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ADDITIONAL USE OF BLENDED LOW ENRICHED URANIUM (BLEU) IN REACTORS AT TVA'S BROWNS FERRY AND SEQUOYAH NUCLEAR PLANTS

Limestone County, Alabama, and Hamilton County, Tennessee

PREPARED BY:
TENNESSEE VALLEY AUTHORITY

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ENVIRONMENTAL ASSESSMENT

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The Proposed Decision and Need

TVA's Browns Ferry (BFN) and Sequoyah (SQN) Nuclear Plants provide substantial amounts of relatively low-cost generation to the TVA power system as an integral part of the Tennessee Valley Authority's (TVA) current generation portfolio. In both the *Energy Vision 2020 Integrated Resource Plan Environmental Impact Statement* (TVA 1995) and the updated *Integrated Resource Plan* (TVA 2011a), TVA also planned for the existing nuclear plants, such as BFN and SQN, to continue to be an important component of TVA's future portfolio of power generating facilities.

At BFN and SQN, TVA utilizes nuclear fuel that is derived from either commercially available low-enriched uranium (LEU) or from weapons-grade highly enriched uranium (HEU) declared surplus to defense needs of the United States government. LEU is defined as containing less than 5 percent of the uranium isotope U-235, while HEU contains more than 20 percent of the isotope U-235 compared to naturally occurring uranium that has 0.7 percent U-235. Enrichment is a means of increasing the percentage of uranium-235 within a uranium sample. Uranium must be enriched to cause a nuclear reaction which generates heat through fission (discussed below). This heat can then be used to generate electricity. The HEU material can be processed into blended low-enriched uranium (BLEU) for use as fuel in commercial nuclear reactors. BLEU is formed by a procedure known as "downblending," where the percentage of uranium-235 is reduced, making it suitable for power generation.

In 1995, 200 MT of HEU was declared surplus to the defense needs of the United States. The U.S. Department of Energy (DOE) developed a program to manage the disposition of this excess material. Under this program,, DOE agreed to provide TVA 33 metric tons (MT) of HEU for production of off-specification BLEU fuel (specifications for fuel are defined by the standards of the American Society for Testing and Materials [ASTM]; off-specification features are discussed below). This BLEU fuel has been used in TVA reactors at BFN or SQN since 2005 and will be used until 2016. To date, using this BLEU fuel has provided a reliable source of lower cost fuel, and has also resulted in substantial cost-savings to both TVA and rate payers for electricity in the TVA Power Service Area. In 2005, 200 MT of additional HEU material was declared as surplus. If some of this additional HEU was acquired by TVA and used to formulate BLEU, it could (1) result in further substantial cost savings to TVA for reactor fuel; (2) reduce the environmental impacts of the nuclear fuel cycle for TVA reactors by avoiding additional mining, milling, and processing of raw materials that would otherwise occur to acquire fuel from commercial sources; and (3) assist in furthering United States policies and international agreements for the nonproliferation of weapons-usable fissile material.

TVA will decide whether to use additional BLEU fuel in TVA reactors at BFN and SQN. To use more BLEU (beyond that derived from the initial 33 MT of HEU), TVA would also undertake the following two actions:

1. Enter into an agreement(s) with the DOE to obtain an additional 28 MT of HEU for a total of 61 MT of HEU (the maximum amount available to TVA under the current HEU disposition program).

2. Implement contracts to process (i.e., handle and downblend) the HEU to BLEU and to fabricate reactor fuel assemblies (which house the fuel rods containing the enriched uranium).

TVA has prepared this environmental assessment (EA) to better inform decision-makers and the public of the potential impacts from using BLEU fuel in TVA's BFN and SQN reactors. The primary focus of this EA is to document whether there is the potential for additional or different environmental impacts to occur from the use of BLEU fuel at BFN and SQN, as compared to the scenario in which LEU is used in these reactors. The potential impacts associated with the uranium fuel cycle are also discussed. In addition, this document also identifies and clarifies the applicability of previous NEPA documents and their bounding analyses for the Proposed Action of continuing use of BLEU at BFN and SQN.

Background

After considering several alternatives in an environmental impact statement (EIS) for the disposition of surplus HEU (DOE 1996a), DOE's selected alternative (DOE 1996b) was to implement a program to make the HEU unusable for weapons and to maximize its availability for commercial use as fuel for nuclear power plants. This effort includes downblending HEU to BLEU and selling up to 85 percent of the total resulting fuel. Approximately 200 MT of HEU is to be processed in this DOE program. Under an existing interagency agreement with DOE, TVA will eventually obtain BLEU derived from as much as 33 MT of this HEU. The environmental impacts of the actions and the agency decisions associated with handling the material, processing it into BLEU fuel, as well as transporting and utilizing this initial amount of HEU were evaluated in DOE's EIS (DOE 1996a; Summary in Attachment 1 to this EA), the DOE's Record of Decision (ROD) (DOE 1996b; Attachment 2) and TVA's ROD (TVA 2001; Attachment 3) subsequently adopting the DOE EIS.

The ability to use BLEU was demonstrated at SQN by using four fuel assemblies derived from HEU; these fuel assemblies were used from spring 1999 through fall 2000. Results of the test indicated that the HEU-derived fuel performed normally; did not cause any changes in plant operational parameters, characteristics or safety; and did not generate any new or additional wastes beyond those already occurring with typical operations.

TVA has been using BLEU fuel in TVA reactors at BFN since 2005 and at SQN since 2008. To date, there have been no management, operational, safety, or environmental issues identified with the use of BLEU fuel in these reactors. One additional loading of BLEU fuel derived from the initial 33 MT of HEU obtained from DOE is planned for SQN Unit 2 in 2011. Fuel loadings from this original HEU amount are also planned for Units 1, 2 and 3 at BFN between 2012 and 2016.

In 2005, an additional 200 tons of HEU was declared surplus. The DOE and the National Nuclear Security Administration (NNSA) conducted a Supplemental Analysis (DOE 2007) for the disposition of this newly available HEU. The DOE proposed to allocate about 61 MT of this additional HEU over the next few decades for BLEU fuel production. TVA already has been allocated 33 MT of this 61 MT total, leaving a remainder of 28 MT. TVA's additional 28 MT of BLEU could be derived from the various DOE inventory sources (DOE 1996a and 2007). The DOE Supplemental Analysis evaluated the potential environmental impacts of both the current program and the proposed new initiatives to determine whether the existing EIS (DOE 1996a) should be supplemented, a new EIS should be prepared, or if no further NEPA analysis was necessary. Based upon that evaluation, DOE and NNSA concluded that (1) continued implementation of the ongoing disposition activities and the addition of the new disposition initiatives would not substantially change the environmental impacts from those described in the DOE HEU EIS (DOE 1996a),, (2) the activities did not represent substantial changes in any proposed actions or result in any new circumstances relevant to environmental concerns, and.(3) pursuant to 10 CFR 1021.314(c), no additional NEPA analyses were required.

Acquisition of LEU nuclear fuel from commercial sources and its use in TVA reactors is typically considered part of the normal operations of TVA nuclear generating plants. As such, the effects have been assessed in the supplemental EISs (SEIS) for the Nuclear Regulatory Commission (NRC) relicensing of BFN (TVA 2002) and SQN (TVA 2011b). Many of the indirect and cumulative effects were considered under discussions of fuel cycle impacts in those documents. The present TVA EA tiers from the original DOE EIS for the HEU program (DOE 1996a) that was subsequently adopted by TVA (TVA 2001) and the TVA SEIS for relicensing the three nuclear units at BFN (TVA 2002). This EA also incorporates, by reference, additional materials from the TVA adoption (TVA 2001); the supplemental analysis performed by DOE and NNSA (DOE 2007); and the NRC *Generic Environmental Statement for License Renewal of Nuclear Power Plants* (NRC 1996); and the SEIS for relicensing the two units at SQN (TVA 2011b).

The 2001 TVA ROD identified approximately 33 MT of HEU to be processed into BLEU. As the DOE program evolved, the public was kept informed through public forums and TVA Board meetings where the public also had opportunities to comment. In July 2008 and July 2009, DOE presented information at the Fuel Supply Forums of the Nuclear Energy Institute (NEI) that under the DOE program TVA could be receiving the resulting output of BLEU from a total of approximately 61 MT of HEU. Finally, DOE issued a public Expression of Interest for processing the additional 28 MT of HEU, thereby making public DOE's plans to process all of the subject 61 MT of HEU and dispose of it by ultimately irradiating it in a commercial reactor(s).

Other Environmental Reviews and Documentation

The following documents are pertinent to the current TVA EA. With the exception of DOE 1996a and 1996c, these documents are available either as attachments to this EA or on TVA's public environmental review website (http://www.tva.gov/environment/reports/index.htm). These two documents are available upon written request from the DOE.

