stable state for long-term surveillance and maintenance. The full range of required activities, described in detail in *PUREX/UO₃ Deactivation Project Management Plan* (WHC 1994), are estimated to take approximately four years at a total project cost of \$185,000,000. The current surveillance and maintenance costs are approximately \$34,000,000 per year, or \$100,000 per day.

A specific result of cessation of PUREX Plant operations is that excess chemicals are available, including the approximately 692,000 liters (183,000 gallons) of slightly radioactively contaminated nitric acid. The material is stored in four storage tanks at the PUREX Plant. The relative layout of the PUREX Plant, and storage tanks, is shown in Figures 1, 2, 3, and 4. Approximately 94,500 liters (25,000 gallons) of nitric acid are stored in two tanks in the PUREX Plant U-Cell vault, and 597,500 liters (158,000) gallons are stored in two tanks in the 203-A Bulk Radioactive Chemical Storage Area. The average concentration of the nitric acid is approximately 10 moles per liter (not more than 52 weight percent nitric acid aqueous solution [in water]). The total quantity of plutonium (Pu) in the nitric acid is less than 0.03 grams (0.01 ounces). The total quantity of uranium (U) is approximately 7,400 kilograms (16,300 pounds). The fissile components of the nitric acid consist of the negligible inventory of plutonium (as ^{238}Pu and ^{239}Pu) and approximately 72 kilograms (158 pounds) of ^{235}U .

With no DOE use for the surplus LSA nitric acid identified, private sector interest was solicited. An Expression of Interest was received from British Nuclear Fuels private limited company (BNF plc), the sole respondent to the Commerce Business Daily request dated December 28, 1993. The Commerce Business Daily, a daily publication that advertises available property from the government sector, has 20,000 to 30,000 subscribers. No other private enterprise, nationally or internationally, expressed any interest in purchasing the surplus LSA nitric acid.

This action previously was addressed under the *National Environmental Policy Act of 1969* (NEPA) as a categorical exclusion, wherein DOE determined that the action would meet the conditions of 10 *Code of Federal Regulations* (CFR) 1021, "National Environmental

Figure 1. HANFORD SITE

Figure 2. PUREX LAYOUT

Figure 3. PUREX PLANT

Surplus Nitric Acid Storage Tanks

Figure 4. 203-A STORAGE TANKS

Policy Act Implementing Procedures," Subpart D, B6.1, published in the Friday, April 24, 1992, 57 *Federal Register* (FR) 15151. On the basis of the initial NEPA review, 10 transportation containers were procured, and contract negotiations were initiated with BNF plc.

Upon further consideration, the DOE determined that additional NEPA review was required prior to making a decision on disposition of the LSA nitric acid (Appendix A). Therefore, this Environmental Assessment (EA) was prepared to provide a quantitative analysis of potential risks and environmental impacts associated with the proposed action, and alternatives, in the continental U.S., and on international waters, and to allow a determination of whether or not an Environmental Impact Statement is required. No quantitative analysis is provided for activities on English soil; however, a qualitative discussion of such activities is included for continuity and completeness.

This NEPA review proceeded concurrently with contractual negotiations for the sale of the nitric acid portion of the surplus PUREX Plant LSA nitric acid. These negotiations were continued to keep this option available until the NEPA process is completed, and do not prejudice any future decisions. Transfer of the material to BNF plc is contingent upon completion of the NEPA process for the proposed action and a decision to proceed, and receipt of an export license from the U.S. Nuclear Regulatory Commission (NRC). The export license has been issued.

This EA addresses surplus radioactively-contaminated (i.e., LSA) nitric acid presently stored at the Hanford Site. At the time of the December, 1992, DOE PUREX Plant deactivation directive, there was an inventory of bulk chemicals at PUREX in various stages of use. Since that time, DOE has attempted to disposition those materials in a manner consistent with waste minimization requirements, including the *Pollution Prevention Act of 1990*, State of Washington requirements (i.e., WAC 173-303), and DOE Orders and policies (e.g., DOE Order 5400.1, *General Environmental Protection Program*; and DOE Order 5820.2A, *Radioactive Waste Management*). Compliance with the aforementioned laws and orders requires waste minimization programs and practices, pollution prevention awareness program, and annual waste reduction reports and goals. Examples of ongoing waste minimization efforts at the PUREX Plant have resulted in the successful sale of approximately 250,000 liters (66,000 gallons) of uncontaminated nitric acid and 84,000 liters (22,000 gallons) of potassium hydroxide. Beneficial uses for substantial quantities of other PUREX Plant surplus chemicals (e.g., sulfuric acid, sodium hydroxide, and potassium permanganate) and other bulk chemicals have also been established, with subsequent disposition of the materials.

3.0 Alternatives Including the Proposed Action

The scope of the proposed action and alternatives addresses the disposition of the entire inventory of the LSA nitric acid (i.e., 692,000 liters [183,000 gallons]). A piece-meal approach to disposition the material (i.e., various volumes of surplus nitric acid managed in different ways) is considered to be inefficient, requiring manpower-intensive engineering studies and time. The costs would be above those associated with the proposed action and alternatives discussed below.

The DOE is proposing to transport approximately 692,000 liters (183,000 gallons) of LSA nitric acid currently stored at the Hanford Site in Richland, Washington, to BNF plc, located in Sellafield, England. The nitric acid would be used as a process chemical during routine commercial nuclear fuel reprocessing operations. As part of the BNF plc operations, the uranium contained in the LSA nitric acid (i.e., approximately 7,400 kilograms [16,300 pounds]) would be recovered and converted to solid UO_3 . The DOE will retain title to an amount of UO_3 that is equivalent to the amount recovered from the LSA nitric acid. The UO_3 would be transferred to suitable storage containers and transferred to interim storage in an International Atomic Energy Agency-safeguarded BNF plc storage facility, such as Sellafield. A typical container would be a 208-liter (55-gallon) drum. The UO_3 would be returned to the U.S. for storage at a DOE facility by April 1, 1997. Current plans are to return the material to the Hanford Site for storage with the existing inventory pending final disposition. The small quantity of plutonium (i.e., less than 0.3 grams [0.01 ounces]) would not be recovered for return to DOE, but would remain within the processing streams associated with routine BNF plc operations. The total cost associated with the proposed action are projected to be less than \$3,000,000.

Managing the LSA nitric acid as a waste also is being considered. Various alternatives, described below in Section 3.2, have been evaluated. The information in this EA indicates that managing the LSA nitric acid as a waste does not reduce risks, minimize environmental impacts, or limit costs when compared to managing the material as a product. Continued storage of the material onsite (or offsite) only delays final disposition. Disposal involves regulatory compliance issues and conflicts with national policy on minimization of hazardous waste. Therefore, transfer of the LSA nitric acid to BNF plc is considered as the preferred alternative. Table 1 provides a synopsis of the alternatives addressed for disposition of the LSA nitric acid. See Sections 3.1- 3.2.5 for details regarding the information summarized in Table 1.

Table 1. Synopsis of Proposed Action and Alternatives for
Disposition of Surplus PUREX Plant Nitric Acid

Proposed Action and Alternatives	Complete Acid Disposition?	Cost (in millions)	Secondary Waste Streams (air)?	Secondary Waste Streams (liquid)?	Additional Processing Required?	Time Required to Implement Alternative?	PUREX Deactivation Impacted?	Complete PUREX Deactivation?
BNF plc	Yes	< 3	No	No	No	Now	No	Yes
No Action (a)	No	N/A (4a)	UNK	UNK	Yes	Now	Yes	No
No Action (b)	No	UNK (4a)	UNK	UNK	Yes	UNK	No	No
Alternative DOE uses	Yes	UNK	Yes	Yes	UNK	~ 16 years (1)	(2)	(3)
Continued Storage at Hanford	No	> 2 (4a)	UNK	UNK	Yes	> 2 years	(2)	No
Acid Consolidation	No	UNK	UNK	UNK	UNK	UNK	(2)	(3)
Sugar Denitration in PUREX	Yes	> 68 (5)	Yes	Yes (6)	Yes	> 2 years	Yes	Yes
Sugar Denitration in New Facility	Yes	> 2 (4b)	Yes	Yes (6)	Yes	> 2 years	(2)	(3)
Direct Neutralization	Yes	> 4	Yes	Yes (6)	Yes	> 1 year	Yes	Yes
Biodenitrification	Yes	UNK	No	Yes	Yes	UNK	(2)	(3)
Distillation	No	UNK	Yes	Yes	Yes	UNK	Yes	No

(a) Nitric acid inventory remains in U-Cell. (b) Nitric acid inventory removed from U-Cell.

UNK - Unknown; this would be determined at a later date if this alternative is chosen. N/A - Not Applicable.

(1) For use in calciner. (2) No, if nitric acid removed from U-Cell. (3) Yes, some time in the future.

(4a) Additional costs associated with permitting, surveillance, and maintenance. (4b) Additional costs associated with new facility design/construction, permitting, surveillance, and maintenance.

(5) Includes costs associated with delaying the deactivation of the PUREX Plant.

(6) Neutralized liquid waste stream would be transferred to Tank Farms and would require future processing.

3.1 Proposed Action

The DOE proposes to transfer the LSA nitric acid to BNF plc, located in Sellafield, England. The transfer would cost DOE less than \$3,000,000. The BNF plc facility is an International Atomic Energy Agency (IAEA)-safeguarded nuclear fuel fabrication firm providing nuclear fuel for commercial power reactors throughout the world. The BNF plc would use the acid as a process chemical during routine nuclear fuel reprocessing operations. The BNF plc has a readily available supply of commercial grade nitric acid which could be purchased through the private sector if the LSA nitric acid was not available to them. BNF plc would use the LSA nitric acid in place of approximately eight percent of the B205 facility's annual nitric acid requirements. The B205 facility is an IAEA-safeguarded nuclear fuel processing facility operated by BNF plc to recover nuclear material for use in fabricating power reactor fuel. The annual B205 facility nitric acid usage represents approximately one-half of Sellafield Site's yearly requirements.

The shipments of LSA nitric acid would be categorized as LSA, fissile exempt, per U.S. Department of Transportation (DOT) specifications. Approximately 52 shipments from the PUREX Plant to BNF plc would be required. Individual shipping containers have a maximum capacity of approximately 15,120 liters (4,000 gallons). A shipping container is typically loaded to between 80- and 90-percent of maximum capacity. A shipping container of the LSA nitric acid would have a dose rate of less than 0.5 millirem per hour at contact, and less than 1.9 kilograms (4.2 pounds) of fissile radionuclides (WHC 1995a). Therefore, shipments would be substantially below the requirements associated with the DOT's LSA, fissile exempt shipping category.

Only the nitric acid portion of the material would be sold to BNF plc for use at the Sellafield facility. The DOE would retain title to the equivalent inventory of the total uranium in the acid (approximately 7,400 kilograms [16,300 pounds]). The uranium inventory would be converted to uranium trioxide (UO_3) powder, and temporarily stored, pending return to the U.S. The small quantity of plutonium (less than 0.3 grams [0.01 ounces]) would not be recovered for return to DOE, but would remain within the processing streams associated with routine BNF plc operations.

In July 1994, DOE applied to the Nuclear Regulatory Commission for an export license to ship the nitric acid. The application was reviewed by U.S. executive branch agencies and EURATOM (European Atomic Energy Community). EURATOM is an international organization which deals with safeguards and movement of nuclear material from, to, and through the European community. In parallel with these export license application reviews, a Federal Register notice concerning the export license application was published. At the same time, DOE considered whether the proposed shipment of the LSA nitric acid would be compatible with U.S. nonproliferation policy.

The nonproliferation policy of the Clinton administration is that the "United States does not encourage the civil use of plutonium," however, the U.S. will remain a reliable nuclear supplier and "maintain its existing commitments regarding the use of plutonium in civil nuclear programs."¹

In evaluating the nonproliferation policy aspects of the proposed shipment, DOE considered the fact that BNF plc has a readily available supply of nitric acid, which could be procured from any number of U.S. or other commercial sources. Although the LSA nitric acid contains uranium, the U.S. would retain title to an equivalent amount of uranium, which would be converted to UO_3 , and stored at BNF plc (under IAEA safeguards) until shipped back to the U.S. for final disposition. The fact that there is no appreciable inventory of plutonium in the acid (less than 0.3 grams [0.01 ounces]) eliminates the issue of civil plutonium stockpiling.

The proposed action appeared to be a case-specific solution to a material disposition problem, promoting waste minimization and reducing potential emissions to the environment. The export would not "...make a material contribution to the proliferation of weapons of mass destruction..."¹. This proposal also is consistent with Executive Order 12114, *Environmental Effects Abroad of Major Federal Actions*. These facts appeared to support the position that the transfer of nitric acid from the PUREX Plant was a policy-neutral decision, and did not set a precedent from either a technical or policy standpoint.

DOE also considered the fact that interested parties such as Ecology, the U.S. Environmental Protection Agency (Region 10), Yakama Indian Nation, and the Confederated Tribes of the Umatilla Indian Reservation do not object to the shipments.

DOE also considered the proposed nitric acid transfer in terms of maintaining existing commitments with regard to European civil plutonium programs. There are no existing commitments between the DOE and BNF plc to provide nitric acid for reprocessing activities. Additionally, denying the transfer will not cast the U.S. as an unreliable nuclear supplier. BNF plc has no urgent need to obtain nitric acid from the DOE, and nitric acid is readily available on the open market.

Specific consideration was given to the perception that the transfer will constitute encouragement of civil plutonium stockpiling and use because the U.S. government will be providing a necessary chemical ingredient for reprocessing spent fuel. Further, the proposed shipment might be perceived as financially encouraging the reprocessing of spent nuclear fuel abroad by providing BNF plc with a means of lowering its operating costs to some degree.

DOE also considered the views of citizens groups such as Greenpeace, Snake River Alliance, and Physicians for Social Responsibility which have objected to the shipments based on nuclear nonproliferation concerns. The two central points were that a sale would not appear to be a firm, consistent step to lessen the global proliferation threats and that a sale would conflict with actual policy. The response to these concerns is that DOE's policies and the

¹ The White House, Office of the Press Secretary, "Fact Sheet, Nonproliferation and Export Control Policy," September 27, 1993.

President's Nonproliferation and Export Control Policy place no prohibitions on government or commercial industry providing nitric acid to BNF plc. The rationale is that nitric acid is widely available from various commercial sources; therefore, this nitric acid would neither encourage nor discourage civil plutonium stockpiling. The sale would have only a marginal impact on BNF plc's operating cost.

After weighing these and other concerns, the Secretary of Energy authorized consideration of the transfer of the LSA nitric acid to BNF plc as an alternative to disposition of the material. The Secretary indicated that, if upon completion of the NEPA process the shipment of the nitric acid from Hanford to BNF plc is found to be appropriate, shipment could commence contingent upon receipt of an export license approved by the NRC (Appendix A). The export license (XSNM02827, Appendix B) has been issued.

The transportation routes, procedures, and emergency response plans were developed using conservative methodology for radioactive shipments. That is, even though this material has very low levels of radioactive contamination, guidelines and regulations typically associated with transportation of high-level radioactive materials were used.

A typical sequence of activities for packaging and transportation includes several steps. Aqueous LSA nitric acid (less than 52 percent nitric acid [by weight] in water) would be transferred from the 203-A storage tanks to the transport containers (Figure 5). These containers are designed and fabricated to meet or exceed all appropriate specifications, including those of the DOT, the IAEA, and the International Maritime Organization (IMO). Transfer would be accomplished by mechanically pumping from the PUREX Plant storage tanks to individual containers.