Related DOE documents

- *Disposition of Surplus Highly Enriched Uranium - Final Environmental Impact Statement* (DOE 1996a)

- *DOE Record of Decision for Disposition of Surplus Highly Enriched Uranium* (DOE 1996b)

- *Storage and Disposition of Weapons-Usable Fissile Materials - Programmatic Environmental Impact Statement* (DOE 1996c)

- *Disposition of Surplus Highly Enriched Uranium - Supplemental Analysis* (DOE 2007)

Related TVA documents

- *Final Environmental Statement, Browns Ferry Nuclear Plant, Units 1, 2, and 3* (TVA 1972)

- *Final Environmental Statement Sequoyah Nuclear Plant Units 1 and 2* (TVA 1974)

- *Energy Vision 2020, Integrated Resource Plan/Programmatic Environmental Impact Statement* (TVA 1995)

- Record of Decision for Adoption of DOE's *Disposition of Surplus Highly Enriched Uranium - Final Environmental Impact Statement* (TVA 2001)

- *Final Supplemental Environmental Impact Statement for Browns Ferry Nuclear Plant Operating License Renewal* (TVA 2002)

- *Environmental Impact Statement for TVA's Integrated Resource Plan - TVA's Environmental and Energy Future* (TVA 2011a)

- *Supplemental Environmental Impact Statement - Sequoyah Nuclear Plant Units 1 and 2 License Renewal* (TVA 2011b)

Related NRC documents

- *Generic Environmental Statement for License Renewal of Nuclear Power Plants* (NRC 1996)

- *Generic Environmental Impact Statement for License Renewal of Nuclear Plants: Regarding Browns Ferry Nuclear Plant, Units 1, 2, and 3 - Final Report* (NUREG-1437, Supplement 21 2005)

Alternatives and Comparison

TVA considered a No Action Alternative and the proposed Action Alternative.

No Action Alternative

Under the No Action Alternative, TVA would continue its current and planned use for BLEU downblended to reactor fuel from the 33 MT of HEU obtained under the previous agreement with DOE. After this fuel was depleted, TVA would fulfill its future need for nuclear fuel from available commercial sources of nuclear fuel starting in 2016 through about 2022. During this time period, TVA could obtain enough commercial-sourced fuel to supply the refuelings at SQN and BFN. TVA currently has contracts with companies like

USEC Inc. Areva and Louisiana Energy Services (Urenco) to enrich natural uranium feedstock to the fuel production process that would be obtained from natural uranium miners (e.g., Cameco). The fabrication of LEU fuel would be carried out at the same facilities that are used to generate BLEU fuel. The complete fuel assemblies would continue to be shipped via truck from Richland, Washington, to SQN and BFN. TVA would not enter into agreements with DOE to obtain the additional 28 MT of HEU, nor implement contracts to process the HEU into BLEU for use as reactor fuel. TVA would not use BLEU fuel in its reactors at BFN or SQN beyond the current plans for use of the original 33 MT of HEU obtained from DOE.

Proposed Action Alternative

Under the Action Alternative, TVA would continue its current and planned use of BLEU downblended to reactor fuel from the 33 MT of HEU obtained under the original agreement with DOE. After the original amount of fuel was used, TVA would continue to fulfill most of its need for nuclear fuel from available commercial sources. Under the Action Alternative, TVA would also implement agreements and contracts with DOE to obtain an additional 28 MT of HEU for downblending into BLEU in order to meet TVA reactor fuel needs for BFN and SQN through 2022. The HEU would remain in the custody of the DOE until it was downblended into BLEU fuel. TVA would implement contracts to process the additional HEU into BLEU and to fabricate fuel assemblies. Similar to current arrangements for processing completed LEU fuel assemblies, these fuel assemblies containing BLEU would be shipped via truck from Richland, Washington to SQN or BFN.

Alternatives Not Considered in Detail

There are no technical limitations that prevent any TVA nuclear unit from using BLEU fuel. However, due to tritium production at TVA's Watts Bar Nuclear Plant (WBN) for the purpose of United States national defense, the use of BLEU fuel was not considered for that facility. Under current international treaties United States government policy precludes the use of BLEU fuel to support defense-related purposes. Maintaining the flexibility to utilize BLEU at SQN and/or BFN provides TVA with a cost advantage over commercial LEU fuel and gives DOE a means of disposing of surplus materials and savings on their storage or potential disposal costs. Therefore, use of the BLEU fuel would be preferred at any site that is not prevented from utilizing it due to policy restrictions. The use of BLEU fuel at only one of the facilities was, therefore, not independently evaluated.

Comparison of Alternatives

Table 1. Comparison of Alternatives

Potential For Effects	No Action	Proposed Action
Radiological Effects of Normal Operations	Annual doses to the public are well within regulatory limits. Radiological exposure to public is very minor. No observable public health impacts are expected. Doses to nonhuman biota are well below regulatory limits. No acute effects are expected through any exposure	Same as for No Action Alternative. However, contact dose for BLEU is higher than commercial fuel. The effect on inspectors is minor and would not result in changes to fuel inspection or fuel management, nor would it significantly increase the radiation risk to

Potential For Effects	No Action	Proposed Action
	pathway.	inspectors.
Transportation of Radiological Materials	Minor effects for transporting LEU fuel assemblies per bounding by Table S-4 of NRC GEIS (NRC 1996) for relicensing.	For transportation of fuel assemblies, same risks and minor impacts for BLEU as the No Action Alternative. Impacts identified in Table S-4 of NRC GEIS also bounding. One extra delivery truck every fuel reload with BLEU as compared to a reload of LEU.
Used Fuel Management	Minor impacts to public from used fuel storage (TVA 2002; TVA 2011b). Less used fuel and fewer spent fuel assemblies to manage than for BLEU. Current and anticipated capacity for used fuel storage adequate at both BFN and SQN.	Up to 10 percent more used fuel. This increased amount is readily accommodated in planned capacities for used fuel storage in terms of fuel pool capacity and dry cask needs. Use of BLEU adds an additional 1/2 dry cask per reactor every two years. Minor effects.
Nuclear Plant Safety	In the event of a design-basis accident, impacts would be minor and limited by plant design and the emergency actions of trained TVA personnel (TVA 2002; TVA 2011b). Results of severe accident analyses for SQN (TVA 2011b) or BFN (TVA 2002) indicate the risk to the maximally exposed offsite individual is small. The consequences of a severe accident would be well within current NRC safety goals. Consequences of terrorist threat bounded by severe accident analyses.	Due to no change in accident scenarios and radiological similarity of the fuels (reactor cores), same as for No Action Alternative.
Uranium Fuel Cycle (UFC)	Impacts of LEU use are identified in Tables S-3 and S-4 of NRC GEIS for relicensing of BFN (TVA 2002) and SQN (2011b). Impacts “small” or minor.	Impacts of BLEU identified in Tables S-2 and S-3 (Alternative 5) of DOE HEU SEIS. Fewer emissions overall than those identified in NRC (1996) for the typical uranium fuel cycle (UFC) producing LEU

Potential For Effects	No Action	Proposed Action
		from raw materials.
Emissions to Air and Water Resources	Nonradiological emissions from nuclear plant operations are minor. UFC emissions identified from Table S-4 (NRC 1996) are minor.	Same as No Action Alternative for nuclear plant operations. Fewer emissions overall for production of BLEU than LEU.
Solid Waste (other than used fuel)	Minor amount generated by plant operation, disposed of off-site in permitted landfills, as described in TVA (2002) and TVA (2011b). Amounts generated in UFC defined in NRC (1996, Table S-3) whose impacts are "small" or minor.	Same as No Action Alternative. Minor amount generated by plant operation. Substantially less solid waste created in converting HEU to BLEU than what is created in the typical UFC.
Potential for derivative effects to other resources (e.g., biological, floodplain, wetland, etc.).	As described in TVA (2002) and TVA (2011b). Secondary derivative effects as described by NRC (1996). Minor effects.	Same as No Action alternative. Minor effects. No additional impacts from use of BLEU fuel.

TVA = Tennessee Valley Authority
BLEU = blended low enriched uranium
LEU = low enriched uranium
NRC = Nuclear Regulatory Commission
GEIS = generic environmental impact statement
BFN = Browns Ferry Nuclear Plant
SQN = Sequoyah Nuclear Plant
UFC = uranium fuel cycle
DOE = U.S. Department of Energy

Affected Environment and Evaluation of Impacts

Site Description

The TVA BFN and SQN plants and their operations are described in the documents prepared to support TVA decisions about relicensing of BFN (TVA 2002) and SQN (TVA 2011b). The complex sequence of events and processes of acquiring and assembling the original surplus HEU materials from multiple DOE sites across the United States, processing and downblending them to BLEU, fabricating fuel assemblies, and transporting of the various materials, have previously been described in detail (DOE 1996a; DOE 1996b; DOE 1996c;TVA 2001). The 1996 DOE EIS summary describing the facilities and processes involved is included as Attachment 1 to this EA. Based upon the DOE Supplemental Analysis (DOE 2007; Attachment 4), it is anticipated that the same existing facilities and methods would be involved with processing the additional 28 MT of HEU.

Comparison of Basic Radiological Characteristics of BLEU and LEU Fuel

In determining what the differences in impacts are between fuel types, it is important to identify to what degree the fuels differ in radiological characteristics. There are various isotopes or variant forms of uranium atoms present in a nuclear reactor each with different characteristics. Like commercial LEU, BLEU fuel is composed of at least 94 percent of the isotope uranium-238, up to 5 percent of the isotope uranium-235, and less than 1 percent of other elements, which are considered impurities. The Interagency Agreement (IA) between TVA and DOE specifies the allowable concentration of elements in the remaining 1 percent of the BLEU fuel provided to TVA. These specifications are the same for the BLEU fuel derived from the original 33 MT or the additional 28 MT of HEU.