The LSA nitric acid containers were designed using the most stringent requirements from all governing bodies, including DOT specification 51 (DOT-51; DOT records indicate that a DOT-51 container has never lost its entire contents in an accident). These requirements then were increased to provide for an added margin of safety. For example, the containers are sized to accommodate approximately 15,100 liters (4,000 gallons) of LSA nitric acid to meet both weight and filling limits, but would be filled to nominally 80-90 percent of capacity. The containers are stainless steel. The thickness of the barrel (0.8 centimeters [0.31 inches]) and end cap material (1.1 centimeters [0.42 inches]) exceeds requirements. These transport containers are nearly three times thicker than most tanks currently used to transport hazardous materials.

The stacking strength requires a three-high configuration acceptance criteria; the LSA nitric acid transport containers are designed to meet a stacking strength of nine-high, fully loaded. This is three times the requirement. Tests were performed to insure integrity of the containers. They were subject to a dynamic impact test as prescribed by the Canadian National Railway and passed. In addition, the tanks were subjected to an acoustical emissions test. This test exceeds, and is more reliable than, conventional X-ray technology for weld integrity.

All incidents which involved the release of materials from DOT-51 containers have been caused by faulty valves or fittings. The LSA nitric acid transport containers are designed without bottom fittings. They must be loaded and unloaded from the top. The top

Figure 5. LSA Nitric Acid Transport Container

opening is bolted with over 25 bolts and is covered by a secured cupula. The LSA nitric acid transport containers are designed to maintain their integrity and minimize release of the contents in the event of an accident.

Sample analyses (WHC 1995a) indicate that the LSA nitric acid is within the operating specifications of BNF plc. Additional samples may be taken and analyzed to verify that the material continues to meet BNF plc processing specifications. PUREX Plant personnel may take representative samples from each bulk storage tank prior to loading the first transport container. Additionally, samples from individual transport containers may be taken. The samples would be shipped to BNF plc for analyses. It is estimated that a total of no more than 10 liters (3 gallons) of material per sample would be required. This would minimize the potential for receipt of unacceptable LSA nitric acid at Sellafield, England.

The containers would be transported by a qualified motor carrier. A qualified motor carrier is one which has passed a DOE motor carrier evaluation program. The evaluation includes review of the carrier's insurance coverage and claims history, safety records (both personnel and equipment), emergency action plans, security plans, and driving policy. Driver selection processes, training and licensing are evaluated. Equipment condition (i.e., inspections and maintenance records) also is included in the evaluation.

The LSA nitric acid transport containers would be appropriately secured and transported on special chassis. The chassis have a lower center of gravity, wide axle stance and air ride suspensions. The LSA nitric acid transport containers would be radiologically measured by trained personnel using prescribed procedures and equipment (e.g., hand-held radiation monitors), prior to release. Both the containers and trailers would undergo inspection prior to transport (additional details regarding inspection may be found in Appendix C, and WHC 1995b). Although not required for LSA, fissile exempt shipments, the procedures include provisions for carrier compliance with federal and state regulations pertaining to highly-radioactive shipments; vehicle inspection at origin; and computerized satellite tracking. The satellite tracking system is referred to as TRANSCOM. The TRANSCOM system combines satellite communications, computerized database management, user networks, and ground communications with en route shipments of radioactive materials.

The procedures would ensure compliance with appropriate standards, specifications, and regulations, including DOT guidelines, and carrier security demands. The security concerns arise because of the nuclear material component. However, there is little threat for diversion due to the small quantity of fissile materials which is not readily transformed into weapons-grade materials.

The containers would be transported under DOE requirements, including the aforementioned procedures. The DOE has prepared a transportation plan, *U.S. Department of Energy LSA/Nitric Acid Transportation Plan to British Nuclear Fuels plc* (WHC 1995b), delineating organizational responsibilities, shipment schedule, communications, emergency considerations, and transportation requirements. Alternative ports of transit were considered, and are discussed in Section 3.2.6. Approximately 52 shipments from the Hanford Site to an east coast port would be required to transfer the entire inventory of LSA nitric acid to BNF plc. The proposed shipment routes are from Hanford to Portsmouth, Virginia; Port Elizabeth,

New Jersey; or Baltimore, Maryland (see Figures 6, 7 and 8). Due to computer modeling limitations, the actual route from Hanford (Figures 6, 7 and 8) may be slightly different than the route analyzed in this EA. For example, the model does not attempt to minimize the number of urbanized areas with population over 100,000 traversed for a trip. The actual route minimizes population densities wherever practical. Therefore, the calculated impacts in this EA are conservative. Transport time from the Hanford Site to the east coast is approximately four days.

It may be necessary to amend the transportation route to address safety, logistical, environmental or other reasonable concerns. Circumstances which could affect the selected route, include actions such as road closures, detours, unanticipated inclement weather, and shipping delays. Should such events occur, appropriate procedures would be in place to minimize additional travel times, and corresponding potential radiation exposure. Those procedures may include highway escorts, traffic control, and appropriate supplemental public notification. Therefore, events such as route changes or slight delays are not expected to result in any substantial change in risk to the worker or public during transportation of the LSA nitric acid. Additional details regarding transportation are provided in WHC 1995b.

Once at the east coast port, the containers would be unloaded to a dock holding station, pending transfer to an ocean carrier. Holding time at the port would be minimized by precise coordination between the overland shipper and the ocean carrier. The transportation to the port of entry in England would be conducted pursuant to international regulations, including those found in the United Nations' *Recommendations on the Transport of Dangerous Goods, IAEA Safety Standards; Regulations of the Safe Transport of Radioactive Material 1985 Edition (as amended 1990)*, and the IMO's *International Maritime Dangerous Goods Code*. Ocean transport would typically be less than two weeks.

Once in England, the cargo would be off-loaded to a waiting overland carrier and transported to the BNF plc B205 (Magneox Fuels Processing) facility at Sellafield, England. The B205 facility is an IAEA-safeguarded nuclear fuel processing facility operated by BNF plc to recover nuclear material for use in fabricating power reactor fuel. BNF plc would use the LSA acid in place of approximately 8 percent of the B205 facility's annual nitric acid requirements. The annual B205 facility nitric acid usage represents approximately one-half of the Sellafield Site's yearly requirements. Transportation would be conducted under all applicable British transportation requirements. Once at Sellafield, England, the aqueous LSA nitric acid would be off-loaded to the BNF plc B205 facility.

Prior to the first shipment of LSA nitric acid to BNF plc, minor modifications to the Sellafield facility (i.e., piping modifications to establish an appropriate feed point) would be made. These modifications would eliminate the potential for radiologically contaminating clean BNF plc bulk nitric acid storage tanks.²

² In order to maintain the availability of the sale alternative, DOE provided funding for this minor modification at the BNF plc B205 facility that would allow the plant to receive the surplus PUREX Plant LSA nitric acid.

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Preferred Route for DOE Radioactive LSA/Nitric Acid from Hanford to Port Elizabeth, New Jersey

**Figure 7. Proposed LSA Nitric Acid
Shipment Route from Hanford to Port Elizabeth, New Jersey**

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After offload of the LSA nitric acid at the BNF plc B205 facility in Sellafield, England, there would be a small residual volume of acid remaining in the transport container. It is expected that less than 40 liters (10 gallons) of LSA nitric acid per container would remain. The transport containers would be returned to the Hanford Site for reuse. Return routes would be similar to those for the original shipments.

As part of the BNF plc operations, the uranium (i.e., approximately 7,400 kilograms [16,300 pounds]) contained in the LSA nitric acid would be recovered and converted to solid UO_3 . The DOE will retain title to an equivalent amount of uranium in the LSA nitric acid. The UO_3 (approximately 8,800 kilograms [19,400 pounds]) would be transferred to suitable storage containers and transferred to interim storage in an IAEA-safeguarded BNF plc storage facility, such as Sellafield. A typical container would be a 208-liter (55-gallon) drum. Approximately 30 drums may be required to accommodate the solid UO_3 . The UO_3 would be returned to the U.S. for storage at a DOE facility by April 1, 1997. When the material is returned, any additional packaging requirements would be met (e.g., overpack as necessary per shipping regulations in force at the time) and transported back to the DOE facility.

After the entire inventory of LSA nitric acid is removed from the PUREX Plant, the storage tanks would be stabilized (e.g., rinsed and isolated) and placed into a condition suitable for long-term surveillance, pending decommissioning of the PUREX Plant. Rinse solutions would be transferred to existing waste management facilities at Hanford for treatment, storage, and/or disposal. The transport containers would be returned to the Hanford Site, decontaminated as necessary, and reused or dispositioned, as appropriate.

3.2 Alternatives to the Proposed Action

3.2.1 No-Action Alternative

Under the No-Action Alternative, the LSA nitric acid would remain in the existing U-Cell and 203-A PUREX Plant storage tanks. This alternative, although eliminating transportation impacts (both routine and accident scenarios), does not address the actual disposition of the material. The No-Action Alternative would continue to present the risks associated with the storage of large quantities of radioactive, aqueous nitric acid. Nitric acid is extremely corrosive. The existing tanks and retention basins in 203-A are approximately 40 years old, and could fail in the event of an earthquake.

Also, the material eventually would be categorized as a mixed waste, subject to RCRA storage, treatment, and disposal requirements. The current configuration is not RCRA-compliant, and would require modifications and appropriate permits for continued storage. The No-Action Alternative would eliminate the potential to manage the material as a product. This would require waste treatment and disposal, with associated environmental impacts and costs as discussed in Section 3.2.5.

Finally, the ultimate goal of deactivation of the PUREX Plant could not be achieved while nitric acid is stored in the U-Cell storage tanks. Deactivation requires the removal of major

source terms (i.e., radioactive and hazardous materials) from the building, and the physical isolation of residual materials from the environment. The physical capabilities to allow future removal of the U-Cell nitric acid (e.g., external transfer routes, electrical power, and equipment) would have to remain in service in the No-Action Alternative.

A modification to the No-Action Alternative would be to transfer the U-Cell nitric acid (approximately 94,500 liters [25,000 gallons]) to other areas of the PUREX Plant facility outside of the PUREX Plant canyon area. DOE considered transferring the nitric acid to either the transport containers or the 203-A storage tanks.

The 10 transport containers (total capacity of approximately 151,000 liters [40,000 gallons]) would provide adequate storage space for the U-Cell nitric acid. The ability to transfer nitric acid directly to transport containers from U-Cell presently does not exist. Direct transfer to transport containers from U-Cell would require modifications to the facility. Indirect transfers from U-Cell could be made by filling transport containers with LSA nitric acid from the 203-A tanks and pumping the U-Cell material into 203-A tanks.

The option of storing the U-Cell LSA nitric acid in 203-A tanks also was considered. There presently is not adequate storage space in the 203-A storage tanks for the U-Cell LSA nitric acid. Two of the 203-A tanks contain LSA nitric acid (597,500 liters [158,000 gallons]), and do not have available space to receive the U-Cell LSA nitric acid inventory. The remaining two tanks in the 203-A storage facility contain water (e.g., rain water and snow melt) from the 203-A containment sump.

However, neither the transport containers nor the 203-A storage tanks are RCRA-compliant. Therefore, although transferring the U-Cell nitric acid to another PUREX Plant storage location would eliminate the impacts to PUREX Plant canyon deactivation, the aforementioned risks and regulatory compliance issues associated with onsite storage of large volumes of nitric acid would remain.

3.2.2 Alternative DOE Uses

Nitric acid routinely has been used at other DOE facilities (e.g., Idaho National Engineering Laboratory [INEL] and Savannah River Site [SRS]). However, there currently is no identified immediate use for the LSA nitric acid within the DOE Complex.

For example, waste processing operations at INEL include converting liquid waste solutions to solids through a calcination process. The calciner facility currently is in standby, preparing to restart in CY 1996 for a six-month operating campaign, with a potential for up to three future campaigns. Historically, the calciner used small amounts of nitric acid in the off-gas treatment system to minimize particulate emissions. The large inventory of LSA nitric acid would accommodate approximately 16 years of INEL calciner operations. INEL presently has a sufficient inventory of nitric acid to accommodate projected needs. Also, in this process, the nitric acid is ultimately converted to oxides of nitrogen and released directly to the

environment. The lack of a projected, long-term calciner campaign, the minimal requirements for acid during potential future operations, and the regulatory issues associated with transport of radioactive materials to INEL do not appear to support this alternative.

Fuels processing operations similar to the Hanford Site's PUREX process have been conducted in the past at SRS. The SRS facilities are presently in standby. DOE has determined that expedited action is required to stabilize plutonium solutions currently stored at the SRS, and has conducted a NEPA review (DOE 1994c). The Record of Decision does not define a need for additional nitric acid at SRS.

3.2.3 Continued Storage in Hanford Site Upgraded or New Facility

Alternative Hanford Site storage options were considered. The options included upgrading the existing tankage to achieve regulatory compliance, as well as a new Hanford Site, regulatory-compliant nitric acid storage facility. This alternative would have minimal transportation impacts (both routine and accident scenarios). However, the risks associated with indefinite storage of aqueous nitric acid would still be present, and continued storage would be counter to DOE's waste minimization policy.

Upgrading the U-Cell and 203-A storage facilities to achieve regulatory compliance would require that the existing retention basin be repaired/modified to applicable leak-proof standards. Regulatory-compliant liquid level indicators would need to be installed. Engineering studies would be necessary to evaluate the need for enhancing the structural integrity of the tanks. Also, as discussed in Section 3.2.1, maintaining the inventory of the 94,500 liters (25,000 gallons) of LSA nitric acid in the existing U-Cell vault would impact deactivation of the PUREX Plant canyon.

It is estimated that the design, procurement and construction of two new regulatory-compliant storage tanks (assuming approximate capacity of 380,000 liters [100,000 gallons] each) in or adjacent to the PUREX Plant would cost at least \$2,000,000. Appropriate permits, addressing hazardous waste storage and air emissions, would be required at additional costs. This could result in at least a 2-year delay in transfer of the LSA nitric acid out of the existing tankage, maintaining the risks discussed in Section 3.2.1. Additionally, as described in Section 3.2.1, unless the 94,500 liters (25,000 gallons) of LSA nitric acid is removed from the U-Cell vault, associated delays in the deactivation of the PUREX Plant canyon would occur. This would result in additional costs (approximately \$100,000 per day), above the aforementioned \$2,000,000. Further, transfer of the LSA nitric acid to an uncontaminated facility would result in additional future decontamination activities at the Hanford Site.

There would be environmental impacts associated with the construction and operation of a new storage facility. It would be expected that land use would be limited to a small area in or adjacent to the PUREX Plant. The amount of equipment and materials which would be used, such as fuel for construction machinery and steel/concrete for tanks, represent a minor long-term commitment of nonrenewable resources. Noise levels would be comparable to existing conditions at the Hanford Site. Dust controls, such as wetting the ground surface as appropriate, would be implemented.

The operation of the facility could result in minor amounts of gaseous emissions through a passive ventilation system. Automatic effluent monitors and alarms would be included in the design. Appropriate notifications to regulatory authorities would be made prior to initiation of construction activities.