When compared to normal fuel, the increased concentration of uranium-234 and uranium 236 present in the remaining 1 percent causes the fuel to be considered "off-specification." All other pertinent elements for BLEU are within normal fuel specifications for reactors. Some minor variations in metals and chlorine characteristics of the fuel are also allowable but typically controlled for in the manufacturing process. The IA specifications ensure that the BLEU material TVA receives will not differ in substantive ways from commercial LEU fuel.

The radiological consequences of using the off-specification BLEU are minimal. In a commercial nuclear power reactor, atoms undergo fission, or the split of atoms, which releases energy, thereby providing the heat for power production. In a reactor, the fission of uranium-235 and plutonium isotopes provides that heat. Essentially, no fission occurs in the uanium-234 and uranium-236. The same number of uranium and plutonium atoms combined must fission to produce the required heat and power, whether uranium 234/236 is present or not.

Fission products (see the severe accident section for definition) result from the splitting of the atoms. These fission products are important because many are also radioactive and can potentially affect both the normal operations of nuclear reactors and the estimated impacts of nuclear accident scenarios. Because of the radiological characteristics of the isotopes of the fuels discussed above, the difference in the resulting fission products, whether using BLEU or LEU fuel, is negligible. Since the resulting mix of isotopes in a commercial reactor core is essentially the same, whether using LEU or BLEU, normal operations and accident condition scenarios are almost identical. The consequences are examined further below.

Potential Impacts Evaluated

The potential for impacts, as described above, as well as the differences in such impacts between LEU and BLEU use in TVA reactors, are primarily dependent upon whether there are any significant differences in radiological releases between the two types of fuel. The potential for differentiating impacts between the use of LEU and BLEU was further evaluated, using internal TVA staff project scoping, the nature of the actions considered, and the above discussion of the similarity of BLEU and commercially available LEU. The potential for creating differing impacts between the two fuel types were considered for the following media areas: radiological effects of normal operations, transportation of radiological materials, used fuel management, nuclear plant safety, uranium fuel cycle, emissions to air and water resources, solid waste (other than used fuel), and the potential for indirect effects to other environmental resources (e.g., wildlife, endangered species, cultural resources, floodplains, wetlands, environmental justice).

Radiological Effects of Normal Operations

The radiological effects of normal operations for the current operations of BFN and SQN (using LEU and/or partial loadings of BLEU as fuel) were described in the respective relicensing SEISs for those facilities (TVA 2002; TVA 2011b). The SEISs describe background doses of radiation, exposure pathways (gaseous and liquid), expected doses to the public or biota, and total cumulative doses from all sources. Annual doses to the public are well within regulatory limits. According to the SEIS assessments, no observable public health impacts are expected from normal operations of either facility. Doses to nonhuman biota are well below regulatory limits and no acute effects are expected through any media or exposure pathway. As described in the comparison above, BLEU radiological characteristics are so similar to those of LEU fuel that no differences in effects between the No Action Alternative and the Proposed Action Alternative are expected to be discernable. However, the contact dose for TVA fuel inspectors is slightly higher for BLEU (approximately 5 to 10 mrem/hr) than regular LEU fuel (approximately 3 mrem/hr). Since radiation levels fall off in distance with the inverse square law, this increased contact dose is a consideration only for direct contact of the fuel assemblies which is minimal. This difference is insignificant, does not significantly increase the dose received by inspectors that follow standard protection techniques of minimizing exposure time, maximizing distance from the source and shielding as appropriate. This difference would not result in changes to either fuel inspection or management.

Transportation of Radiological Materials

The transportation of radiological materials is required to operate any nuclear power facility. The transportation of radiological materials (HEU) in various compounds and forms from the various DOE facilities throughout the United States has been evaluated (DOE 1996a; DOE 1996b; DOE 1996c; TVA 2001). The EIS (DOE 1996a) preferred alternative considered downblending, shipping intermediate materials, and shipping finished fuel assemblies for 85 percent of 200 MT HEU (nominally 170 MT). TVA would receive the BLEU from the processing of 61 MT of 200 MT HEU analyzed in the EIS; this is significantly less than the total amount bounded by the transportation analyses of the preferred alternative in the DOE EIS (DOE 1996a).

The final step of fuel assembly fabrication would occur for either LEU (No Action Alternative) or BLEU (Action Alternative) in Richland, Washington; the materials would then be transported to either BFN or SQN. In accordance with DOT and NRC regulations, new unirradiated fuel assemblies, whether LEU or BLEU, would be shipped by truck to the BFN or SQN site. These would include regulations applicable to the shipping containers NRC/DOT-approved for use with nuclear fuel at the time of shipment. Experience at BFN has demonstrated that the number of fresh fuel assemblies per reload of BLEU has to be increased by about 10 percent in order to accommodate neutron absorption by the presence of the uranium-236 isotope. This situation creates the need for one extra delivery truck for every full fuel reload with BLEU (Action Alternative) as compared to a reload of LEU (No Action Alternative).

Because LEU and BLEU are so radiologically similar, the risks of transporting these fuels under the No Action alternative and the Proposed Action Alternative, respectively is bounded by the limits of Table S-4 (10 CFR 51.52, Attachment 5) of the NRC's *Generic Environmental Statement for License Renewal of Nuclear Power Plants Final Report* (NRC 1996). This table includes the NRC evaluation of the environmental effects of transporting radioactive fuel and waste to and from light water reactors (LWRs). The table addresses two categories of environmental considerations (1) normal conditions of transport, and (2) accidents in transport ([10 CFR Part 51] Subparagraphs 10). The regulations at 10 CFR 51.52(a) (1) through (5) delineate specific conditions the reactor licensee must meet in order to use Table S-4 as part of its environmental impact evaluation. The conditions in paragraph (a) of 10 CFR 51.52 establishes that the applicability of Table S-4 to unirradiated fuel related to reactor core thermal power; fuel form, enrichment, and encapsulation; and the mode of transport for unirradiated fuel.

The impacts of transporting unirradiated fuel have been determined by NRC to be minor (NRC 1996). TVA previously determined the applicability of the conditions of Table S-4 in the relicensing process for the environmental reviews for BFN (TVA 2002) and SQN (TVA 2011b). TVA staff members have also examined the values and conditions of the table and have determined that they apply to and bound the transportation effects resulting from use of BLEU (Action Alternative) as well as LEU (No Action Alternative) for either BFN or SQN. That information (Attachment 5) is herein incorporated by reference. The distance between the SQN and BFN is about 150 highway miles and is insignificant in terms of the distances fuel assemblies would need to be shipped to supply either power plant, due to their proximity to major highways.

Used Fuel Management

Used fuel management (also referred to as “spent fuel management”) at the two TVA nuclear facilities are described for BFN (TVA 1972; TVA 2002) and for SQN (TVA 1974; TVA 2011b). Additional used fuel during the current licensing or relicensing period for both facilities would either be stored in the used fuel pools or dry cask storage systems approved by NRC in accordance with 10 CFR Part 72. The used fuel would then be transferred to the DOE in accordance with the Nuclear Waste Policy Act of 1982 and its subsequent amendments. At each nuclear plant site TVA manages used fuel similarly, whether the fuel is BLEU or LEU.

As compared to the use of LEU (No Action Alternative), the use of BLEU (Action Alternative) would result in a minor increase in the amount of used fuel to be managed. Uranium-236 is an “impurity” in BLEU fuel that absorbs neutrons. Neutron absorption reduces the amount of heat generated. To obtain the appropriate amount of heat from the reactors, this characteristic must be compensated for by either increasing the enrichment of the fuel or by increasing the number of new fuel assemblies in a fuel reload by as much as 10 percent. Increasing the enrichment does not affect operations or the results of accident analyses, because the resulting fuel reactivity is maintained equivalent to commercial grade uranium (i.e., the neutron absorption from the uranium-236 is offset by the additional uranium-235). Likewise, increasing the number of fresh fuel assemblies per fuel reload has no effect on operations or results of accident analyses, but could increase the used fuel storage requirements by up to 10 percent. During the period of BLEU use, as compared to the use of LEU, about one-half additional dry storage cask would be needed about every two years per reactor. This amount of increase in spent fuel storage is within the normal cycle-to-cycle variability associated with energy production and refueling outages at TVA reactors. This amount is readily accommodated within current and/or planned used fuel storage capacity (fuel pool capacity and transition ultimately to dry cask storage) and management capability at the BFN and SQN sites and does not present a significant increase in risk to the public.

Nuclear Plant Safety

Nuclear plant safety is primarily concerned with postulated accidents (both design-basis and severe) involving radioactive materials, including protection against intentional destructive acts (IDAs). The term “accident” refers to any unintentional event (i.e., outside of the normal or expected plant operation envelope) that results in the actual or potential release of radioactive material into the environment.

Design Basis Accidents - At the most general level, the analyses supporting the evaluations and the consequences of postulated design-basis accidents (DBAs) involve:

- The selection of appropriate DBAs that are representative of the particular reactor design (i.e., which potential accidents involving radiological materials are most likely for that particular design and configuration of nuclear plant).
- The development of assumptions and probabilities related to accident scenarios and dispersion.
- The calculation of site-specific radiological doses received by onsite workers and the public from release of fission products.

The DBAs cover a spectrum of events, including those with a greater probability of occurrence and those that are less probable but would have greater consequences. TVA performed the appropriate analyses as described in the TVA EISs for relicensing of BFN (TVA 2002) and SQN (TVA 2011b).