Also, as with the No-Action Alternative (Section 3.2.1), continued storage does not address the actual disposition of the material. This alternative would continue to present the problems associated with the storage of large quantities of radioactive, aqueous nitric acid. The material would be categorized as a mixed waste, subject to RCRA storage, treatment, and disposal requirements. This alternative would eliminate the potential to manage the material as a product, requiring eventual waste treatment and disposal, with associated environmental impacts and costs.

3.2.4 Consolidation of DOE Complex-Wide Surplus Nitric Acid

Consideration was given to consolidate surplus nitric acid throughout the DOE Complex. Since no beneficial purpose within the DOE Complex for the material has been identified (Section 2.0), this alternative assumes the material would be designated as a waste. This alternative likely would result in potentially greater impacts (considering an increased volume) than those associated with continued storage of the LSA nitric acid (as waste) on the Hanford Site (Section 3.2.3), with the additional potential impacts (incident-free and accident) associated with transportation within the continental U.S. (Sections 5.1.2 and 5.2.2).

Further, selection and permitting of one site to store, treat, and dispose of all DOE surplus nitric acid (total volume dependent upon separate programmatic needs at other facilities) is outside the scope of this EA, and does not support the near-term PUREX Plant deactivation schedule. The LSA nitric acid is not a waste, as a use as a product (i.e., process chemical) has been identified. The *Federal Facilities Compliance Act of 1992* (FFCA) addresses requirements for federal facilities that are storing mixed waste that is awaiting treatment technology development.

3.2.5 Processing the LSA Nitric Acid as Waste

Consideration was given to converting the LSA nitric acid to a less hazardous form.

3.2.5.1 Sugar Denitration in the Existing PUREX Plant

Sugar denitration, a routine procedure during PUREX Plant operation, involves reacting nitric acid with sucrose (an approximately 22 weight percent solution of sugar in water). The reaction between the nitric acid and sugar produces NO_x , carbon dioxide, and water vapors, and reduces the nitric acid concentration. This alternative would result in additional waste streams, and is inconsistent with waste minimization goals.

Specifically, this alternative would result in gaseous and liquid effluents. Approximately 2.9×10^5 kilograms (631,000 pounds) of NO_x would be generated, and released to the

atmosphere through the existing PUREX Plant off-gas discharge system. Also, approximately 692,000 liters (183,000 gallons) of sodium nitrate solution would require interim storage. If existing double-shell tanks at the Hanford Site (i.e., tank farms) were used, additional processing (i.e., waste volume reduction) would be conducted to concentrate the liquid effluent to minimize storage requirements. The resultant approximately 1.4×10^5 liters (37,000 gallons) of concentrated solution would require final processing along with all other Hanford Site tank farm wastes.

New tankage for the approximately 692,000 liters (183,000 gallons) of sodium nitrate solution could be constructed specifically for this alternative. However, associated costs (see Section 3.2.3 for new tank design, procurement and construction) would be incurred. Budget cycles and permitting requirements would provide delays. Also, ultimate disposition of the solution would not be achieved, requiring eventual processing along with all other Hanford Site tank wastes.

The processing of the material would require reestablishing the operating configuration of appropriate PUREX Plant systems. This engineering work, coupled with development of the proper *Clean Air Act of 1976* permit(s) not currently in place could delay deactivation of the PUREX Plant by as much as 22 months. Ecology has specified that prior to implementing sugar denitration, review and approval of the Hanford Site Prevention of Significant Deterioration permit would be required. The costs associated with a projected 22-month delay include surveillance and maintenance, regulatory, operations, and completion of deactivation tasks deferred because of PUREX Plant requirements to support sugar denitration. Therefore, the cost impact could be up to \$68,000,000.

3.2.5.2 Sugar Denitration in New Facilities on the Hanford Site

Sugar denitration in new facilities (i.e., storage tanks and a processing facility) was considered. This alternative provides many of the same environmental impacts associated with the construction and operation of a new facility identified in Sections 3.2.3 and 3.2.5.1.

As discussed in Section 3.2.3, new RCRA-compliant storage tanks would be required. Associated design, procurement, and construction costs would be incurred (at least \$2,000,000). The design, permitting, construction, and operation of a new waste treatment (i.e., sugar denitration) facility would increase these costs. Additionally, as described in Section 3.2.1, unless the 94,500 liters (25,000 gallons) of nitric acid is removed from the U-Cell vault, associated delays in the deactivation of the PUREX Plant would result in additional costs.

Environmental impacts associated with secondary waste streams and future decontamination activities of a new facility would be similar to those discussed in Sections 3.2.3 and 3.2.5.1.

3.2.5.3 Direct Neutralization

Direct neutralization was considered. Neutralization would involve mixing the LSA nitric acid with a basic solution to reduce the acid concentration. Basic media considered included aqueous solutions of sodium hydroxide, potassium hydroxide, or magnesium hydroxide. Neutralization would generate secondary waste streams. These waste streams would include, respectively, radioactively-contaminated solutions of sodium nitrate, potassium nitrate, or

magnesium nitrate as well as air emissions (water, carbon dioxide, hydrogen, and NO_x). In this alternative, approximately 1,230,000 liters (325,000 gallons) of neutralized solution would be generated. Ultimate disposition of the resulting neutralized solution would not be achieved, requiring tank storage and future processing along with all other Hanford Site tank wastes.

As with sugar denitration (Section 3.2.5.1), additional costs would be incurred with this alternative compared to the proposed action. Routine operations at the Hanford Site involve routing waste directly to existing underground double-shell tanks. Storage space in the existing double-shell tank system is limited and costly. Further processing of this material to a stable form would be required eventually, along with other Hanford Site tank farm wastes, potentially extending the clean-up of the Hanford Site.

As an alternative to use of the existing double-shell tanks, new storage tanks (designed specifically for storage of the neutralized nitric acid) could be constructed. Consistent with Section 3.2.3, the design, procurement and installation of four new storage tanks (approximate capacity of 380,000 liters [100,000 gallons] each) would cost approximately \$4,000,000. Similar impacts associated with risks and funding, as those described in Section 3.2.3, would be expected. That is, this alternative could result in a two- to five-year delay in transfer of the LSA nitric out of the existing tankage, maintaining the risks discussed in Section 3.2.1. Additionally, as described in Section 3.2.1, unless the 94,500 liters (25,000 gallons) of nitric acid is removed from the U-Cell vault, associated delays in the deactivation of the PUREX Plant canyon would result in additional costs. Transfer of the neutralized solution to a uncontaminated facility also would result in additional future decontamination activities at the Hanford Site.

3.2.5.4 Other Processing Options

Other potential processing options, requiring facility modifications, were considered. The options included biodenitrification and distillation. In each instance, lack of technical feasibility, lack of existing processing equipment and/or additional waste streams make these options undesirable.

3.2.5.4.1 Biodenitrification

Biodenitrification is used in waste water treatment facilities to convert nitrates into nitrogen and carbon dioxide gases. There is no existing Hanford Site production-scale facility currently using this technology. However, a waste-water treatment facility, using biodenitrification, is operating at the Oak Ridge National Laboratory (ORNL).

The microorganisms used in the ORNL process only can withstand nitrate concentrations up to approximately 5,000 milligrams per liter (0.042 pounds per gallon). The process typically operates in the 2,000 milligram per liter (0.016 pounds per gallon) range. The LSA nitric acid nitrate concentration is approximately 620,000 milligrams per liter (5.2 pounds per gallon). Assuming the microorganisms can efficiently operate at the threshold nitrate concentration limit of 5,000 milligrams per liter (0.042 pounds per gallon), the LSA nitric acid would have to be diluted 124 times with fresh water. Such a dilution would result in increasing the volume of LSA nitric acid to be dispositioned from 692,000 liters (183,000 gallons) to 8.6×10^7 liters (2.3×10^7 gallons [i.e., 23 million gallons]).

There are other regulatory and technical issues which make this ORNL alternative unattractive. The State of Tennessee has prohibited ORNL from receiving waste water from other DOE sites, such as Argonne National Laboratory. Existing tankage in the ORNL waste water treatment facility is carbon steel, which is incompatible with the LSA nitric acid. The ORNL process would require extensive modification due to the levels of heavy metals (such as uranium) in the LSA nitric acid compared to ORNL's waste water streams.

Further, commercial biodenitrification systems as a unit operation have been considered for Hanford Site waste streams. For example, some waste water stored in the 300 Area of the Hanford Site contains small amounts of uranium and nitrates (100 milligrams per liter [8.4×10^{-4} pounds per gallon]). If the uranium and nitrates were removed, the resultant solution would be compatible for discharge to the environment. The uranium would be removed by a series of physical processes after biodenitrification. The optimum performance of this biodenitrification process is obtained at nitrate concentrations less than 50 milligrams per liter (4.2×10^{-4} pounds per gallon). The use of this biodenitrification process would require the addition of 8.7×10^9 liters (2.3×10^9 gallons [i.e., 2,300 million gallons]) of dilution water to reduce the nitrate concentration to operational levels.

3.2.5.4.2 Distillation

Distillation is a process which separates different components in a solution based on boiling points. Separation of the nitric acid from the uranium and non-volatile isotopes could be achieved by using existing equipment at the PUREX Plant. However, distillation would not produce a non-radioactive acid because of volatile isotopes already present in the LSA nitric acid (e.g., ruthenium), and not result in a useable product. Therefore, the generation of two contaminated waste streams, coupled with associated delays in PUREX Plant deactivation activities, make this alternative unattractive.

3.2.5.4.3 Processing Options Considered but Dismissed from Detailed Analyses

Several alternatives associated with processing the nitric acid were considered but dismissed from detailed analyses as unreasonable, generally due to the radioactive nature of the material, or prohibitive costs.

Different compounds requiring chemical conversion of the nitric acid, were considered. A common industrial use for nitric acid is as a process chemical for the production of ammonium nitrate (i.e., fertilizer). Similarly, commercial grade organic nitrates are produced on a large scale. Nitroglycerine and trinitrotoluene (commonly known as TNT) require nitric acid for their synthesis. Due to the length of time and costs required to establish the facilities and equipment for processing and the radioactive content of the final material, these alternatives were dismissed from further consideration.

Also, alternative waste processing options were considered. Examples included sugar denitration with NO_x abatement and/or absorption. This alternative would result in most of the same liquid effluent impacts as discussed in Section 3.2.5.1, with minimal gaseous NO_x effluents. However, this process would require major equipment procurements (e.g., ammonia storage system) and substantial facility modifications. Rigorous process controls would be

required to minimize gaseous releases of ammonia to the environment. Therefore, the additional technology development, additional costs, and large volumes of secondary wastes resulted in elimination of this alternative from detailed analysis.

3.2.6 Alternative U.S. Ports

Alternative U.S. ports were considered, but no viable alternatives were identified. Following a comprehensive search, only two carriers were identified who would transport the nitric acid. Those carriers typically do not use west coast ports as points of egress to Europe, and limited their ports of transit to the specific east coast ports mentioned in Section 3.1. Transportation time is minimized by using east coast ports.

Military ports considered but not evaluated in detail. The use of a military port would require making arrangements for special handling and chartering a ship. The costs of such an endeavor would be substantial. DOT regulations categorize the LSA nitric acid as Low Specific Activity Radioactive Material; as such no special handling procedures are required. Regulatory requirements contained in hazardous materials regulations imply that the most dangerous component of this material would be the radioactive component but, as described in this EA, due to the small quantity of fissile radionuclides in any one transport container (less than 1.9 kilograms [4.2 pounds]), the nitric acid component is of most concern. Corrosive materials, such as nitric acid, are routinely shipped without any special handling procedures or restrictions. In 1993 alone, approximately 5.3×10^9 liters (1.4×10^9 gallons [1.4 billion gallons]) of nitric acid was produced and transported internationally without substantial incident (*Survey of Current Business; February 1994*). The use of a military port would be considered in more depth if the material being shipped was highly radioactive.

3.2.7 Alternative Continental U.S. Transportation Modes

Other modes of transportation, such as rail, air transport, or barge, were considered, even though the existing containers are authorized by DOE for truck transport only.

Rail transport of the LSA nitric acid was considered. The potential environmental impacts associated with such transport would be similar to those experienced with ground truck transport. The transit time from the Hanford Site to an east coast port is estimated to be approximately 11 days, as compared to the four-day transit time by truck (WHC 1995b). Trains traverse many remote areas which could prove difficult for emergency responders to access, if an accident were to occur.

Air transportation of large quantities of the LSA nitric acid is possible, and would be more expensive than other forms of transportation (i.e., dollars per unit mass). Radiation doses to persons not involved in the transportation essentially would be zero under normal conditions. Transport packages would be more likely to fail in an air accident and disperse the radioactive components and nitric acid over a wider area due to the tremendous forces usually involved in

such an accident. As stated in the *National Transportation Statistics, Annual Report for 1992* (DOT 1992), probability of an air accident is about 20 times less than the probability of a truck accident, on a per-mile basis. Therefore, the risk from an air crash is low.

Barge transportation is generally slow. No barge route, which would not require extensive transportation by truck and/or multiple loading and unloading of containers between the involved origins and destination, has been identified.

3.2.8 Alternative Truck Transportation Routes

All reasonable overland routes from the Hanford Site to selected east coast ports were considered in development of the proposed action. Even though unnecessary for LSA shipments, designated routings were selected per DOE and DOT requirements for overland shipments of nuclear materials. Evaluation of potential routes included consideration of population density (urban, suburban, and rural); road surface; and distance. The routes chosen were selected to minimize transit time and risk.

4.0 Affected Environment

The affected environment includes the transportation routes through the corridor states (generally interstate highways), as well as the selected east coast ports, in addition to the Hanford Site. The general environmental description of the routes was considered in the route-specific aggregate data used to analyze transportation impacts.

4.1 Plutonium-Uranium Extraction Plant

The PUREX Plant is located in the 200 East Area of the approximately 1,450-square-kilometer (560-square-mile) semiarid Hanford Site in the southeastern portion of the State of Washington (Figure 1). The 200 East Area is approximately 11 kilometers (7 miles) west of the Columbia River, the nearest natural watercourse. The nearest population center is the City of Richland, approximately 35 kilometers (22 miles) to the south. The City of Richland has a population of 32,315, while the population within an 80-kilometer (50-mile) radius of the 200 Areas is approximately 375,860.

The Hanford Site has a mild climate with 15 to 18 centimeters (6 to 7 inches) of annual precipitation, and infrequent periods of high winds of up to 128-kilometers (80-miles) per hour. Tornadoes are extremely rare; no destructive tornadoes have occurred in the region surrounding the Hanford Site. The probability of a tornado hitting any given waste management unit on the Hanford Site is estimated at 1 chance in 100,000 during any given year. The region is categorized as one of low to moderate seismicity.

The 200 East Area is not located within a wetland or in a 100- or 500-year floodplain. No plants or animals on the federal list of "Endangered and Threatened Wildlife and Plants," (50 CFR 17) are found in the immediate vicinity of the PUREX Plant, nor would existing plant or animal species found on the Hanford Site be affected by the proposed action. General information regarding the Hanford Site may be found in the *Hanford Site National Environmental Policy Act (NEPA) Characterization* report (Cushing 1994).

No sensitive cultural resources in the area of the PUREX Plant have been identified, or are anticipated. No Cultural Resources Review was conducted for the proposed action since no ground disturbance or facility modifications are planned as part of the proposed action. Additional information regarding the cultural resources on the Hanford Site may be found in the *Hanford Cultural Resources Laboratory Annual Report for 1993* (PNL 1993).

4.2. East Coast Ports

The proposed east coast ports are Port Elizabeth, New Jersey; Baltimore, Maryland; and Portsmouth, Virginia.