The use of either LEU or BLEU as fuel has no effect on the selection of design basis accidents (they are based upon plant design), nor does it affect accident scenarios or calculations since, as discussed above, the isotopes involved for a LEU or BLEU reactor core are essentially the same. Therefore, the analyses of the two above referenced EISs adequately characterize and continue to bound the potential impacts of implementing either the No Action Alternative or the proposed Action Alternative for BFN or SQN.

Severe Accidents - Severe accidents are defined as accidents with substantial damage to the reactor core and degradation of the containment systems. Because the probability of a severe accident is so low, the NRC considers them too unlikely to warrant normal design controls to prevent or mitigate the consequences. Severe accident analyses consider both the risk of a severe accident and the offsite consequences.

Among the numerous factors considered in severe accident analyses (see TVA 2011b, Section 3.19.2.1), the only one that could even possibly be affected differently by the use of LEU or BLEU is the plant-specific release of fission products and actinides (defined below). When uranium or plutonium atoms split (fission), they release a relatively large amount of energy which is then converted into heat; this heat is used to generate electricity. The smaller atoms left behind after fission are referred to as fission products. In addition, some of the uranium and plutonium atoms in nuclear fuel assemblies absorb neutrons without fissioning, becoming even heavier atoms called actinides. Both fission products and actinides are radioactive, which pose a health hazard if they are released into the environment. Using BLEU fuel does not alter the mix (i.e., source term) of radionuclides in the core and or those available for release following a severe accident. The different source term between BLEU fuel (Action Alternative) and LEU fuel (No Action Alternative) leads to no difference in calculated consequences following a postulated severe accident. Therefore, there are no differences between the No Action Alternative and the proposed Action Alternative in regard to severe accident impacts. The severe accident considerations in TVA (2002) for BFN and TVA (2011b) for SQN adequately characterize and remain bounding for use of both BLEU and LEU.

Intentional Destructive Acts - Some nongovernmental entities and members of the public have expressed concern about the risks posed by nuclear generating facilities in light of the threat of terrorism. TVA believes that the possibility of a terrorist attack affecting operation of one or more units at SQN or BFN is very remote, and postulating potential health and environmental impacts from a terrorist attack involves substantial speculation. TVA has detailed, sophisticated security measures in place to prevent physical intrusion into all of its nuclear plant sites by hostile forces seeking to gain access to plant nuclear reactors or other sensitive facilities and materials. TVA security personnel maintain current training to react to and repel hostile forces threatening TVA nuclear facilities. TVA's security measures and personnel are inspected and tested by the NRC. It is highly unlikely that a hostile force could successfully overcome these security measures and gain entry into sensitive facilities; it is even less likely that they could do this quickly enough to prevent operators from putting plant reactors into safe shutdown mode. However, the security threat that is more frequently identified by members of the public or in the media are not hostile forces invading nuclear plant sites but attacks using hijacked jet airliners, the method used on September 11, 2001 against the World Trade Center and the Pentagon.

The likelihood of this occurring is equally remote in light of today's heightened security awareness at airports, but this threat has been carefully studied. The NEI commissioned the Electric Power Research Institute (EPRI) to conduct an impact analysis of a large jet airline being purposefully crashed into sensitive nuclear facilities or containers including nuclear reactor containment buildings, used fuel storage pools, used fuel dry storage facilities, and transportation containers. Using conservative analyses, EPRI concluded that there would be no release of radionuclides from any of these facilities or containers because they are designed to withstand potentially destructive events. Nuclear reactor containment buildings, for example, have thick concrete walls with heavy reinforcing steel and are designed to withstand credible earthquakes, overpressures (a transient air pressure, such as the shock wave from an explosion that is greater than the surrounding atmospheric pressure) and hurricane force winds. The EPRI analysis used computer models in which a Boeing 767-400 was crashed into containment structures that were representative of all U.S. nuclear power containment types. The containment structures suffered some crushing and chipping at the maximum impact point, but were not breached. The results of this analysis are summarized in an NEI paper titled "Aircraft Crash Impact Analyses Demonstrate Nuclear Power Plant's Structural Strength" (NEI 2002). The EPRI analysis is fully consistent with research conducted by NRC. When the NRC considered such threats, Commissioner McGaffigan observed:

> Today the NRC has in place measures to prevent public health and safety impacts of a terrorist attack using aircraft that go beyond any other area of our critical infrastructure. In addition to all the measures the Department of Homeland Security and other agencies have put in place to make such attacks extremely improbable (air marshals, hardened cockpit doors, passenger searches, etc.), NRC has entered into a Memorandum of Understanding with NORAD/NORTHCOM to provide realtime information to potentially impacted sites by any aircraft diversion.
>
> As NRC has said repeatedly, our research showed that in most (the vast majority of) cases an aircraft attack would not result in anything more than a very expensive industrial accident in which no radiation release would occur. In those few cases where a radiation release might occur, there would be no challenge to the emergency planning basis currently in effect to deal with all beyond-design-basis events, whether generated by mother nature, or equipment failure, or terrorists (NRC 2007).

Notwithstanding the very remote risk of a terrorist attack affecting operations, TVA increased the level of security readiness, improved physical security measures, and increased its security arrangements with local and federal law enforcement agencies at all of its nuclear generating facilities after the events of September 11, 2001. These additional security measures were taken in response to advisories issued by NRC. TVA continues to enhance security at its plants in response to NRC regulations and guidance. The security measures TVA has taken at its sites are complemented by the measures taken throughout the United States in order to improve security and to reduce the risk of successful terrorist attacks. This includes measures designed to respond to, and reduce, the threats posed by hijacking large jet airliners. In the very remote likelihood that a terrorist attack would successfully breach the physical and other safeguards at BFN or SQN resulting in the release of radionuclides, the consequences of such a release are reasonably captured by the consideration of the impacts of severe accidents discussed above in this section. For that analysis the effects of the No Action Alternative or proposed Action Alternative are the same. Therefore, there would be no additional concerns regarding radiological releases created by partial use of BLEU fuel at either TVA facility.

The Uranium Fuel Cycle

As described above, due to the high similarity of fission products, the differences in either type or degree of direct effects potentially occurring from use of either LEU or BLEU in TVA reactors are minor or nonexistent. However, the potential uranium fuel cycle (UFC) effects of LEU (No Action) and BLEU (Proposed Action) would be different.

The effects from the UFC for the use of typical LEU under the No Action Alternative are described in the Generic Environmental Statement (GEIS) for License Renewal of Nuclear Power Plants (NRC 1996) and the TVA SEIS for SQN Plant Units 1 and 2 license renewal (TVA 2011b). The information from sections 6.2 and 6.3 of the NRC GEIS, including the material from Tables S-3 (Uranium Fuel Cycle Environmental Data) and S-4 Environmental Impacts of Transportation of Fuel and Waste To and From One Light-water-cooled Nuclear Power Reactor) are herein incorporated by reference.

The two referenced tables are presented as Attachment 5 to this EA. Conclusions drawn from this material for BFN (TVA 2002) and SQN (2011b) are that environmental effects are minor ("small" in NRC 1996) for radiological releases, nonradiological releases to air and water, water use, solid waste, effects of normal operations; radiological effects of transportation of such materials; used fuel management; severe accidents, UFC; and the potential for derivative or indirect effects to other resources (e.g., biological, floodplain, wetlands). As normalized for a 1000 MW(e) reactor, the physical and operating features of BFN and SQN (TVA 2002; TVA 2011b) indicate that the type and degree of impacts of burning LEU fuel at the two TVA facilities are adequately characterized and bounded by the information presented in Table S-3 (NRC 1996a) of Attachment 5 to this EA.

In contrast, for use of BLEU as reactor fuel under the proposed Action Alternative, only a minor portion of the above referenced UFC impacts for production of commercial LEU would occur. The majority of impacts have already occurred in the process of extracting and processing the uranium and other materials for weapons-use (e.g., mining and milling ore, chemical conversions needed for processing and uranium enrichment of the isotope U-235). The subset of equivalent impacts that would occur for use of either LEU or BLEU, are those associated with the final step production of fuel assemblies and their transport to TVA from the Richland, Washington site. These final steps are only a minor contributor to the total impacts accruing from the UFC.

There are, however, emissions and impacts that occur during the handling and downblending of HEU to BLEU. These emissions partially offset the environmental advantages of using BLEU produced from weapons-usable material. In the process of making BLEU fuel, there are environmental effects associated with processing of the 61 MT (the original 33 MT plus an additional 28 MT) of existing HEU, blending it down to BLEU fuel, and transporting it. With the exception of its use in the reactors these potential environmental effects were described and readily bounded by analyses in DOE's EIS (DOE 1996a). Impacts from its use in TVA reactors are discussed above and in TVA's ROD (TVA 2001). The analyses in DOE (1996a) were for as much as 200 MT of HEU, of which for the selected alternative, about 85 percent (a nominal 170 MT) would be downblended to BLEU and made available for use as fuel in commercial reactors. The types of emissions, releases, and effects on environmental resources for DOE's (and TVA's) preferred alternative of Maximum Commercial Use of HEU are, therefore, characterized and bounded by the information presented in 1996 DOE EIS (Attachment 1).

There are very basic differences in the processes of producing BLEU or LEU that do not lend themselves to comparison. However, in terms of the overall UFC, implementing the proposed Action Alternative (including the production and use of BLEU) would result in lower emissions to air and water; only a fraction of the potential for land disturbance; less generation of radiological or nonradiological solid wastes; less water use; and fewer impacts from transportation of materials, as compared to the No Action Alternative. However, BLEU is a constituent of only a portion of the fuel assemblies being used during any particular fuel loading cycle at a TVA nuclear plant. Therefore, the environmental benefits of the proposed Action Alternative over the No Action Alternative are less than if full loads of BLEU were utilized (i.e., not enough BLEU is available at any one time to fully load with BLEU).