The proposed ports are frequent destinations for container cargo ships traveling from ports throughout the world, and have a great deal of experience handling containerized cargo of all kinds. Typically, the ports provide berthing space, cranes, pier storage, dry storage, and open-yard storage. Generally, there is roadway access via major arteries connecting the port terminals with interstates, as well as rail service.

4.2.1 Port Elizabeth, New Jersey

Port Elizabeth, New Jersey, is located just outside of the metropolitan Newark, New Jersey region. The Newark, New Jersey area has a total population of just under 5,000,000. The 278 towns and cities in the 9-county region encompass 2,387 square miles, which represents about 29 percent of New Jersey's total area. The area is accessible by bus, train and air.

Port Newark/Elizabeth Seaport, with direct access to the Atlantic Ocean, is the second largest container port in the world. Workers there handle 57,000,000 million tons of cargo each year, and they dock 2,740 ships per year.

4.2.2 Baltimore, Maryland

Baltimore, Maryland, is located in eastern Maryland. The projected population in the year 2000 is approximately 718,600. The area surrounding Baltimore is comprised of many cities, occupying an area of approximately 150 square miles, and is accessible by bus, train, and air.

Baltimore has access to the Chesapeake Bay, which opens to the Atlantic Ocean. The ports in the Baltimore vicinity open to the Patapsco Bay; which accesses the Chesapeake Bay.

In Calendar Year 1994, workers moved 530,000 20-foot-equivalent units of containerized cargo, with 2,300 vessel calls. There were no accidents involving release of any materials at the port.

4.2.3 Portsmouth, Virginia

Portsmouth, Virginia, (located on the southeast coast of the state), is one of five cities considered part of Hampton Roads (the other four are Chesapeake, Norfolk, Suffolk and Virginia Beach). The Hampton Roads area is the largest metropolitan area in Virginia, with a population projection in the year 2000 of approximately 1,383,000. Portsmouth, itself, consists of an area of approximately 1,100 square miles, and is accessible by bus, train, and air. The 1995 population estimate for Portsmouth was approximately 103,800. Similar to Baltimore, Maryland (see Section 4.2.2), Portsmouth has access to the Chesapeake Bay, which opens to the Atlantic Ocean.

The port facilities at Hampton Roads are considered the second or third most active container port of the East and Gulf Coasts, having handled approximately 5.9 billion kilograms (13 billion pounds) and 875,000 20-foot-equivalent units of containerized cargo. The Hampton Roads ports have experience handling radioactive materials; in CY 1992 approximately 1,000,000 kilograms (2,200,000 pounds) of uranium dioxide was moved through the facilities (DOE 1994c).

4.3. Territorial Limits for Ocean Transport

The proposed action would include ocean transport on the Atlantic Ocean, within territorial limits for the U.S. and Great Britain. The U.S. territorial limits extend approximately 19 kilometers (12 miles) from the shoreline. Additionally, approximately 3,000 nautical miles in international waters, per one-way transit, would be required. Descriptive information of the North Atlantic, much of which is applicable to the entire ocean transport route, may be found in U.S. Army Corps of Engineers documentation (CERL 1990).

5.0 Environmental Impacts

The following sections present quantitative information on those potential environmental impacts that have been identified as a result of activities being proposed for the packaging of LSA nitric acid at the Hanford Site's PUREX Plant, and subsequent transport of the material to selected east coast ports. Both routine operations (incident-free packaging and transportation) and accident scenarios are analyzed, in Sections 5.1 and 5.2, respectively.

This Section of the EA provides quantitative analyses of potential risks and environmental impacts associated with the transport of LSA nitric acid and UO_3 in the continental U.S. and on international waters. Those risks address the hazards associated with the LSA nitric acid and its radioactive components. The predominant radioactive constituent is uranium, with approximately 7,400 kilograms dissolved in 692,000 liters (183,000 gallons) of nitric acid. In the same volume of LSA nitric acid there is a trace quantity of plutonium (less than 0.3 grams (0.01 ounces)). No quantitative analysis is provided for activities on English soil. However, a qualitative discussion of the latter activities is included for continuity and completeness.

The handling (including transportation) of hazardous liquid chemicals occurs daily in the continental U.S. In 1993 alone, approximately 5.3×10^9 liters (1.4×10^9 [1.4 billion] gallons) of nitric acid was produced and transported internationally without substantial incident (*Survey of Current Business; February 1994*). In the same calendar year, the DOT's *Hazardous Materials Information System* indicated that there were 22 accidents in the U.S. involving the release of concentrated (i.e., 40 - 70 weight percent) nitric acid during shipment. Only two accidents involved bulk tanker-truck shipments, with a maximum release of about 39 liters (10 gallons). None of the 22 accidents involved a hospitalization or lost work day. The total damages associated with the 22 accidents (which include damage to the carrier, property and cleanup costs) was \$15,904. The damages associated with the two tanker-truck accidents were \$165. Even so, there are uncertainties and risks associated with even the most routine handling operations. All activities would comply with current DOE orders, and state, federal and international regulations.

The LSA nitric acid represents a very small fraction of the volume of nitric acid shipped each year. The small amount of LSA nitric acid, the low level of radioactivity associated with it, and the relatively few shipments (approximately 52 [total] within 12 months) make the risks associated with the handling and transportation of the LSA nitric acid small. As discussed in Section 3.1, samples of LSA nitric acid may be collected and transported to BNF plc for analyses (approximately 10 liters [3 gallons] per sample). The impacts associated with transport of these samples would be negligible compared to a single 15,100 liters (4,000 gallons) shipment.

With regard to the return of the solid UO_3 to the U.S., the predominant danger associated with the routine handling and transportation of the UO_3 is not radiological, for there is no radiation exposure above normal background associated with UO_3 powder. Specifically, the hazard is toxicological, due to internal ingestion of heavy metals (i.e., uranium), which could arise only in the event of an accidental release of the material to the environment. The proposed

action would require the return of approximately 30 containers (208-liter [55-gallon] drums) containing approximately 8,900 kilograms (19,600 pounds) of UO_3 . This represents a single truckload of packaged uranium material.

For perspective, large quantities of natural uranium ore routinely are transported in railcars throughout the U.S. Data published by the U.S. Bureau of the Census (*Statistical Abstract of the U.S.; 1993*) indicate that the total U.S. production and import of uranium in 1993 was approximately 1.3×10^7 kilograms (2.8×10^7 [280 million] pounds). This represents approximately 165 railcars of material readily accessible to the environment. For further comparison, overland transport by truck trailers for this material would require approximately 670 shipments.

The UO_3 , when returned from BNF plc, would be stored within the DOE Complex. It is expected that the material would be returned to the Hanford Site and added to the existing UO_3 inventory presently stored at the 2714-U facility in the 200 West Area. The inventory of UO_3 which would be returned represents a small fraction of the total inventory of uranium presently stored within the DOE Complex. Specifically, the 8,900 kilograms (19,600 pounds) represents approximately 0.002 percent (by weight) of the total DOE uranium inventory, which is approximately 4.2×10^8 kilograms (9.2×10^8 [920 million] pounds). The current uranium inventory at the Hanford Site's 2714-U facility is approximately 6.7×10^5 kilograms (1.5×10^6 [1.5 million] pounds).

Additionally, it is expected that potential personnel exposure to both radiation and hazardous materials during routine handling operations at the selected ports, during ocean transport, offloading in England, and subsequent BNF plc operations would be no greater than existing conditions at those locations, and less than the low exposure currently experienced by the PUREX Plant personnel monitoring the total quantity of the LSA nitric acid. Appropriate procedures will be in place to ensure minimum exposure to radiation and hazardous materials (in keeping with As Low As Reasonably Achievable principles) and maximum employee and public safety.

Qualitatively, potential impacts associated with both routine operations and accidents outside the continental U.S. would not be expected to be substantially different than those described in the following sections for activities at the PUREX Plant and U.S. transportation.

It is noted that commercial liners (i.e., commercial container ships) are common carriers operating on scheduled sailings over established trade routes. Most international maritime trade goods are transported via such ships. The cargo on container ships is loaded into individual International Standards Organization containers (i.e., large metal boxes roughly the size and shape of the trailer of an 18-wheeler truck) that can be lifted onto and off-of the ship with their cargo inside. The containers are used to minimize the need to handle the cargo since the cargo is loaded into the container at the cargo's point of origin and not touched again until the cargo is unloaded at its final destination. Use of the containers also facilitates and speeds loading and unloading of the ship and the transfer of the cargo to and from truck transport in the ports. The ports servicing container ships are equipped with specially built cranes, specifically designed to automate as much of the loading/unloading operation as possible.

5.1 Proposed Action: Impacts from Routine Operations

This section of the EA considers routine operations associated with the proposed action, as described in Section 3.1. Routine operations are those activities which are necessary to accomplish the daily tasks associated the proposed action. Routine operations do not involve accidents. Accidents are addressed in Section 5.2.

5.1.1 LSA Packaging and Loading at the Plutonium-Uranium Extraction Plant

The potential for release of radioactive and hazardous LSA aqueous nitric acid during packaging and loading exists. However, appropriate controls would be in place in order to maintain personnel exposure to radiation well below DOE guidelines (5,000 millirem per year), in keeping with As Low As Reasonably Achievable principles. Appropriate procedures and administrative controls (e.g., personnel training and a Radiation Work Permit) would be in place prior to any proposed activities. Also, radiation and hazardous chemical worker exposure levels would be monitored during the proposed actions (i.e., personal dosimeters and constant air monitors).

Some radiological exposure would be expected for the workers involved in the proposed packaging and loading. The dose rate associated with the LSA nitric acid storage tanks (less than 0.5 millirem per hour at contact) is very low. Any one transfer operation would be expected to involve no more than five workers for less than eight hours each, at a distance of at least 6 meters (20 feet) from the LSA nitric acid storage tanks. At this distance, all exposure would be due to background radiation. Therefore, the proposed action would not measurably contribute to the annual worker exposure.

Average occupational external whole-body exposure to personnel in the PUREX Plant due to routine operations in CY 1993 was approximately 15 millirem. This is substantially less than the maximum allowable exposure of 5,000 millirem per year. Therefore, operations, based on a dose-to-risk conversion factors of 4.0×10^{-4} (onsite) latent cancer fatalities (LCF) per person-rem (roentgen equivalent man) (56 FR 23363), no LCFs per year would be expected to result from the proposed packaging and storage. It is anticipated that routine operations would not provide additional exposure of toxic or noxious vapors to workers.

No public exposure to radiation above that currently experienced from Hanford Site operations is anticipated as a result of these actions. As reported in the *Hanford Site Environmental Report for Calendar Year 1993* (PNL 1994), the potential dose to the hypothetical offsite maximally exposed individual during CY 1993 from Hanford Site operations was 0.03 millirem. The potential dose to the local population of 380,000 persons from 1993 operations was 0.4 person-rem. The 1993 average dose to the population was 0.001 millirem per person. The current DOE radiation limit for an individual member of the public is 100 millirem per year, and the national average dose from natural sources is 300 millirem per year. The extremely low doses associated with the total inventory of LSA nitric acid at the PUREX Plant would not contribute to offsite public exposure, nor would there be any offsite exposure from the individual, loaded shipping containers. Therefore, with no additional offsite exposure involved with the packaging and loading of the LSA nitric acid, no adverse health effects to the public are expected.

No toxicological exposure to workers or the general public is expected to occur as a result of routine handling of the LSA nitric acid. The material will be handled in a manner consistent with packaging and transportation of highly corrosive, industrial chemicals. PUREX Plant personnel routinely handle hazardous chemicals on a daily basis. A comprehensive training program specifically designed to address the transfer of the LSA nitric acid from the storage tanks to the transportation containers has been instituted. The program includes procedures (e.g., use of personnel protective clothing), specific hazardous materials training, and equipment safeguards (e.g., leak proof transfer hose couplings).

Small quantities of hazardous materials (e.g., solvents, cleaning agents, rinse solutions), which may be generated during the proposed actions at the PUREX Plant would be managed and disposed of in accordance with applicable federal and state regulations. Radioactive material, radioactively-contaminated equipment, and radioactive mixed wastes at the PUREX Plant would continue to be appropriately packaged, stored, and/or disposed of at existing facilities on the Hanford Site. None of the materials are anticipated to be generated in substantial quantities when compared to the annual amount routinely generated throughout the Hanford Site. For example, it is expected that less than 5 cubic meters (180 cubic feet) of radioactive and mixed wastes would be generated. In comparison, during CY 1992, approximately 23,800 cubic meters (840,500 cubic feet) of Hanford Site low-level nonindustrial waste was received for disposal and/or storage in the 200 Areas (WHC 1993).

The proposed action is not expected to impact the flora and fauna, air or water quality, land use, or have socioeconomics effects. Noise levels would be comparable to existing conditions at the PUREX Plant. No cultural resources would be impacted since no ground disturbance or facility modifications are planned as part of the proposed action. The amount of equipment and materials to be used, such as fuel for transportation, represent a minor long-term commitment of nonrenewable resources.

5.1.2 Transportation

This section addresses the impacts of incident-free (routine) truck transport of radioactive and hazardous materials (specifically LSA nitric acid) in the continental U.S., in which the shipments reach their destinations without incident (transportation accident scenarios are addressed in Section 5.2.2). The approaches and data that were used to calculate these impacts are detailed in the RADTRAN analysis, as well as the characteristics of the radioactive shipments that are important to determining the radiological impacts. This section presents the results of the RADTRAN 4 input parameters and assumptions (Neuhauser 1992). The return of UO_3 powder to the U.S. would be expected to use similar modes and routes. Associated potential environmental impacts would be small because, as discussed in Section 5.0, return of the UO_3 would involve a single shipment of containerized solid material.

5.1.2.1 RADTRAN 4. The RADTRAN 4 computer code yields conservative estimates of radiological exposure to workers and the public (Neuhauser 1992). The conservatism comes from the assumptions which are made in selecting data in the program itself. For example, in

the absence of actual measurements, the highest allowable external radiation level for a package (under transportation regulations) were used. In practice, packaging arrangements reduce this below the assumed level by a factor of 10.

5.1.2.2 Potential Impacts. The shipment characteristics necessary to calculate the radiological impacts of transport include the type of transportation packaging, the number of shipments, and the quantity of radioactive material within the package (referred to as the "inventory"). These parameters are presented in the RADTRAN Analysis for the transportation packaging considered in this EA. Some of the information also is used in the analysis of transportation accidents, which is analyzed in Section 5.2, and detailed in the RADTRAN analysis (WHC 1995a).

Radiological impacts during normal transport involve dose to the public from radiation emitted by radioactive material packages as the shipment passes by, and to transport workers who are in the general vicinity of a radioactive material shipment. Even though radiation shields are incorporated into packaging designs (if required by regulations), some radiation penetrates the package and exposes the nearby population to an extremely low dose rate. After the shipment has passed, no further exposure occurs.

The stainless steel shipping containers and ancillary piping meet the applicable requirements of transportation regulations and specifications, including: DOT 51, 49 CFR 178.245; DOT IM-101, 49 CFR 178.270; and International Maritime Dangerous Goods (IMDG) Code for IMO-1 (Type 1 Portable Tanks). The RADTRAN analysis is based on the package specifications (WHC 1995b), which provide a more conservative evaluation of potential environmental impacts. Specifics of conservative assumptions used in the analysis, such as total activity per container (less than 0.9 curies), number of workers (2), persons exposed during stops (50), and average exposure during stops (0.5 millirem per hour at 1 meter from the cask) are provided in *Transportation Impact Analysis for the Shipment of Low Specific Activity Nitric Acid* (WHC 1995a). The average radiation exposure used in the analysis (i.e., the aforementioned 0.5 millirem per hour at 1 meter) exceeds the actual dose rate and was used because it is the minimum value which allows the model to provide a calculated impact. In reality, the actual dose rate from a loaded LSA nitric acid transport container would not exceed 0.5 millirem per hour at contact, because of the much smaller inventory and the thickness of the transport container walls when compared to the existing 203-A nitric acid bulk storage tanks.³

It is noted that the empty transport containers, which would be returned to the Hanford Site, would have residual LSA nitric acid (less than 40 liters [10 gallons]). With this small quantity of residual material, radiological and toxicological risks would be negligible. Therefore, the potential radiological and toxicological risks associated with the return clearly would be bounded by the shipment of full transport containers.

³As discussed in Section 5.1.1, the dose rate from the total inventory of LSA nitric acid is very low (i.e., less than 0.5 millirem per hour at contact). The LSA nitric acid transport containers would provide even more shielding than the existing storage tanks at 203-A because of the thicker walls of the transport container, and contain a much smaller inventory.

The groups exposed to radiation while the shipments are in-transit include truck drivers, those who directly handle radioactive shipments while they are en route, and the general public (e.g., bystanders at truck stops, persons living or working along a route, and nearby travelers (moving in the same and opposite directions). The RADTRAN 4 computer code (Neuhauser 1992) was used to calculate exposures during highway transport to these population groups. Potential impacts of exposure to shipboard personnel would be expected to be very low, and bounded by those projected for drivers. Shipboard personnel generally would not be in the immediate vicinity of cargo for any extended period of time, unlike the proximity of the truck cab to the transport container.

The transportation analysis (WHC 1995a) indicated that the total dose to truck crews (workers) would amount to less than 0.5 person-rem for all of the shipments to any specific east coast port (see Table 2). Based on the projected 52 shipments, the total radiation exposure to the driver(s) would be less than 0.01 person-rem per shipment. For perspective, a single tooth x-ray provides an individual exposure of approximately 0.01 person-rem.

Total public doses (attributable to the projected 52 shipments) were calculated to be less than 3 person-rem (predominantly from exposures received during truck stops). There are no excess LCFs predicted to result from routine doses from the LSA nitric acid shipments. As stated earlier, specifics of conservative assumptions used in the analysis, such as total activity per container (less than 0.9 curies), number of workers (2), persons exposed during stops (50), and average exposure during stops (0.5 millirem per hour at 1 meter from the cask) are provided in WHC 1995a.

No toxicological impacts would occur during normal transport. Hazardous chemicals are shipped daily throughout the U.S. The nitric acid transport containers are appropriately designed to eliminate releases during normal operation. As stated in Section 5.1.1, the material would be handled in a manner that is substantially more conservative than the methods normally used for packaging and transportation of highly-corrosive, industrial chemicals.

Table 2.
Incident-Free Radiological Impacts.

	Worker	Public
Hanford, Washington to Portsmouth, Virginia		
Total Dose (person-rem)	0.43	3.1
Latent Cancer Fatalities	1.7×10^{-4}	1.6×10^{-3}
Hanford, Washington to Baltimore, Maryland		
Total Dose (person-rem)	0.41	2.2
Latent Cancer Fatalities	1.6×10^{-4}	1.1×10^{-3}
Hanford, Washington to Port Elizabeth, New Jersey		
Total Dose (person-rem)	0.43	2.3
Latent Cancer Fatalities	1.7×10^{-4}	1.2×10^{-3}

It may be necessary to amend the transportation route to address safety, logistical, environmental or other reasonable concerns. Circumstances which could affect the selected route, include actions such as road closures, detours, unanticipated inclement weather, and shipping delays. Should such events occur, appropriate procedures would be in place to minimize additional travel times, and corresponding potential radiation exposure. Those procedures may include highway escorts, traffic control, and appropriate supplemental public notification. Therefore, events such as route changes or slight delays are not expected to result in any substantial change in risk to the worker or public during transportation of the LSA nitric acid.

To place the exposures and health effects in perspective, a comparison was made to natural background exposures received by the same population affected by the LSA nitric acid shipments. According to the National Council on Radiation Protection and Measurements (NCRP 1987), the average annual natural background exposure in the United States is about 300 millirem per year. The resulting average annual radiation dose from natural background radiation to the exposed population between the east coast and the Hanford Site was calculated to be approximately 6,000 person-rem per year. This may be compared with the calculated additional exposure of less than 3 person-rem associated with the proposed action (Table 2). Therefore, the highest incident-free population dose for the entire LSA nitric acid shipment campaign in the continental U.S. is less than 0.1 percent (i.e., one-tenth of 1 percent) of the calculated national average exposure from background radiation for the same population. Using the appropriate health effects conversion factors addressed earlier, the resulting health effects due to natural background exposure were calculated to be 3 LCFs, compared to no LCFs (calculated to be less than 2×10^{-4} LCFs) associated with the proposed action.

5.2 Proposed Action: Impacts from Accidents

Potential accidents associated with the disposition and transportation of the LSA nitric acid have been analyzed. The severity of consequences depends on the extent of exposure, and the specific location of the affected individual(s). Material Safety Data Sheets provide information regarding hazards of nitric acid and uranium (in nitric acid).

Symptoms of exposure to aqueous nitric acid, NO_x , and uranium (in nitric acid) may include burning sensation, coughing, wheezing, laryngitis, shortness of breath, headache, nausea and vomiting. Aqueous nitric acid may be fatal if inhaled, swallowed, or absorbed through the skin. Nitric acid causes burns. Nitric acid, NO_x , and uranium (in nitric acid) are extremely destructive to tissue of the mucous membranes and upper respiratory tract, eyes and skin. Nitric acid is a strong oxidizer, and when contacted with combustible material or flammable materials could cause fires. A violent exothermic reaction could occur when nitric acid comes into contact with water.

The impacts associated with potential transportation accidents are expressed as risk. For this analysis, risk is defined as the product of the probability of occurrence of an accident involving the LSA nitric acid shipments and the consequences of an accident. Consequences are expressed in terms of the health effects from a release of radioactive plutonium and uranium from the packaging or the exposure of persons to toxic vapors of NO_x .

Probability categories for accidents range from anticipated to incredible events (WHC 1988). That is, an anticipated event is one where the frequency ranges from 1 to 1×10^{-2} (one chance in one hundred). An unlikely event has a frequency range from 1×10^{-2} (one chance in one hundred) to 1×10^{-4} (one chance in ten thousand). An extremely unlikely event has a frequency range from 1×10^{-4} (one chance in ten thousand) to 1×10^{-6} (one chance in one million). Incredible events have a frequency of less than 1×10^{-6} (one chance in one million).

Historically, over the past 10 years only one injury requiring hospitalization or a lost work day has resulted in the U.S. from tanker-truck transportation accidents involving nitric acid shipments. This accident occurred in 1985. Over the same 10-year period, a total of 70 tanker-truck accidents occurred during nitric acid shipments. These resulted in the single major injury and three minor injuries.

5.2.1 LSA Nitric Acid Offload to Shipping Containers

Postulated accidents associated with the offload of LSA nitric acid at the PUREX Plant have been considered. For conservatism, two potential events associated with the entire inventory of LSA nitric acid were analyzed. The following analysis bounds potential minor spills and leaks which could occur during offload activities at the PUREX Plant.

Two events were analyzed, both dealing with a spill of the LSA nitric acid during a seismic event at the Hanford Site. These events are high consequence/low probability scenarios. The seismic event has a probability of about once every 3,000 years (i.e., a safety class 2 earthquake [DOE-RL 1989]). Neither event would be expected to result in an LCF.

In the first scenario, it was assumed that the nitric acid storage tanks failed during a seismic event, with the material being contained within the existing retention basin. The resulting dose to an onsite worker (i.e., considered to be 100 meters [330 feet]) from the event, was calculated to be 0.036 rem effective dose equivalent (EDE). The dose at the site boundary was calculated to be 4.6×10^{-5} rem. Based on those doses, and dose-to-risk conversion factors of 4.0×10^{-4} and 5.0×10^{-4} (onsite and offsite, respectively) LCFs per person-rem (56 FR 23363), this accident scenario would result in 1.5×10^{-5} LCFs (onsite) and 2.3×10^{-8} LCFs (offsite).

The second scenario assumed not only failure of the nitric acid storage tanks during the seismic event, but included the additional failure of the retention basin, causing the LSA nitric acid to pool in a geologic depression outside of the PUREX Plant. In this second scenario, the calculated onsite and offsite doses would be the same as those identified above. That is, the onsite consequences were 0.036 rem (1.5×10^{-5} LCFs), and the consequences at the site boundary were 4.6×10^{-5} rem (2.3×10^{-8} LCFs).

There would be potential toxicological effects associated with such an event. As stated in Section 5.0, the severity of consequences depend on the extent of exposure, and the specific location of the affected individual(s). Toxicological consequences are based on concentrations of a specific material in parts per million of the material in air. The calculated worst-case toxicological consequences occur in the scenario where the nitric acid storage tanks fail during a seismic event with the additional failure of the retention basin. The results (shown in Table 3) indicate that if such an event were to occur, the toxicological consequences to the onsite worker would be 30 parts per million of NO_x . The toxicological consequences to the offsite individual would be 5.9×10^{-2} parts per million of NO_x . These calculated values are based on the entire inventory of LSA nitric acid.

Table 3.
Concentration of NO_x associated with LSA Nitric Acid Spill (parts per million)

Retention Basins Intact		Retention Basins Fail	
Onsite	Offsite	Onsite	Offsite
2.1	1.4×10^{-3}	30	5.9×10^{-2}

The resultant calculated toxicological consequences may be compared to draft Hanford-specific Emergency Response Planning Guidelines (ERPG) for NO_x developed by the Hanford Environmental Health Foundation and applied in accordance with toxicological risk acceptance guidelines in WHC-CM-4-46, *Nonreactor Facility Safety Analysis Manual* (WHC 1988). These guidelines, which are based on lesser consequences being acceptable for higher frequency events, provide the basis for evaluating potential risk to onsite workers and the offsite population.

Emergency Response Planning Guidelines 1 (ERPG-1) is the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing other than mild transient adverse health effects or perceiving a

clearly defined objectionable odor (see Section 5.0). Similarly, ERPG-2 is the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing or developing irreversible or other serious health effects or symptoms which could impair an individual's ability to take protective action. Finally, ERPG-3 is the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing or developing life-threatening health effects.

Typically, calculated onsite consequences are limited to a range from ERPG-2 to ERPG-3, dependent upon event frequency (one per year and 1×10^{-6} per year, respectively). The criteria for NO_x , as discussed in WHC 1988, are 25 parts per million (ERPG-2), and 50 parts per million (ERPG-3). The aforementioned calculated onsite concentration of 30 parts per million is slightly above the airborne concentration where nearly all individuals could be exposed for up to one hour without experiencing or developing irreversible or other serious health effects or symptoms which could impair an individual's ability to take protective action (ERPG-2).

Personnel working near aqueous nitric acid storage facilities would be well aware of the hazards and response procedures, and would evacuate and remain clear of any plume coming from a NO_x release. Based on the extremely low probability of occurrence, even if the consequences of such an event are as calculated for the onsite worker, the extremely low probability of occurrence and administrative training and controls make the risks of a NO_x release from the proposed action small.

Similarly, the offsite consequences of a NO_x release are limited from ERPG-1 (corresponding to an event frequency of 1 per year) to ERPG-2 (corresponding to an event frequency of 1×10^{-6} per year) (WHC 1988). These guidelines correspond to 2 parts per million and 25 parts per million, respectively. The calculated offsite toxicological consequences of 5.9×10^{-2} parts per million fall well below the concentration where nearly all individuals could be exposed for up to one hour without experiencing other than mild transient adverse health effects or perceiving a clearly defined objectionable odor (see Section 5.0).

5.2.2 Transportation

The impacts associated with potential transportation accidents are expressed as risk. For this analysis, risk is defined as the product of the probability of occurrence of an accident involving the LSA nitric acid shipments and the consequences of an accident. Consequences are expressed in terms of the health effects from a release of radioactive constituents from the packaging or the exposure of persons to toxic vapors of NO_x .

The analyses consider the affected public and the drivers. Vehicular fatalities as a result of vehicular impact are not included within the scope of this document.

In the event that an individual could not evacuate the immediate vicinity of a potential accident scene, the individual may or may not be directly exposed to material. The effects to an individual as a result of exposure to any chemical are a result of time of exposure, concentration and distance. The specific exposure to an individual who is unable to evacuate

would depend upon extent of a spill (i.e., the amount of material released), their proximity to the spill and the meteorological conditions. For distances less than 100 m, it is assumed that the direct physical injuries due to the vehicular accident itself would be the principle hazard; otherwise, the individual would be able to evacuate the area and minimize their exposure. Additionally, the initial response by the drivers and/or the emergency response personnel would reduce the risk and exposure of individuals unable to evacuate the accident scene.

For this analysis, it is assumed that the drivers retain the capability to take protective action, such as exiting the vehicle and moving out of any irritating plume (upwind) to a distance of at least 100 meters (330 feet). During this exit period, it is possible that the driver(s) may be exposed to concentrations of nitric acid vapors which could cause destruction to tissue of the mucous membranes and upper respiratory tract, eyes, and skin. However, proper emergency response (e.g., flushing affected external areas with water while removing contaminated clothing) would minimize the amount of permanent physical damage to the individual(s). As discussed below, potential accidents could result in minimal impact to worker and public health and safety.

States and tribes having jurisdiction over areas through which these shipments would pass have the primary responsibility for protecting the public and the environment, and for establishing incident command should there be an emergency involving the shipments. DOE would provide technical advice and assistance to authorities and carriers of DOE cargos, when requested. The selected carrier for these shipments has the primary responsibility for providing emergency response assistance and recovery/restoration actions, if required.

In the event of a highway incident, where the transport container is involved, the driver would notify the 911 line, the appropriate state control, the carrier's central dispatch facility, and TRANSCOM of the event. In the event of an accidental release of the PUREX Plant nitric acid, the carrier is required to notify the National Response Center per DOT and U.S. Environmental Protection Agency regulations (49 CFR 171, *General Information, Regulations, and Definitions*, and 40 CFR 302, *Designation, Reportable Quantities, and Notification*, respectively. The National Response Center would provide appropriate response in support of recovery/restoration.

If the driver is unable to respond, the carrier's dispatch center or TRANSCOM Control Center would notify the state patrol that the driver is not responding. The state highway patrol can then locate the truck and establish incident command, if necessary.

Further, emergency response procedures accompany the shipment. These procedures are attached to the bill of lading. The driver would be in control of these documents at all time during shipment. These procedures address the potential toxicological and radiological hazards associated with the material. The procedures also include a phone number, manned 24-hours a day, which could be called for emergency assistance. In the event that the paperwork was unaccessible (e.g., a fire in the transporter cab), a first responder could contact the chosen carrier or TRANSCOM, which would provide emergency response information.