With regard to the use of additional BLEU under the Action Alternative, the detailed DOE/NNSA Supplemental Analysis (DOE 2007) concluded that the continued implementation of the ongoing disposition activities and the addition of new disposition initiatives for HEU would not substantively change the environmental impacts from those described in the original HEU EIS (DOE 1996a). The analyses concluded that the activities did not represent substantial changes in any proposed actions or result in any new circumstances relevant to environmental concerns. Proposed downblending processes and rates would remain within the parameters evaluated in the HEU EIS, and therefore, similar annual nonradiological emissions, waste generation and transportation activities associated with ongoing surplus HEU disposition activities would be expected for disposition of the additional HEU supporting TVA's Action Alternative.

Projected radiological risks from normal operations at the DOE facilities to both workers and the public would increase from those presented in DOE's 1996 HEU EIS as a result of incorporating higher average uranium-235 enrichment of the new HEU proposed for downblending, updated population statistics and larger dose to latent cancer fatality (LCF) risk factors now utilized. However, operation of the surplus HEU disposition facilities continues to pose no more than a small risk to human health, and no new or different bounding accident scenarios were identified. Transportation activities supporting the new initiatives would add small, negligible additional impacts. DOE concluded that, although the additional proposed downblending would increase total impacts by approximately 10 percent, the additional impacts would be distributed over an expanded timeframe and continue to be well within applicable DOE limits and each site's capacity to manage. TVA staff have independently examined the DOE information in the supplemental analysis and concluded that the analyses reasonably and adequately bound the potential for environmental effects associated with TVA's actions.

Air and Water Resources and Solid Waste

Because there are no pertinent distinguishing characteristics between BLEU and LEU fuel, during normal operations of either BFN or SQN, the nonradiological releases to air and water are expected to be the same under either the No Action Alternative or Proposed Action Alternative. As discussed for BFN (TVA 2002) and for SQN (TVA 2011b), nonradiological emissions and impacts to the air as well as to surface and groundwater would be minor. As compared to one another, implementation of either the No Action Alternative or the Proposed Action Alternative would not generate greater amounts of nonradiological solid waste. Manufacturing of the BLEU fuel assemblies and fuel pellets for BFN and SQN is also the same, so no additional environmental impact to air or water resources from using either BFN or SQN for irradiating BLEU fuel are expected.

However, TVA's 2001 ROD notes regarding the UFC that "TVA's actions would also avoid the environmental impacts associated with producing an equivalent amount of LEU from 14 million pounds of natural uranium (as U3O8) that in turn would require mining of 140,000 tons of ore." The resulting impacts normalized to a 1000 MWe reactor are as described in Attachment 5, Table S-4. If 61 MT of HEU is processed instead of 33 MT of HEU, total emissions would increase, however as compared to commercial production of LEU, a proportional increase in avoided environmental impact from emissions to air and water and generation of solid waste would also be anticipated. Use of 61 MT of HEU would avoid the emissions and environmental impacts to air and water resources associated with producing an equivalent amount of LEU from 26 million pounds of natural uranium (as triuranium octoxide [U3O8]) that in turn would require mining of 259,000 tons of ore. So, the processing of additional HEU to LEU is expected to result in the avoidance of certain environmental impacts and would easily offset any potential increase in other emissions or impacts (identified in Attachment 1, Table S-2, Alternative 5 and Table S-3) associated with the downblending of HEU to BLEU.

Other Derivative Effects (e.g., biological, endangered species, cultural resources, floodplains, wetlands, or environmental justice)

Because there are no physical construction activities, management, or process changes associated with use of either fuel in the TVA reactors, the potential for derivative impacts related to the use of LEU (No Action Alternative) or BLEU (Action Alternative) is related to whether there are differences in emissions (radiological or nonradiological) from BFN or SQN and to those effects identified for the UFC.

Beyond those features and processes identified and analyzed in the relicensing SEISs for BFN (TVA 2002) and SQN (TVA 2011b), there would be no new activities and no significantly different emissions (radiological or nonradiological) associated with either alternative, of the present EA, with the potential to directly affect any natural resources or media (e.g., air, water, solid waste, or land). As such, the analyses included in those documents continue to be bounding for use of either BLEU or LEU. For the pertinent licensing periods these impacts to the other resource areas are identified for BFN (TVA 2002) and for SQN (TVA 2011b) as minor.

The only areas in which differing indirect impacts between the use of LEU or BLEU could occur are those discussed above with regard to the UFC. Those derivative effects are also identified in Table S-4 (Attachment 5) incorporated by reference from the NRC's GEIS for relicensing of nuclear power plants (NRC 1996), and discussed in greater detail in TVA 2011b. With regard to endangered species, cultural resources, floodplains, wetlands, or environmental justice, there are no characteristic differences between using BLEU or LEU in TVA reactors that would otherwise create new issues or additional impacts relevant to environmental concerns.

Cumulative Impacts

Use of weapons-derived BLEU fuel at the two TVA facilities would reduce the need for additional mining, milling, and processing of uranium; this would reduce the international UFC impacts of processing more raw uranium materials. TVA's proposed Action Alternative would also provide a minor extension in the world's nuclear fuel supply. Energy required to support the production of BLEU (Action Alternative) would be only a fraction of that required to support the mining, milling and production of LEU from raw materials. However, the use of BLEU at BFN and SQN would also slightly increase the amount of used fuel to be managed onsite and eventually at the site or repository selected by the United States government for such materials. In accordance with recommendations of the U.S. National Academy of Sciences, the policy of the United States government to make weapons-grade fissile materials at least as proliferation-resistant (i.e., not contributing to the possibility of using nuclear weapons) as used fuel from commercial reactors. As such, used fuel produced by use of either the LEU or BLEU in TVA reactors would not contribute to any greater threat of international proliferation.

Mitigation Measures

The avoidance and minimization measures identified in the TVA ROD (TVA 2001) for the original 33 MT of HEU would also apply for the continued use of BLEU in reactors at BFN and SQN and the acquisition, processing, and use of the additional 28 MT of HEU. With adherence to these measures, implementing the continued use of BLEU in TVA nuclear reactors at BFN and SQN and the acquisition of additional HEU would result in only minor impacts on the human environment during normal operations. Consistent with the earlier TVA ROD (TVA 2001) DOE, TVA and its contractors would take all reasonable steps to avoid or minimize harm, including the following:

- TVA would use current safety and health programs and practices to reduce impacts by maintaining worker radiation exposure as low as reasonably achievable.

- TVA, and its contractors would meet appropriate waste minimization and pollution prevention objectives consistent with the Pollution and Prevention Act of 1990 As discussed in the HEU EIS (DOE 1996a), segregation of activities that generate radioactive and hazardous wastes would be employed, where possible, to avoid the generation of mixed wastes. Treatment to separate radioactive and nonradioactive components would be employed to reduce the volume of mixed wastes. Where possible, nonhazardous materials would be substituted for those that contribute to the generation of hazardous or mixed waste. Waste streams would be treated to facilitate disposal as nonhazardous wastes, where possible. In addition to following such practices in its own federal facilities, TVA and DOE would seek to include comparable requirements in contracts with the involved commercial facilities.

Preferred Alternative

TVA's preferred alternative is the Proposed Action Alternative, *i.e.*, to continue the current use of LEU and partial loadings of BLEU at BFN and SQN reactors that is derived from the original 33 MT of HEU obtained from DOE. TVA would also obtain an additional 28 MT of HEU from the DOE to downblend into BLEU, and would use this additional BLEU for partial fuel loads in TVA's BFN and SQN nuclear reactors for the period of about 2016 to 2022.

TVA Preparers

Bruce Yeager, NEPA Program Manager	NEPA Project Management
Predrag Mastilovic, Manager Nuclear Fuel Supply	Nuclear Fuel
Chris Carey, Manager Nuclear Safety Analysis	Nuclear Safety

Agencies and Others Consulted

Prior to the TVA's adoption of the DOE EIS in 2001 and its subsequent issuance of the ROD for obtaining the original 33 MT tons of HEU, TVA recirculated the original DOE EIS to the public and agencies in the states of Tennessee, South Carolina, and Washington for comment. Four agencies, two organizations, and three individuals commented on TVA's adoption of the DOE document. The comments were summarized and addressed in the TVA ROD (TVA 2001).

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Attachment 1

DOE Summary - Disposition of Surplus Highly Enriched Uranium - Final Environmental Impact Statement

Attachment 2

DOE Record of Decision for Disposition of Surplus Highly Enriched Uranium

Attachment 3

TVA Record of Decision for Adoption of DOE's Disposition of Surplus Highly Enriched Uranium - Final Environmental Impact Statement

Attachment 4

DOE Supplemental Analysis for Disposition of Surplus Highly Enriched Uranium

Attachment 5

Table S-3 (Uranium Fuel Cycle Environmental Data) and Table S-4 (Environmental impacts of transportation of fuel and waste to and from one light-water-cooled nuclear power reactor, normal conditions of transport) from the NRC's Generic EIS for License Renewal of Nuclear Power Plants.