Finally, the container is marked and placarded in accordance with DOT regulations. Placards indicating the radioactive and corrosive nature of the shipment are permanently attached to the transport containers. These visual warnings provide information to first responders and the general public regarding the hazards and appropriate emergency response. For example, emergency response guidelines for a release of nitric acid include isolation of the spill area. Response crews would use self-contained breathing apparatus, rubber boots and heavy rubber gloves during cleanup. Sand or vermiculite (i.e., kitty litter) would be used to absorb free liquid, and packaged in closed containers for disposal. Similar procedures would apply due to the presence of the uranium (both in the nitric acid and as UO_3 powder).

Specific details regarding emergency preparedness, notifications, emergency response, recovery, and cleanup and site restoration may be found in the transportation plan prepared for the shipment of the LSA nitric acid (WHC 1995b).

The maximum foreseeable accident associated with the shipping container was analyzed. Should an accident involving an LSA nitric acid shipment occur, a release of radioactive or toxic material could occur only if the transport packaging were to become breached. The RADTRAN 4 computer code was used to calculate the radiological impacts of transportation accidents involving LSA nitric acid shipments. The analysis assumed an airborne release of 100 percent of the contents of the package for accidents that occur over 30 miles per hour. This is extremely conservative because no credit was taken for the high-quality fabrication of the container, or the fact that only a fraction of the liquid would become airborne.

A transportation accident, should it occur, would involve a maximum container volume of 15,100 liters (4,000 gallons). The maximum exposure in the immediate vicinity (i.e., 100 meters [330 feet]) to radiological contaminants would be expected to be substantially less than that projected (0.036 rem [1.5×10^{-5} LCFs]) for the release of the entire inventory of 692,000 liters (183,000 gallons) of LSA nitric acid previously discussed in Section 5.2.1. Therefore, no health effects to an individual in the immediate vicinity of a postulated accident would be expected.

Further, the results indicate that the total transportation accident risks to the general public from the maximum foreseeable accident during continental U.S. (overland truck) LSA acid shipments are, conservatively, 16 person-rem (Table 4). This equates to about 0.008 LCFs. This represents the total risk (accident frequency times the collective dose) to all individuals in urban, suburban, and rural population zones along the entire route for all 52 shipments. The transportation impacts (accident risks) are dominated by a shipment from the PUREX Plant to the east coast port, primarily because of the long overland shipping distance from the PUREX Plant to the east coast (about 4,200 kilometers [2,600 miles]), compared with the relatively short overland distance on English soil.

Table 4.
Potential Radiological Transportation Accident Risks.

Hanford, Washington to Portsmouth, Virginia	
Total Dose (person-rem)	12
Latent Cancer Fatalities	6.2×10^{-3}
Hanford, Washington to Baltimore, Maryland	
Total Dose (person-rem)	13
Latent Cancer Fatalities	6.6×10^{-3}
Hanford, Washington to Port Elizabeth, New Jersey	
Total Dose (person-rem)	14
Latent Cancer Fatalities	7.1×10^{-3}

Toxicological consequences of such an event during transportation were also analyzed (WHC 1995a). Calculations were used to assess the toxicological health effects for three maximum individual receptor locations and two weather conditions for a potential accident that results in a release of the entire tank contents. The three downwind locations were considered (100 meters [330 feet], 200 meters [660 feet], and 1,000 meters [3,300 feet]). The worst-case meteorological conditions considered tend to disperse the released material very slowly, resulting in the highest possible downwind concentrations. These conditions, represented by light steady winds, nighttime skies, and low levels of turbulence, tend to overstate the actual risks. A more likely set of conditions were also evaluated, which included slightly greater turbulence.

An evaporative release model was used to determine the release rate from the spilled pool of nitric acid (WHC 1995a). The concentrations at the receptor locations were calculated using atmospheric dispersion parameters using the methods recommended by the NRC. At all three receptor locations and under even worst-case weather conditions, the calculated concentrations were below the levels that could result in acute health effects. That is, the maximum calculated concentration of NO_x (18 parts per million) occurred at 100 meters (330 feet). Exposures at this level could cause temporary discomfort (e.g., irritation of the eyes and skin). However, such exposure on a daily basis would not adversely affect a worker's health. At 200 meters (660 feet), the calculated concentration of NO_x (0.61 parts per million) likely would be undetectable by humans. The calculated concentration of NO_x at 1,000 meters (3,300 feet) was 0.041 parts per million.

During offload at an eastern dock, it would be expected that the potential industrial risks associated with movement of these types of containers, with similar types of hazardous chemicals, would be similar to all such industrial activities. That is, workers in the area would encounter the same risks as with any commercially available nitric acid. Additionally, it would

be expected that the onsite (i.e., 100 meters [330 feet] radiological and toxicological effects of a drop of a full container (i.e., approximately 15,100 liters [4,000 gallons]) would be far less than postulated for the entire inventory currently stored at the PUREX Plant. Due to the location of the dock (i.e., industrial section of an urban area), potential exposure to the public (i.e., offsite) could be greater by as much as several orders of magnitude in the event of an accidental release. Even so, the offsite effects would be expected to be less than the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing or developing irreversible or other serious health effects or symptoms which could impair an individual's ability to take protective action (i.e., ERPG-2).

The potential for a severe port accident, after the LSA nitric acid container is loaded aboard the carrier, was considered. No more than three U.S. port calls would be expected for any particular shipment of LSA nitric acid. Marine accident data provided by the U.S. Coast Guard were the basis for estimates of accident frequencies per port call (DOE 1986). Specifically, the probability that a collision would result in the penetration of a cargo hold containing a LSA nitric acid shipping container was calculated to be 2.9×10^{-5} per port call. Additionally, the probability of a severe fire following collision was estimated at 1.1×10^{-8} per port call. The radiological consequences of a severe port accident associated with even several containers of LSA nitric acid clearly would be bounded by a similar event involving spent nuclear fuel. A container of LSA nitric acid would have less than 0.9 curies of radioactivity, versus tens of thousands of curies associated with a spent nuclear fuel cask (DOE 1994b). The following analysis was provided in the *Environmental Assessment of Urgent-Relief Acceptance of Foreign Research Reactor Spent Nuclear Fuel* (DOE 1994b).

A postulated severe port accident associated with spent nuclear fuel was recently analyzed by DOE. In the event of such an accident (involving major mechanical damage, fire, oxidation of 100 percent of the fuel, and release of radioactive material from a cask containing 33 spent nuclear fuel elements), the dose to a maximally exposed individual (i.e., an individual assumed to be standing outside approximately 30 meters (100) feet away from the event and remaining there for 24 hours, would be 25,000 millirem. At such close distance, it is highly probable that the individuals, if not evacuated, would be harmed more by the explosion and fire engulfing the cask than by the radiation dose. If the individual were inside a building approximately 30 meters (100 feet) away and remained there for 24 hours after the accident, the dose would be reduced to 220 millirem. At a more likely distance, where an individual may be located outside for a period of 24 hours after the accident, the dose at 100 meters (330 feet) would be 210 millirem. When considered in conjunction with the probability of occurrence, the accident has an extremely small risk. For example, the risk of developing a single fatal cancer for the most severe case (i.e., individual outside, 30 meters [100 feet], 24 hours receiving 25,000 millirem) is about 1 chance in 600 million.

Compared to tens of thousands of curies associated with a spent nuclear fuel cask for the postulated accident discussed in the preceding paragraph, a transport container of LSA nitric acid would have less than 0.9 curies of radioactivity. Based on the extremely small risk associated with spent nuclear fuel, the radiological risks associated with a potential port accident involving LSA nitric acid would be even lower.

The total toxicological effects of a postulated severe port accident would depend upon the nature of the entire cargo on board. Other materials typically found on ocean-going vessels, such as petroleum products, could be present in far greater quantities and are flammable. As stated above, the maximally exposed individual approximately 30 meters (100 feet) away probably would be harmed more by the explosion and fire than by exposure to the nitric acid. At 100 meters (330 feet), it would be expected that the effects directly attributable to the PUREX Plant nitric acid would be similar to those evaluated during transportation (i.e., a NO_x concentration of 18 parts per million). This exposure would not be expected to result in any health effects.

Further, the potential radiological and chemical environmental impacts from ocean transport of loaded LSA nitric acid transport containers are expected to be negligible, and clearly bounded by those potential impacts associated with ocean transport of spent nuclear fuel. A container of LSA nitric acid would have less than 0.9 curies of radioactivity, versus tens of thousands of curies associated with a spent nuclear fuel cask. For example, approximately 383 shipments of spent nuclear fuel were received in the U.S. from foreign research reactors prior to 1990 (Cashwell 1990). In the same time-frame, the Nuclear Assurance Corporation (NAC) indicated that the two largest companies in the commercial business of shipping spent nuclear fuel by sea logged over approximately 5.6×10^6 kilometers (3.0×10^6 nautical miles) over 18 years without a significant incident (NAC 1986). Since approximately 6.2×10^4 kilometers (3.4×10^4 nautical miles) at sea are involved in shipment of the LSA nitric acid, which is less than one percent of the NAC quoted distance, it is not anticipated that there would be a significant incident over the entire shipping campaign, or that the vessel transporting the shipping container(s) between the U.S. and the English port of entry would be involved in some incident. This conservative probability is the sum of all incident probabilities and includes minor incidents as well as major incidents. Only a small subset of these incidents would be severe enough to result in sufficient damage to the shipping container to allow a release of the nitric acid to the environment. The recent analysis involving foreign research reactor spent nuclear fuel (DOE 1994b) provides additional information regarding the potential consequences of ocean transport of nuclear materials.

The affected human population would be a long distance away from material/gaseous releases and thus atmospheric mixing and dilution would tend to disperse released radioactivity and chemical toxicity. However, humans would not be the principally exposed species in a deep ocean accident. The impacts of such an event would primarily affect marine life. The Nuclear Energy Agency of the Organization for Economic Cooperation and Development in Paris, France, estimated the impacts of various accident scenarios involving shipment of reprocessed commercial spent nuclear fuel. The peak doses to biota residing on the ocean floor in or near the uppermost sediment layer were evaluated for fish, crustaceans, and mollusks (NEA 1988). Uranium, the major radiological constituent of spent nuclear fuel and of the LSA nitric acid, has not been found to bioaccumulate in fish and bioaccumulates only slightly in crustaceans and mollusks (IAEA 1976). Nitrates are common components of marine life and environment. Natural ocean currents would promote mixing and dilution of any release of nitric acid. Therefore, the consequences to the public and marine life from accidental releases of radiological or toxicological contaminants associated with the LSA nitric acid on the open sea, should they occur, would be minor.

Finally, the potential impacts of the UO_3 shipments for storage in either England, or returned to the U.S., are considered negligible relative to shipments of LSA nitric acid in the continental U.S. because there is only one shipment and the powder form of the UO_3 is less mobile than the liquid LSA nitric acid. As discussed earlier, for any accident the severity of consequences depend on the extent of exposure, and the specific location of the affected individual(s). UO_3 powder does not constitute a major external radiation and/or chemical hazard. However, uranium compounds are toxic if they are inhaled, swallowed, or if they come in contact with the eyes. Driver(s) of the transport vehicle carrying the UO_3 would have appropriate hazardous materials training, and would take the necessary treatment steps in the event of any contamination. For example, flushing external surfaces with water and removal of contaminated clothing would minimize health hazards. Ingestion of large quantities of water, followed by induced vomiting, would reduce internal exposure. Further, emergency response teams also would be trained to deal with an accidental spill of hazardous materials. Response guidelines for solid UO_3 are similar to typical procedures used to respond to hazardous material spills. These guidelines include isolation of the spill area. Trained response personnel would use self-contained breathing apparatus, rubber boots and heavy rubber gloves during cleanup. Spilled UO_3 powder would be collected in the most convenient and safe manner, and deposited in sealed containers.

5.3 Proposed Action: Environmental Justice

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, directs Federal agencies to 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 for implementation of the Executive Order. However, the analysis in this EA (Sections 5.1 and 5.2) indicates that there would be minimal impacts to both the offsite population and potential workforce during handling and transportation of the LSA nitric acid, under both routine and accident conditions. Additionally, transportation in the continental U.S. would involve established, existing highways, minimizing transit time and associated potential exposure. Therefore, it is not expected that there would be any disproportionately high and adverse impacts to any minority or low-income populations.

5.4 Proposed Action: Cumulative Impacts

The proposed action would be similar to many existing activities associated with Hanford Site operations which occur daily (i.e., packaging, transport and storage of radioactive and hazardous materials). The management of the LSA nitric acid, however, poses substantially less of a hazard than many other materials at Hanford (e.g., high-level tank waste). As stated in Section 5.1, less than 1 LCF would be expected to workers or the general public as a result of the proposed action. The proposed action also would reduce the potential for, and consequences of, inadvertent releases of radioactive and hazardous materials at the PUREX Plant, and would reduce waste management requirements.

Further, the risks associated with routine transportation of radioactive and hazardous materials are very small. The transportation of the LSA nitric acid would not be expected to substantially contribute to existing worker and public exposure from natural background radiation, or the existing toxicological background environment. As stated previously (Section 5.1.2.2), the average annual radiation dose from natural background radiation to the exposed population between the east coast and the Hanford Site was calculated to be approximately 6,000 person-rem per year. This may be compared with the calculated additional exposure of less than 3 person-rem associated with the proposed action.

Also, as discussed in Section 5.0, the relatively low volume of the LSA nitric acid is inconsequential when compared to annual U.S. shipments of hazardous chemicals. Therefore, no measurable cumulative impacts would be anticipated as a result of the proposed disposition and transportation of the LSA nitric acid.

6.0 Permits and Regulatory Requirements

6.1 Facility Compliance

It is DOE policy to carry out its operations in compliance with all applicable federal, state, and local laws and regulations. Facilities on the Hanford Site, including the PUREX Plant, operate in compliance with National Ambient Air Quality Standards (*Clean Air Act of 1977*, U.S. Environmental Protection Agency). Hanford Site radioactive stacks, including those at the PUREX Plant, have been registered with the State of Washington Department of Health (DOH), Office of Radiation Protection. The DOH has issued a radioactive air emissions permit for the Hanford Site. No additional air emission permits would be required for the proposed action.

All generated solid wastes would be handled in a manner compliant with applicable federal and state regulations and DOE orders. For example, requirements include WAC 173-303 and DOE Order 5820.2A, *Radioactive Waste Management*.

6.2 Transportation Requirements

The loading and transportation of LSA nitric acid to the BNF plc will comply with the applicable regulations, orders, and guidance promulgated by agencies such as the DOE, DOT, IAEA, and IMO. These agencies have developed comprehensive regulations covering the performance of the shipping packaging, vehicle safety, routing of shipments, and physical protection. International regulations include those found in the United Nations' *Recommendations on the Transport of Dangerous Goods*, *IAEA Safety Standards; Regulations of the Safe Transport of Radioactive Material 1985 Edition (as amended 1990)*, and the IMO's *International Maritime Dangerous Goods Code*.

Appendix C provides some key elements associated with transportation of the LSA nitric acid within the continental U.S. Additionally, specific regulations that apply to offsite shipments of LSA nitric acid are found in the CFR under the following headings:

- 10 CFR 110 "Export and Import of Nuclear Equipment and Material"
- 46 CFR 64 "Marine Portable Tanks and Cargo Handling Systems"
- 49 CFR 107 "Hazardous Materials Program Procedures"
- 49 CFR 171 "General Information, Regulations, and Definitions"
- 49 CFR 172 "Hazardous Materials Table and Hazardous Materials Communications Regulations"

- 49 CFR 173 "Shippers-General Requirements for Shipments and Packaging"
- 49 CFR 177 "Carriage by Public Highway"
- 49 CFR 178 "Shipping Container Specifications"
- 49 U.S.C. 1801 et seq, "Hazardous Materials Transportation Act"

7.0 Agencies Consulted

The States of Washington and Oregon, the Yakama Indian Nation, the Confederated Tribes of the Umatilla Indian Reservation, the Wanapum Band, and the Nez Perce Tribe, the Western Governor's Association, the Southern States Energy Board, the MidWest Council of State Governments, and associated corridor states and stakeholders were notified regarding the proposed action. More than 70 letters of notification for preparation of this EA were issued.

An early draft of the EA was provided to an ad hoc board of Hanford stakeholders. This early draft EA was modified in response to the ad hoc board's comments. Subsequently, copies of the draft EA were distributed to states, tribes, and interested parties.

In addition, prior to finalization of the EA, public meetings were held in Portsmouth, Virginia; Baltimore, Maryland; and Newark, New Jersey. Public comments, in the form of letters, oral testimony, and written comment forms from the public meetings, are provided in Appendix D. Specific responses to the comments are also provided in Appendices D and E (Volume 2).

Details of the transportation plans have been discussed with interested corridor state agencies in weekly teleconference calls.

8.0 References

- 10 CFR 110, 1993, "Export and Import of Nuclear Equipment and Material," *Code of Federal Regulations*, as amended.
- 40 CFR 302, 1993, "Designation, Reportable Quantities, and Notification," *Code of Federal Regulations*, as amended.
- 46 CFR 64, 1993, "Marine Portable Tanks and Cargo Handling Systems," *Code of Federal Regulations*, as amended.
- 49 CFR 107, 1993, "Hazardous Materials Program Procedures," *Code of Federal Regulations*, as amended.
- 49 CFR 171, 1993, "General Information, Regulations, and Definitions," *Code of Federal Regulations*, as amended.
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Appendices

U.S. DEPARTMENT OF ENERGY RELATED CORRESPONDENCE

The Secretary of Energy
Washington, DC 20585

October 11, 1994

MEMORANDUM FOR THOMAS P. GRUMBLY
ASSISTANT SECRETARY FOR
ENVIRONMENTAL MANAGEMENT

FROM: HAZEL R. O'LEARY *Hazel R. O'Leary*
SUBJECT: Disposition of Hanford Nitric Acid

You are authorized to consider the shipment of 183,000 gallons of nitric acid containing slightly enriched uranium from the Plutonium-Uranium Extraction (PUREX) plant at Hanford, Washington to the British Nuclear Fuels Limited (BNFL) plant at Sellafield, England for recycling, as an alternative in the preparation of an appropriate National Environmental Policy Act (NEPA) document. If, upon completion of the NEPA process, shipment of the nitric acid from Hanford to BNFL is found to be appropriate, shipment may commence upon receipt of an export license approved by the Nuclear Regulatory Commission. The shipment must be conducted in accordance with an approved transportation plan and must utilize Department of Transportation approved shipping containers.

EXPORT LICENSE FOR LSA NITRIC ACID

NRC FORM 250 (6-94) THIS LICENSE EXPIRES 31 December 1995 United States of America Nuclear Regulatory Commission		NRC LICENSE NO. XSNM02827
Pursuant to the Atomic Energy Act of 1954, as amended, and the Energy Reorganization Act of 1974 and the regulations of the Nuclear Regulatory Commission issued pursuant thereto, and in reliance on statements and representations heretofore made by the licensee, a license is hereby issued to the licensee authorizing the export of the materials and/or production or utilization facilities listed below, subject to the terms and conditions herein.		
LICENSEE U.S. Department of Energy 825 Jadwin Avenue Richland, WA 99352 Attn: J. M. Hennig		ULTIMATE CONSIGNEE IN FOREIGN COUNTRY British Nuclear Fuels plc Sellafield, Seascale Cumbria, England CA20 1PG United Kingdom (For use at BNF reprocessing facility)
INTERMEDIATE CONSIGNEE IN FOREIGN COUNTRY None.		OTHER PARTIES TO EXPORT Westinghouse Hanford Company 2355 Stevens Drive, G2-03 Richland, WA 99352 (Supplier) Edlow International Company Suite 500 1666 Connecticut Avenue, NW Washington, DC 20009 (Transportation arrangements)
APPLICANT'S REF. NO. Appl. dated 7/15/94		COUNTRY OF ULTIMATE DESTINATION United Kingdom
QUANTITY 74.0 kilograms 0.5 gram	DESCRIPTION OF MATERIALS OR FACILITIES Uranium-235 Contained in 7,500.0 kilograms Uranium, enriched to <1.0 percent; and Plutonium-239 Contained in 183,000 gallons of aqueous solution of nitric acid expected to be divided into 54 shipments of approx 4,000 gallons each. Conditions 6, 8, and 9 on page two of this license apply to this export. //END//////////////////////////////////////	
Neither this license nor any right under this license shall be assigned or otherwise transferred in violation of the provisions of the Atomic Energy Act of 1954, as amended and the Energy Reorganization Act of 1974. This license is subject to the right of recapture or control by Section 108 of the Atomic Energy Act of 1954, as amended and to all of the other provisions of said Acts, now or hereafter in effect and to all valid rules and regulations of the Nuclear Regulatory Commission.		THIS LICENSE IS INVALID UNLESS SIGNED BELOW BY AUTHORIZED NRC REPRESENTATIVE <i>Ronald D. Hauber</i> Ronald D. Hauber, Director; Division of Nonproliferation, Exports and Multilateral Relations; Office of International Programs DATE OF ISSUANCE NOV 22 1994

FORM NRC-250A
(7-75)

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U.S. NUCLEAR REGULATORY COMMISSION
EXPORT LICENSE

Conditions

License Number XSNM02827

Condition 1 — Licensee shall file with the Customs Officer or the Postmaster two copies, in addition to those otherwise required, of the Shipper's Export Declaration covering each export and mark one of such copies for transmittal to the U.S. Nuclear Regulatory Commission, Washington, D.C. 20555. The following declaration should accompany or be placed on the Shipper's Export Declarations for such exports:

"This shipment is being made pursuant to specific license number (specific license number) filed at (location of Customs office where license is filed), on (date license was filed). This license expires on (expiration date of license), and the unshipped balance remaining on this license is sufficient to cover the shipment described on this declaration."

Condition 2 — Exports authorized in any country or destination, except Country Groups Q, S, W, X, Y, and Z in Part 370, Supplement No. 1, of the Comprehensive Export Schedule of the U.S. Department of Commerce.

Condition 3 — This license covers only the nuclear content of the material.

Condition 4 — The material to be exported under this license shall be shipped in accordance with the physical protection requirements for special nuclear material in 10 CFR 73.

Condition 5 — Special nuclear material authorized for export under this license shall not be transported outside the United States in passenger carrying aircraft in shipments exceeding (1) 20 grams or 20 curies, whichever is less, of plutonium or uranium 233, or (2) 350 grams of uranium 235.

Condition 6 — This license authorizes export only and does not authorize the receipt, physical possession, or use of the nuclear material.

Condition 7 — The licensee shall complete and submit an NRC Form 741 for each shipment of source material exported under this license.

Condition 8 — The licensee shall advise the NRC in the event there is any change in the designation of the company who will package the nuclear material to be exported under this license, or any change in the location of the packaging operation, at least three weeks prior to the scheduled date of export.

Condition 9 — The material to be exported under this license shall be protected in transit, while within U.S. jurisdiction, in accordance with the requirements of 10 CFR Parts 70 and 73 and the licensee's security plan or in accordance with DOE requirements and directives for the transport and protection of such material.

KEY REGULATORY ELEMENTS FOR LSA NITRIC ACID SHIPMENTS

Key Regulatory Elements for LSA Nitric Acid Shipments

Vehicle Safety

The carriers of radioactive materials must meet, at a minimum, the same requirements as carriers for any hazardous material. Truck safety is governed by the Bureau of Motor Carrier Safety of the DOT, which imposes vehicle-safety standards on all truck carriers (49 CFR 325.386 through 325.398). Along with other functions, the Bureau conducts unannounced wayside inspections of all truck-carrier vehicles and drivers. Several states, including Washington and Oregon, also have truck inspection programs. During the inspection, the condition and loading of the vehicle and the drivers' documents are checked. Trucks carrying radioactive materials must be placarded in accordance with 49 CFR 172. In addition, states will use the Commercial Vehicle Safety Alliance's North American Inspection Standards as a guideline for their inspections. These standards include radiological measurements of the containers.

Highway Routing

The DOT's routing regulations, 49 CFR 177.825 (Docket HM-164), were published January 19, 1981, and became effective February 1, 1982. The objectives of these regulations are to reduce impacts of transporting radioactive materials, to establish consistent and uniform requirements for route selection, and to identify the role of state and local governments in the routing of radioactive materials. The regulations attempt to reduce potential hazards by avoiding populous areas and minimizing transit times.

All regulations announced by state and local governments have to be consistent with the provisions of Docket HM-164 or they will be preempted. The DOT holds that conflicting requirements among jurisdictions may be unduly restrictive and may increase risks by directing shipments to highways having higher accident rates.

The DOT regulation requires carriers to use routes selected to minimize transit time and radiological risk. Carriers transporting LSA nitric acid will be required to travel on interstate circumferential or bypass routes, if available, to avoid populous areas. Carriers may use interstate or preferred highways that pass through urban areas only if circumferential routes are not available.

Emergency Response

Many agencies share the responsibilities for dealing with accidents involving shipments of radioactive materials. A national radiological assistance plan has been developed for responding to real or suspected releases of radioactive material from a shipment in transit. For example, under this plan, the Federal Emergency Management Agency (FEMA) has the primary responsibility for emergency response planning for transportation accidents involving radioactive

materials. Also at the federal level, the DOE will make available from its resources radiological advice and assistance to protect the public health and safety and to cope with radiological hazards. Federal support is also available from the U.S. Environmental Protection Agency, the U.S. Department of Health and Human Services through the U.S. Food and Drug Administration, the DOT, and the NRC.

The FEMA has published "Guidance for Development of State and Local Radiological Emergency Response Plans and Preparedness" (FEMA 1983). This document details necessary components of emergency response plans, including institutional responsibilities and jurisdictions, accident characteristics and assessment, radiological exposure control, resources, communications, medical support, notification methods and procedures, emergency response training activities, and post-accident operations.

States and tribes having jurisdiction over areas through which these shipments will pass have the primary responsibility for protecting the public and the environment, and for establishing incident command should there be an emergency involving the shipments. DOE will provide technical advice and assistance to authorities and carriers of DOE cargos, when requested. The selected carrier for these shipments has the primary responsibility for providing emergency response assistance and recovery/restoration actions, if required.

In the event of a highway incident, where the transport container is involved, the driver will notify the 911 line, the appropriate state control, the carrier's central dispatch facility, and TRANSCOM of the event. In the event of an accidental release of the PUREX Plant nitric acid, the carrier is required to notify the National Response Center per DOT and U.S. Environmental Protection Agency regulations (49 CFR 171, *General Information, Regulations, and Definitions*, and 40 CFR 302, *Designation, Reportable Quantities, and Notification*, respectively. The National Response Center would provide appropriate response in support of recovery/restoration.

If the driver is unable to respond, the carrier's dispatch center or TRANSCOM Control Center will notify the state patrol that the driver is not responding. The state highway patrol can then locate the truck and establish incident command, if necessary.

Further, emergency response procedures accompany the shipment. These procedures are attached to the bill of lading. The driver would be in control of these documents at all time during shipment. These procedures address the potential toxicological and radiological hazards associated with the material. The procedures also include a phone number, manned 24-hours a day, which could be called for emergency assistance. In the event that the paperwork was inaccessible (e.g., a fire in the transporter cab), a first responder could contact the chosen carrier or TRANSCOM, which would provide emergency response information.

Finally, the container is marked and placarded in accordance with DOT regulations. Placards indicating the radioactive and corrosive nature of the shipment are permanently attached to the transport containers. These visual warnings provide information to first responders and the general public regarding the hazards and appropriate emergency response.

Executive Summary

The U.S. Department of Energy (DOE) needs to disposition surplus nitric acid as part of deactivating the Plutonium-Uranium Extraction (PUREX) Plant, reduce the risk to the environment, reduce the cost of long-term storage, and assure regulatory compliance.

DOE is deactivating the PUREX Plant at the Hanford Site near Richland, Washington. The deactivation activities will result in placing the PUREX Plant in an environmentally safe and stable condition for long-term surveillance and maintenance. The successful deactivation of the PUREX Plant, which has received support from various stakeholder groups, will stabilize a portion of the Hanford Site's inventory of radioactive and hazardous materials. This will reduce the risk of exposure to both onsite workers and members of the general public. This also will reduce annual funding requirements from the current (approximately) \$34,000,000 per year to less than \$2,000,000 per year. One of the elements of complete deactivation of the PUREX Plant is the disposition of approximately 692,000 liters (183,000 gallons) of surplus nitric acid which is contaminated with low levels of uranium and other radionuclides. The nitric acid is designated as low specific activity (LSA). The nitric acid is stored in four storage tanks at the PUREX Plant. Approximately 94,500 liters (25,000 gallons) of nitric acid are stored in two tanks in the PUREX Plant U-Cell vault, and 597,500 liters (158,000 gallons) are stored in two tanks in the 203-A Bulk Radioactive Chemical Storage Area.

Continued long-term storage in the current storage configuration at the PUREX Plant would not be in compliance with applicable *Resource Conservation and Recovery Act of 1976* (RCRA) requirements, as implemented by the State of Washington Department of Ecology (Ecology) pursuant to the Washington Administrative Code (WAC) 173-303, *Dangerous Waste*

Regulations. Presently, the surplus nitric acid is considered a product by DOE. This position has been discussed with Ecology, based on shipping the nitric acid offsite for use as a raw material. On that basis, Ecology has responded in writing, indicating that although not currently classified as a solid waste, the material is a hazardous substance and should be managed in a manner which ensures that releases will not occur, and human health and the environment will be protected. Additionally, for this material to be excluded from regulation under the provisions of speculative accumulation (WAC 173-303), at least 75 percent of the material must be transferred for recycling within calendar year (CY) 1995.

The LSA category applied to the material is based upon the low levels of radioactive contaminants in the surplus nitric acid. In the approximately 692,000 liters (183,000 gallons) of material, there is a total of less than 0.3 grams (0.01 ounces) of plutonium. Also present is approximately 7,400 kilograms (16,300 pounds) of uranium, of which approximately 72 kilograms (158 pounds) is U-235 (i.e., fissile material).

DOE considered disposition alternatives for the surplus nitric acid. Consideration has included discussions with the States of Washington and Oregon, the Yakama Indian Nation, the Confederated Tribes of the Umatilla Indian Reservation, the Nez Perce Tribe, the Western Governor's Association, and other national and international stakeholders. Five principle alternatives were evaluated:

1. Transfer for Reuse (*the proposed alternative*). This alternative, which is consistent with DOE's efforts to promote waste minimization, would eliminate the need to manage or process the nitric acid as a waste. Although nitric acid has previously been used in operations at several DOE facilities, no current or near-term use for the material could be

identified at any of these facilities. Private sector interest for the nitric acid was solicited through a Commerce Business Daily announcement. British Nuclear Fuels Limited, Inc. (BNFL), was the only entity which expressed interest. BNFL proposed using the LSA nitric acid as a process chemical in the B205 (Mgnox Fuels Processing) facility operated by BNFL's parent organization, British Nuclear Fuels private limited company (BNF plc). The B205 facility, located in Sellafield, England, is an International Atomic Energy Agency (IAEA)-safeguarded nuclear fuel processing facility operated by BNF plc. The facility recovers fissionable isotopes of uranium and plutonium for use in fabricating fuel for domestic and commercial nuclear power reactors. BNF plc would use the LSA acid in place of approximately eight percent of the B205 facility's annual nitric acid requirements. The annual B205 facility nitric acid usage represents approximately one-half of Sellafield Site's yearly requirements.