DOE/EIS-0240-S

Office of
Fissile Materials Disposition

United States Department of Energy

Disposition of Surplus Highly Enriched Uranium Final Environmental Impact Statement

Summary

June 1996

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Department of Energy

Washington, DC 20585

June 1996

Dear Interested Party:

This Summary of the *Disposition of Surplus Highly Enriched Uranium Final Environmental Impact Statement* is enclosed for your information. The entire document is available upon request and may be obtained by calling (202) 586-4513. This document has been prepared in accordance with the National Environmental Policy Act, and reflects comments received on an earlier draft released in October 1995 for review by the public. The document presents the analyses of the environmental impacts of alternatives for the disposition of weapons-usable highly enriched uranium (HEU) that has been declared surplus to national defense needs.

The Department proposes to eliminate the proliferation threat of surplus HEU by blending it down to low enriched uranium (LEU), which is not weapons-usable. The EIS assesses the disposition of a nominal 200 metric tons of surplus HEU. The Preferred Alternative is, where practical, to blend the material for sale as LEU and use over time, in commercial nuclear reactor fuel to recover its economic value. Material that cannot be economically recovered would be blended to LEU for disposal as low-level radioactive waste.

In addition to the "No Action" Alternative, the HEU EIS analyzes four alternatives that represent different proportions of the resulting LEU being used in commercial reactor fuel or disposed of as waste. It analyzes the blending of HEU using three different processes at four potential sites. The transportation of materials is also analyzed.

A public comment period for the HEU Draft EIS was held from October 27, 1995 to January 12, 1996. Comments were received by letter, fax, electronic mail, and telephone recording. In addition, public workshops on the EIS were held in Knoxville, Tennessee and Augusta, Georgia in November, 1995. All comments were considered by the Department in preparing the Final EIS and are presented along with responses in Volume II of the document. A Record of Decision on surplus HEU disposition will be issued no sooner than 30 days following publication of the Notice of Availability of the HEU Final EIS in the Federal Register.

The Department appreciates the participation of outside organizations and the general public in the review of this document.

Sincerely,

J. David Nulton

J. David Nulton, Director
Office of NEPA Compliance and Outreach
Office of Fissile Materials Disposition

COVER SHEET

Lead Federal Agency: U.S. Department of Energy (DOE)
Cooperating Federal Agency: U.S. Environmental Protection Agency

TITLE:

Disposition of Surplus Highly Enriched Uranium Final Environmental Impact Statement
(DOE/EIS-0240)

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ABSTRACT:

This document assesses the environmental impacts that may result from alternatives for the disposition of U.S.-origin weapons-usable highly enriched uranium (HEU) that has been or may be declared surplus to national defense or defense-related program needs. In addition to the No Action Alternative, it assesses four alternatives that would eliminate the weapons-usability of HEU by blending it with depleted uranium, natural uranium, or low-enriched uranium (LEU) to create LEU, either as commercial reactor fuel feedstock or as low-level radioactive waste. The potential blending sites are DOE's Y–12 Plant at the Oak Ridge Reservation in Oak Ridge, Tennessee; DOE's Savannah River Site in Aiken, South Carolina; the Babcock & Wilcox Naval Nuclear Fuel Division Facility in Lynchburg, Virginia; and the Nuclear Fuel Services Fuel Fabrication Plant in Erwin, Tennessee. Evaluations of impacts at the potential blending sites on site infrastructure, water resources, air quality and noise, socioeconomic resources, waste management, public and occupational health, and environmental justice are included in the assessment. The intersite transportation of nuclear and hazardous materials is also assessed. The Preferred Alternative is blending down as much of the surplus HEU to LEU as possible while gradually selling the commercially usable LEU for use as reactor fuel. DOE plans to continue this over an approximate 15- to 20-year period, with continued storage of the HEU until blend down is completed.

PUBLIC INVOLVEMENT:

The Department of Energy issued a HEU Draft EIS on October 27, 1996, and held a formal public comment period on the HEU Draft EIS through January 12, 1996. In preparing the HEU Final EIS, DOE considered comments received via mail, fax, electronic bulletin board (Internet), and transcribed from messages recorded by telephone. In addition, comments and concerns were recorded by notetakers during interactive public hearings held in Knoxville, Tennessee, on November 14, 1995, and Augusta, Georgia, on November 16, 1995. These comments were also considered during preparation of the HEU Final EIS. Comments received and DOE's responses to those comments are found in Volume II of the EIS.

DOE/EIS-0240-S

Disposition of Surplus Highly Enriched Uranium Final Environmental Impact Statement

Summary

United States Department of Energy
Office of Fissile Materials Disposition

June 1996

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LIST OF ACRONYMS AND ABBREVIATIONS

ASTM	American Society for Testing and Materials
B&W	Babcock & Wilcox
BTU	British thermal unit
CEQ	Council on Environmental Quality
CO	carbon monoxide
DOE	Department of Energy
DOT	Department of Transportation
DU	depleted uranium
EA	environmental assessment
EIS	environmental impact statement
ERDA	Energy Research and Development Administration
ha	hectare
HEU	highly enriched uranium
HEU EIS	*Disposition of Surplus Highly Enriched Uranium Final Environmental Impact Statement*
HF	hydrogen fluoride
HLW	high-level waste
IAEA	International Atomic Energy Agency
kg	kilogram
km	kilometer
l	liter
lb	pound
LEU	low-enriched uranium
LLW	low-level waste
m^3	cubic meter
mi	mile
mrem	millirem (one thousandth of a rem)
MWe	megawatt electric
MWh	megawatt hour

NEPA	*National Environmental Policy Act* of 1969
NFS	Nuclear Fuel Services
NO_2	nitrogen oxide
NRC	Nuclear Regulatory Commission
NTS	Nevada Test Site
NU	natural uranium
ORR	Oak Ridge Reservation
Pb	lead
PEIS	programmatic environmental impact statement
PM_{10}	particulate matter (less than 10 microns)
Pu	plutonium
rem	roentgen equivalent man
ROD	Record of Decision
ROI	region of influence
SO_2	sulfur dioxide
SRS	Savannah River Site
t	metric ton
TSP	total suspended particulates
U	uranium
U-234	uranium-234
U-235	uranium-235
U-236	uranium-236
U-238	uranium-238
UF_6	uranium hexafluoride
UNH	uranyl nitrate hexahydrate
USEC	United States Enrichment Corporation
Y–12 EA	*Environmental Assessment for the Proposed Interim Storage of Enriched Uranium Above the Maximum Historical Storage Level at the Y–12 Plant, Oak Ridge, Tennessee*

METRIC CONVERSION CHART

To Convert Into Metric			To Convert Out of Metric		
If You Know	**Multiply By**	**To Get**	**If You Know**	**Multiply By**	**To Get**
Length					
inches	2.54	centimeters	centimeters	0.3937	inches
feet	30.48	centimeters	centimeters	0.0328	feet
feet	0.3048	meters	meters	3.281	feet
yards	0.9144	meters	meters	1.0936	yards
miles	1.60934	kilometers	kilometers	0.6214	miles
Area					
sq. inches	6.4516	sq. centimeters	sq. centimeters	0.155	sq. inches
sq. feet	0.092903	sq. meters	sq. meters	10.7639	sq. feet
sq. yards	0.8361	sq. meters	sq. meters	1.196	sq. yards
acres	0.40469	hectares	hectares	2.471	acres
sq. miles	2.58999	sq. kilometers	sq. kilometers	0.3861	sq. miles
Volume					
fluid ounces	29.574	milliliters	milliliters	0.0338	fluid ounces
gallons	3.7854	liters	liters	0.26417	gallons
cubic feet	0.028317	cubic meters	cubic meters	35.315	cubic feet
cubic yards	0.76455	cubic meters	cubic meters	1.308	cubic yards
Weight					
ounces	28.3495	grams	grams	0.03527	ounces
pounds	0.45360	kilograms	kilograms	2.2046	pounds
short tons	0.90718	metric tons	metric tons	1.1023	short tons
Force					
dynes	.00001	newtons	newtons	100,000	dynes
Temperature					
Fahrenheit	Subtract 32 then multiply by 5/9ths	Celsius	Celsius	Multiply by 9/5ths, then add 32	Fahrenheit

The numbers (estimated by models or calculated, not those obtained from references) in this document have been rounded using engineering judgment to facilitate reading and understanding of the document. Because numbers have been rounded, converting these numbers from metric to English using the conversion table above will give answers not consistent within the text.

METRIC PREFIXES

Prefix	Symbol	Multiplication Factor
exa-	E	1 000 000 000 000 000 000 = 10^{18}
peta-	P	1 000 000 000 000 000 = 10^{15}
tera-	T	1 000 000 000 000 = 10^{12}
giga-	G	1 000 000 000 = 10^{9}
mega-	M	1 000 000 = 10^{6}
kilo-	k	1 000 = 10^{3}
hecto-	h	100 = 10^{2}
deka-	da	10 = 10^{1}
deci-	d	0.1 = 10^{-1}
centi-	c	0.01 = 10^{-2}
milli-	m	0.001 = 10^{-3}
micro-	μ	0.000 001 = 10^{-6}
nano-	n	0.000 000 001 = 10^{-9}
pico-	p	0.000 000 000 001 = 10^{-12}
femto-	f	0.000 000 000 000 001 = 10^{-15}
atto-	a	0.000 000 000 000 000 001 = 10^{-18}

Summary

Introduction

The Department of Energy (DOE) is the Federal agency responsible for the management, storage, and disposition of weapons-usable fissile materials from United States nuclear weapons production and dismantlement activities. Highly enriched uranium (HEU) is a weapons-usable fissile material; in certain forms and concentrations, it can be used to make nuclear weapons.[1] In accordance with the *National Environmental Policy Act* of 1969 (NEPA), the Council on Environmental Quality (CEQ) regulations (40 CFR Parts 1500-1508), and DOE's NEPA Implementation Procedures (10 CFR Part 1021), DOE has prepared this environmental impact statement (EIS) to evaluate alternatives for the disposition of U.S.-origin HEU that has been or may be declared surplus to national defense or national defense-related program needs by the President.