In July 1994, DOE applied to the Nuclear Regulatory Commission for an export license to ship the nitric acid. The application was reviewed by U.S. executive branch agencies and EURATOM (EURATOM [European Atomic Energy Community] is an international organization which deals with safeguards and movement of nuclear material from, to, and through the European community). In parallel with these export license application reviews, a Federal Register notice concerning the export license application was published. At the same time, DOE considered whether the proposed shipment of the nitric acid would be compatible with U.S. nonproliferation policy.

In evaluating the nonproliferation policy aspects of the proposed shipment, DOE considered the facts that BNF plc has a readily available supply of nitric acid, which could be procured from any number of U.S. or other commercial sources, and that interested parties such as Ecology, the U.S. Environmental Protection Agency (Region 10), Yakama

Indian Nation, and the Confederated Tribes of the Umatilla Indian Reservation do not object to the shipments. In addition, the proposed shipment appeared to be a case-specific solution to a material disposition problem, promoting waste minimization and reducing potential emissions to the environment. The export would not "...make a material contribution to the proliferation of weapons of mass destruction..."¹ and would be consistent with Executive Order 12114, *Environmental Effects Abroad of Major Federal Actions*. These facts appeared to support the position that the transfer of nitric acid from the PUREX Plant was a policy-neutral decision, and did not set a precedent from either a technical or policy standpoint.

DOE also considered the proposed nitric acid transfer in terms of maintaining existing commitments with regard to European civil plutonium programs. Specific consideration was given to the perception that the transfer of the surplus nitric acid might be inconsistent with the U.S. policy on nonproliferation because it would constitute encouragement of civil plutonium stockpiling by providing a necessary chemical ingredient for reprocessing spent fuel.

DOE also considered the views of citizens groups such as Greenpeace, Snake River Alliance, and Physicians for Social Responsibility who have objected to the shipments based on nuclear nonproliferation concerns. Specifically, one comment was that a sale would not appear to be a firm consistent step to lessen the global proliferation threats. However, nitric acid is widely available from various commercial sources. Therefore, this nitric acid sale would neither encourage nor discourage civil plutonium stockpiling.

¹ The White House, Office of the Press Secretary, "Fact Sheet, Nonproliferation and Export Control Policy," September 27, 1993.

Another comment was that a sale would conflict with nuclear nonproliferation policies. However, these policies place no prohibitions on government or commercial entities providing nitric acid to BNF plc.

After weighing these and other concerns, the Secretary of Energy authorized consideration of the transfer of the surplus nitric acid to BNF plc as an alternative to disposition of the material. The Secretary indicated that, if upon completion of the *National Environmental Policy Act of 1969* process the shipment of the nitric acid from Hanford to BNF plc is found to be appropriate, shipment could commence contingent upon receipt of an export license approved by the U.S. Nuclear Regulatory Commission. The export license (XSNM02827) has been issued.

Implementation of this alternative would allow the material to be managed as a product, provide waste minimization, and allow the complete deactivation of the PUREX Plant. This alternative would also provide for final disposition of the entire inventory of the surplus nitric acid. The cost associated with implementing this alternative would be less than \$3,000,000; essentially, the cost of transferring the acid to the processing system at Sellafield. This would be relatively low when compared with the costs associated with the other alternatives.

2. No Action. Under the No-Action Alternative, the LSA nitric acid would remain in the existing U-Cell and 203-A nitric acid PUREX Plant storage tanks. This alternative, although eliminating transportation impacts (both routine and accident scenarios), does not address the actual disposition of the material. The No-Action Alternative would continue to present the risks associated with the storage of large quantities of radioactive, aqueous

nitric acid. Nitric acid is extremely corrosive. The existing tanks and retention basins in the 203-A area are approximately 40 years old, and could fail in the event of an earthquake.

Also, the material would be categorized as a mixed waste, subject to RCRA storage, treatment, and disposal requirements. The current configuration is not RCRA-compliant, and would require modifications and appropriate permits for continued storage. The No-Action Alternative would eliminate the potential to manage the material as a product. There would, in addition, remain the need to provide future waste treatment and disposal, with associated environmental impacts and costs.

Finally, the ultimate goal of deactivation of the PUREX Plant could not be achieved while nitric acid is stored in the U-Cell storage tanks. Deactivation requires the removal of major source terms (i.e., radioactive and hazardous materials) from the building, and the physical isolation of residual materials from the environment. The physical capabilities to allow future removal of the U-Cell nitric acid (e.g., external transfer routes, electrical power, and equipment) would have to remain in service in the No-Action Alternative.

A modification to the No-Action Alternative would be to transfer the U-Cell nitric acid (approximately 94,500 liters [25,000 gallons]) to appropriate, available onsite storage facilities outside of the PUREX Plant canyon area. Examples include existing nitric acid transport containers, or in either of the two remaining 203-A storage tanks which do not presently contain nitric acid. The 10 transport containers (total capacity of approximately 151,000 liters [40,000 gallons]) would provide adequate storage space for the U-Cell nitric acid. However, the ability to transfer nitric acid directly to transport containers from U-Cell does not exist. Also, there presently is not adequate storage space in the 203-A

storage tanks. Two of the tanks contain surplus nitric acid (597,500 liters [158,000 gallons]), and do not have available space to receive the U-Cell nitric acid inventory. The remaining two tanks in the 203-A storage facility contain water (e.g., rain water and snow melt) from the 203-A containment sump. Neither the transport containers nor the 203-A storage tanks are RCRA-compliant storage units. Therefore, although transferring the U-Cell nitric acid to another storage location would eliminate the impacts to PUREX Plant canyon deactivation, the aforementioned risks and regulatory compliance issues associated with onsite storage of large volumes of nitric acid would remain.

3. Continued Storage in Hanford Upgraded or New Facility. Alternative Hanford Site storage options for the nitric acid were also considered, including upgrading the existing storage facility to achieve regulatory compliance and constructing a new, storage facility. This alternative would address the environmental, safety and regulatory compliance concerns associated with the current storage facility, and would have a minimal potential for transportation related impacts. This alternative would not address the risks associated with indefinite storage of aqueous nitric acid and the ultimate disposition of the nitric acid. Further, an upgraded or new facility would cost at least \$2,000,000, excluding permitting activities necessary to address hazardous waste storage. The additional future cost associated with processing the material, and ultimately disposing of any resulting wastes, also would be substantial and would depend upon the treatment method selected at that time.
4. Consolidation of DOE Surplus Acid. Consideration was given to consolidating surplus nitric acid from different DOE locations. However, no current or near-term consolidation options for the PUREX Plant nitric acid could be identified. DOE recently initiated a project which will consider the management and disposition of similar types of material,

including surplus nitric acid, at the various DOE sites. This initiative will not yield results in a time frame that is compatible with that in which a decision regarding the ultimate disposition of the PUREX Plant nitric acid must be made. Given the environmental, safety, and cost issues associated with the PUREX Plant nitric acid, there appears to be no benefit to postponing implementation of an acceptable disposition alternative. Selection and permitting of one site to store, treat, and dispose of all DOE surplus nitric acid is outside the scope of the proposed action.

5. Processing the LSA Nitric Acid as Waste. This alternative included options for treating the surplus nitric acid as a waste. Treatment options considered included processing the acid by sugar denitration, direct neutralization, bionitrification, and distillation, in existing and new facilities. Each of these treatment processes would generate substantial secondary waste streams which would require subsequent treatment and disposal. Implementation of the treatment options would also present various technical and regulatory concerns (e.g., releases of oxides of nitrogen to the air, storage space limitations, process throughput rate limits, obtaining permits to treat the material in the State of Washington or other states). The cost and schedule impact associated with processing the nitric acid as waste also could be substantial. For example, a technically practical processing alternative of sugar denitration, which could use existing PUREX Plant equipment, would increase the cost due to an approximately two-year delay in PUREX Plant canyon deactivation. This cost would be approximately \$68,000,000.

Transfer of the surplus nitric acid to BNF plc is considered the preferred alternative. Various transportation modes, routes, and ports were considered. However, truck transport to an east coast port was determined to be preferable. East coast ports were preferred because their

use would result in less transit time and handling requirements than west coast ports (no common ocean carriers that handle this type of material have a route directly from a west coast port to Europe).

All actions associated with the proposed action would be conducted in accordance with applicable national and international regulatory requirements, including those of the IAEA. A typical sequence of activities for material packaging and transportation would include several steps. The nitric acid would be transferred from its existing location in the PUREX Plant to transport containers designed and fabricated to appropriate specifications. The containers would be secured on a truck trailer and radiologically measured by trained personnel using prescribed procedures and equipment (e.g., hand-held radiation monitors) prior to release. Both the containers and trailers would undergo inspection prior to transport to ensure appropriate standards, specifications, and regulations, including U.S. Department of Transportation guidelines, and carrier security demands were met. Approximately 52 shipments from the Hanford Site to an east coast port would be required to transfer the entire inventory of nitric acid to BNF plc. Transport time from the Hanford Site to the east coast would be approximately four days.

Once at the east coast port, the containers would be unloaded to a dock holding station, pending transfer to an ocean carrier. Once in England, the containers would be off-loaded to an awaiting overland carrier and transported to BNF plc's B205 facility at Sellafield, England. Once at Sellafield, England, the nitric acid would be off-loaded to BNF plc tankage. The transport containers would be returned to the Hanford Site for reuse.

As part of the BNF plc operations, the uranium contained in the PUREX Plant nitric acid (i.e., approximately 7,400 kilograms [16,300 pounds]) would be recovered and converted to

solid UO_3 . The DOE will retain title to an amount of UO_3 that is equivalent to the amount recovered from the PUREX Plant nitric acid. The UO_3 would be transferred to suitable storage containers and transferred to interim storage in an International Atomic Energy Agency-safeguarded BNF plc storage facility, such as Sellafield. A typical container would be a 208-liter (55-gallon) drum. The UO_3 would be returned to the U.S. for storage at a DOE facility by April 1, 1997. Current plans are to return the material to the Hanford Site for storage with the existing inventory pending final disposition. The small quantity of plutonium (i.e., less than 0.3 grams [0.01 ounces]) would not be recovered for return to DOE, but would remain within the processing streams associated with routine BNF plc operations.

After the entire inventory of nitric acid is removed from the PUREX Plant, the storage tanks would be stabilized (e.g., rinsed and isolated) and placed into a condition suitable for long-term surveillance, pending decommissioning of the PUREX Plant. Rinse solutions would be transferred to existing waste management facilities at Hanford for treatment, storage, and/or disposal. The transport containers would be returned to the Hanford Site, decontaminated as necessary, and reused or dispositioned, as appropriate.

The potential for significant individual and cumulative environmental impacts due to the conduct of the proposed action has been analyzed. No substantial increase in Hanford Site, corridor states, or international environmental impacts would be expected from the proposed action. Environmental impacts from postulated accident scenarios also were evaluated, and indicated that the risks associated with the proposed action would be small.

Glossary

Acronyms and Initialisms

BNFL	British Nuclear Fuels Limited, Inc.
BNF plc	British Nuclear Fuels Private Limited Company
CERL	Construction Engineering Resources Laboratory
CFR	<i>Code of Federal Regulations</i>
CY	Calendar Year
DOE	U.S. Department of Energy
DOE-RL	DOE, Richland Operations Office
DOH	State of Washington Department of Health
DOT	U.S. Department of Transportation
EA	Environmental Assessment
Ecology	State of Washington Department of Ecology
EDE	Effective dose equivalent
ERPG	Emergency Response Planning Guideline
EURATOM	European Atomic Energy Community
FEMA	Federal Emergency Management Agency
FFCA	<i>Federal Facilities Compliance Act of 1992</i>
FR	<i>Federal Register</i>
IAEA	International Atomic Energy Agency
IMDG	International Maritime Dangerous Goods
IMO	International Maritime Organization
INEL	Idaho National Engineering Laboratory
LCF	latent cancer fatality
LSA	low specific activity
N/A	Not applicable
NAC	Nuclear Assurance Corporation
NCRP	National Council on Radiation Protection and Measurements
NEA	Nuclear Energy Agency
NEPA	<i>National Environmental Policy Act of 1969</i>
NNS	DOE's Office of Nonproliferation and National Security
NO _x	oxides of nitrogen
NRC	U.S. Nuclear Regulatory Commission
PNL	Pacific Northwest Laboratory
Pu	plutonium
PUREX	Plutonium-Uranium Extraction
rem	roentgen equivalent man
SRS	Savannah River Site
TBD	to be determined
TNT	trinitrotoluene

Acronyms and Initialisms (cont'd)

U	uranium
UO ₃	uranium trioxide
WAC	Washington Administrative Code
WHC	Westinghouse Hanford Company

Definition of Terms

As Low As Reasonably Achievable. An approach to radiation protection to control or manage exposures (both individual and collective to the workforce and general public) as low as social, technical, economic, practical, and public policy considerations permit.

Background radiation. That level of radioactivity from naturally occurring sources; principally radiation from cosmogenic and primordial radionuclides.

Decay, radioactive. A spontaneous nuclear transformation of one nuclide into a different nuclide or into a different energy state of the same nuclide by emission of particles and/or photons.

Effective Dose Equivalent. 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 from internal deposition of radionuclides in the body and the effective dose equivalent from external radiation received during a year.

Emergency Response Planning Guidelines No. 1 (ERPG-1). The maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing other than mild transient adverse health effects or perceiving a clearly defined objectionable odor.

Emergency Response Planning Guidelines No. 2 (ERPG-2). The maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing or developing irreversible or other serious health effects or symptoms which could impair an individual's ability to take protective action.

Emergency Response Planning Guidelines No. 3 (ERPG-3). The maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing or developing life-threatening health effects.

Fissile. Material capable of undergoing fission by slow neutrons.

Latent cancer fatality. The excess cancer fatalities in a population due to exposure to a carcinogen.

Definition of Terms (cont'd)

Low Specific Activity. A shipping category designation based on U.S. Department of Transportation (DOT) specifications. The specific requirements are found in 49 *Code of Federal Regulations* 173, "Shippers-General Requirements for Shipments and Packaging."

Maximally exposed individual. A hypothetical member of the public who, by virtue of location and living habits, could receive the highest possible radiation dose from radioactive and/or toxicological effluents released from either the Hanford Site or some location during a transportation accident.

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.

Risk. The product of the probability of occurrence of an accident and the consequences of an accident.

Metric Conversion Chart

If you know	Multiply by	To get
Length		
centimeters	0.39	inches
meters	3.28	feet
kilometers	0.54	nautical miles
kilometers	0.62	statute miles
Area		
square kilometers	0.39	square miles
Mass (weight)		
grams	0.035	ounces
kilograms	2.2	pounds
Volume		
liters	0.264	gallons
cubic meters	35.32	cubic feet

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

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