This *Disposition of Surplus Highly Enriched Uranium Final Environmental Impact Statement* (HEU EIS) consists of two volumes, plus this summary. Volume I contains the main text and the technical appendices that provide supporting details for the analyses contained in the main text. Volume II contains the comments received on the HEU Draft EIS during the public review period and the DOE responses to those comments. Major comments are summarized starting on page S–22. Changes to the HEU Draft EIS Summary are shown by sidebar notation (vertical lines adjacent to text) in this HEU Final EIS Summary for both the text and tables. Deletion of one or more sentences is indicated by the phrase "text deleted." Similarly, where a table or figure has been removed, the phrase "table deleted" or "figure deleted" is shown.

> **Uranium**
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> The heaviest naturally occurring metallic element. It has three naturally occurring radioactive isotopes, uranium-234 (U-234) (<0.01 percent of natural uranium), U-235 (0.7 percent), and U-238 (99.3 percent). U-235 is most commonly used as a fuel for nuclear fission.

The end of the Cold War created a legacy of weapons-usable fissile materials both in the United States and the former Soviet Union. Further agreements on disarmament between the two nations may increase the surplus quantities of these materials. The global stockpiles of weapons-usable fissile materials pose a danger to national and international security in the form of potential proliferation of nuclear weapons and the potential for environmental, safety, and health consequences if the materials are not properly safeguarded and managed. To demonstrate the United States' commitment to reducing the threat of proliferation, President Clinton announced on March 1, 1995, that approximately 200 metric tons (t) of U.S.-origin fissile materials, of which 165 t is HEU, had been declared surplus to the United States' defense needs.[2]

The Proposed Action

The Department of Energy proposes to blend down surplus HEU to low-enriched uranium (LEU), to eliminate the risk of diversion for nuclear

[1] Plutonium (Pu) is the other major weapons-usable fissile material. This document covers the disposition of surplus HEU. The storage of nonsurplus Pu and the storage and disposition of surplus Pu, as well as the storage of nonsurplus HEU and surplus HEU before disposition (or continued storage of surplus HEU if no action is selected in the Record of Decision [ROD] for this HEU EIS), are analyzed in the *Storage and Disposition of Weapons-Usable Fissile Materials Programmatic Environmental Impact Statement*, which was issued (in draft form) in February 1996.

[2] The Secretary of Energy's *Openness Initiative* announcement of February 6, 1996, declared that the United States has about 213 t of surplus fissile materials, including the 200 t the President announced March 1995. Of the 213 t of surplus materials, the *Openness Initiative* indicated that about 174.3 t (hereafter referred to as approximately 175 t) are HEU, including 10 t previously placed under International Atomic Energy Agency (IAEA) safeguards in Oak Ridge, Tennessee. The HEU Draft EIS, which identified the current surplus as 165 t, did not include the IAEA safeguarded material.

proliferation purposes and, where practical, to reuse the resulting LEU in peaceful, beneficial ways that recover its commercial value.[3] Uranium enriched to 20 percent or more in the uranium-235 (U-235) isotope can be used for weapons. The isotope most abundant in nature is U-238. Therefore, the weapons-usability of HEU can be eliminated by blending it with material that is low in U-235 and high in U-238 to create LEU. This isotopic blending process can be performed by blending HEU with depleted uranium (DU), natural uranium (NU), or LEU blendstock. Once HEU is blended down to LEU, it is no more weapons-usable than existing, abundant supplies of LEU. It would need to be re-enriched to be useful in weapons, which is a costly, technically demanding, and time-consuming process. Therefore, blending to LEU is the most timely and effective method for eliminating the proliferation threat of surplus HEU.

Highly Enriched Uranium

Uranium enriched in the isotope U-235 to 20 percent or above, at which point it becomes suitable for use in nuclear weapons.

The Department of Energy's inventory of surplus HEU consists of a variety of chemical, isotopic, and physical forms. If blended down, much of the resulting LEU would be suitable for commercial use in the fabrication of fuel for nuclear power plants. Other portions of the resultant LEU would contain uranium isotopes, such as U-234 and U-236, that would make them less desirable for commercial use. To the extent that they could not be commercially used, these portions would need to be disposed of as radioactive low-level waste (LLW). Some of the material may or may not be directly suitable for commercial use because its isotopic composition would not meet current industry specifications for commercial nuclear reactor fuel. Nonetheless, it could be used as fuel under certain circumstances.

[3] Low-enriched uranium has commercial value because, at appropriate enrichment levels and in appropriate forms, it can be used as fuel for the generation of electricity in nuclear power plants.

Because of the multiplicity of existing material forms and potential end products (commercial reactor fuel or LLW), disposition of the entire inventory of surplus HEU is likely to involve multiple processes, facilities, and business arrangements.

[Text deleted.]

[Figure deleted.]

Low-Enriched Uranium

Uranium with a content of the isotope U-235 greater than 0.7 percent and less than 20 percent.

Purpose of and Need for the Proposed Action

The purpose of the proposed action is to reduce the threat of nuclear weapons proliferation worldwide in an environmentally safe and timely manner by reducing stockpiles of weapons-usable fissile materials, setting a nonproliferation example for other nations, and allowing peaceful, beneficial reuse of the material to the extent practical.

Blending

Dilution of HEU (20 percent or greater U-235 content) with low-enriched (1- to 2-percent U-235), natural (0.7-percent U-235), or depleted (0.2 to 0.7-percent U-235) uranium by one of several available processes to produce LEU.

Comprehensive disposition actions are needed to ensure that surplus HEU is converted to proliferation-resistant forms consistent with the objectives of the President's nonproliferation policy. These proposed actions would essentially eliminate the potential for reuse of the material in nuclear weapons, would demonstrate the United States' commitment to dispose of surplus HEU, and encourage other nations to take similar actions toward reducing stockpiles of surplus HEU. The proposed action would begin to reduce DOE's HEU inventory as well as costs associated with storage, accountability, and security, rather than indefinitely storing such material. Blending down surplus HEU to make non-weapons-usable LEU is the easiest and most rapid path for neutralizing its proliferation potential.

Scope of the Environmental Impact Statement

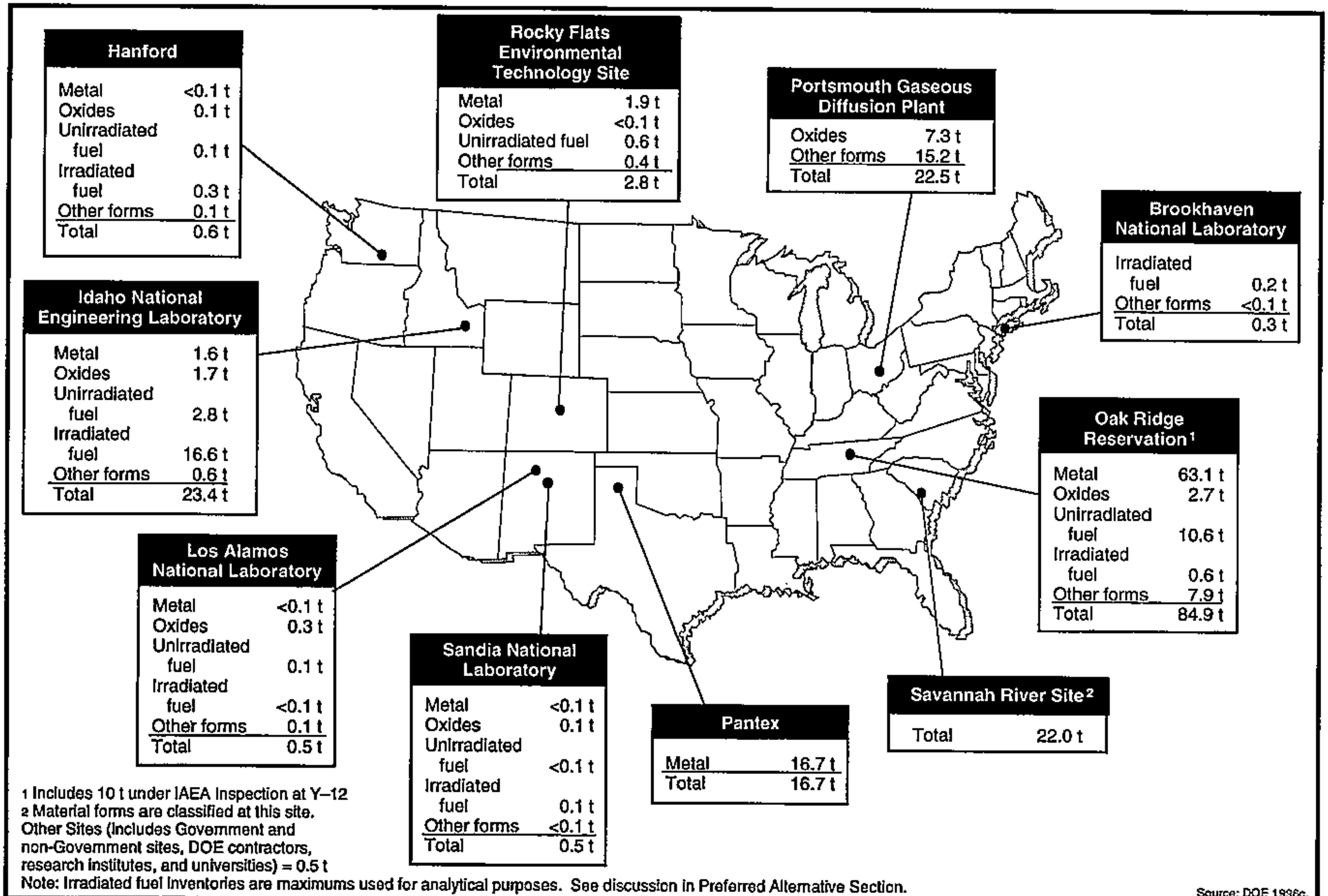
The HEU EIS assesses environmental impacts of reasonable alternatives for the disposition of surplus HEU. The HEU EIS assesses the disposition of a nominal 200 t of surplus HEU, encompassing HEU that has already been declared surplus as well as additional weapons-usable HEU (not yet identified) that may be declared surplus in the future. The material, which is in a variety of forms, is currently located at facilities throughout DOE's nuclear weapons complex, but the majority is stored at the Y–12 Plant in Oak Ridge, Tennessee, or is destined to be moved there for storage. As a result of the Secretary of Energy's *Openness Initiative* announcement of February 6, 1996, DOE is now able to provide additional unclassified details about the locations, forms, and quantities of surplus HEU, which are shown in Figure S–1. This EIS also addresses transfer of title to 7,000 t of NU now owned by DOE to the United States Enrichment Corporation (USEC). This material is part of a larger quantity that is in storage at DOE's Portsmouth and Paducah gaseous diffusion plants.

The HEU EIS assesses potential environmental impacts associated with the four sites where HEU conversion and blending could occur: DOE's Y–12 Plant at the Oak Ridge Reservation (ORR) in Oak Ridge, Tennessee; DOE's Savannah River Site (SRS) in Aiken, South Carolina; the Babcock & Wilcox Naval Nuclear Fuel Division facility (B&W) in Lynchburg, Virginia; and the Nuclear Fuel Services (NFS) facilities in Erwin, Tennessee. The blending processes evaluated are uranyl nitrate hexahydrate (UNH), metal, and uranium hexafluoride (UF_6). UF_6 blending capability does not currently exist at any of the candidate sites.

Uranyl nitrate hexahydrate blending could be used to produce either commercial reactor fuel or LLW, whereas UF_6 and metal blending would only be used to produce LEU for commercial reactor fuel or LLW, respectively. The HEU EIS also assesses the environmental impacts of transportation of these materials. Figure S–2 shows the location of sites that might be used for the HEU blending process(es).

The disposition of surplus HEU was originally considered within the scope of the *Storage and Disposition of Weapons-Usable Fissile Materials Programmatic Environmental Impact Statement* (Storage and Disposition PEIS), which also deals with plutonium (Pu). In the course of the Storage and Disposition PEIS public scoping process (August through October 1994), DOE realized that it might be more appropriate to analyze the impacts of surplus HEU disposition in a separate EIS. DOE held a public meeting on November 10, 1994, to obtain comments on this subject, and subsequently concluded that a separate EIS would be appropriate.

The decision to separate the analysis of surplus HEU disposition from the Storage and Disposition PEIS was made for a number of reasons, including the following: the disposition of surplus HEU could use existing technologies and facilities in the United States, in contrast to the disposition of surplus Pu; the disposition of surplus HEU would involve different timeframes, technologies, facilities, and personnel than those required for the disposition of surplus Pu; decisions on surplus HEU disposition are independently justified, would not impact, trigger, or preclude other decisions that may be made regarding the disposition of surplus Pu, and would not depend on actions taken or decisions made pursuant to the Storage and Disposition PEIS. In addition, a separate action is the most rapid path for neutralizing the proliferation threat of surplus HEU; is consistent with the President's nonproliferation policy; would demonstrate the United States' nonproliferation commitment to other nations; and is consistent with



3217/HEU

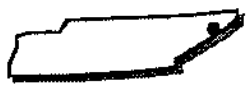
Figure S–1. Locations, Forms, and Amounts of Surplus Highly Enriched Uranium, as of February 6, 1996.

HEU Blending Site (commercial)

Babcock & Wilcox, Lynchburg, VA

- Blend HEU to LEU as UNH (existing process)
- Blend HEU to LEU as UF_6 (new process)

HEU Blending Site (commercial)



Nuclear Fuel Services, Erwin, TN

- Blend HEU to LEU as UNH (existing process)
- Blend HEU to LEU as UF_6 (new process)

HEU Blending Site (DOE)

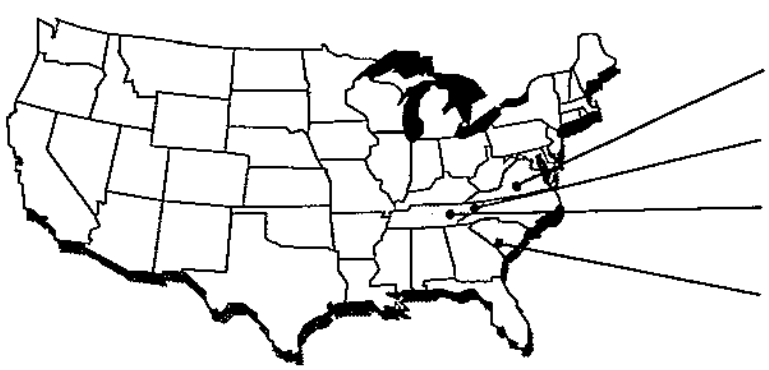
Y–12 Plant at Oak Ridge Reservation, Oak Ridge, TN

- HEU Interim Storage Facility
- Blend HEU to LEU as UNH (existing process)
- Blend HEU to LEU as metal (existing process)

HEU Blending Site (DOE)

Savannah River Site, Aiken, SC

- Blend HEU to LEU as UNH (existing process)



2566/HEU(S)

Figure S–2. Location of Sites That Would be Potentially Involved in the Proposed Highly Enriched Uranium Blending Processes.

the course of action now underway in Russia to reduce Russian HEU stockpiles.

Accordingly, DOE published a notice in the *Federal Register* (60 FR 17344) on April 5, 1995, to inform the public of the proposed plan to prepare a separate EIS for the disposition of surplus HEU. Four comments (one pro and three con) were received on the proposal. For the reasons explained above, DOE concluded that disposition of surplus HEU should be treated separately. The scope of the Storage and Disposition PEIS continues to include storage of surplus HEU beyond a 10-year (yr) period and storage of most nonsurplus HEU.

Until recently, DOE was authorized to market LEU, including LEU derived from HEU, only with USEC acting as its marketing agent.[4] On April 26, 1996, the President signed Public Law 104-134, the *Balanced Budget Down Payment Act*, which included provisions (in Sections 3101-3117, the *USEC Privatization Act*) providing for the privatization of USEC. This legislation provides that, once USEC is privatized, DOE is not required to sell through USEC, but places several conditions on the sale or transfer of DOE's uranium inventory (Public Law 104-134, Sections 3112(d) and 3116(a)(1)). Thus, once USEC is privatized, DOE will have numerous business options for selling LEU derived from surplus HEU and could pursue a number of different methods for undertaking or contracting blending services and LEU sales over time. The HEU EIS addresses the potential impacts associated with the various alternatives regardless of the commercial arrangements.

The exact quantity of future discrete "batches" of surplus HEU, and the exact time at which such batches would be subject to disposition, would depend on a number of factors, including the rate of weapons dismantlement; the rate at which the HEU is declared surplus; market conditions; work orders for commercial fuel feed; legislative restrictions on sales (see Public Law 104-134); and available throughput capacities and capabilities of the blending facilities. The HEU EIS analyzes the blending of surplus HEU at the facilities and using technologies that exist and are available today or that could be added without new construction. It analyzes the transportation of necessary materials from their likely places of origin to the potential blending sites, and from blending sites to the likely or representative destinations for nuclear fuel fabrication or waste disposal. Decisions about the timing and details of specific disposition actions (which facility or process to use) might be made in part by DOE, USEC, the private successor to USEC, or other private entities acting as marketing agents for DOE.

[4] The *Energy Policy Act* of 1992, Public Law 102-486, created USEC as a wholly Government-owned corporation to take over uranium enrichment functions from DOE. The legislation made USEC the Government's exclusive marketing agent for enriched uranium (42 U.S.C. 2297c(a)).

Enrichment

A process whereby the proportion of fissile U-235 in uranium is increased above its naturally occurring value of 0.7 percent. Enrichment to approximately 3 to 5 percent is typical of fuel for nuclear power reactors and to 90 percent or more is typical for weapons.

Preferred Alternative

Several representative, reasonable alternatives are described and assessed in Chapters 2 and 4 of the HEU EIS, and summarized in Tables S–1 through S–3 of this Summary. In addition to the No Action Alternative, there are four alternatives that represent different ratios of blending to commercial use versus blending to waste, different combinations of blending sites, and different combinations of blending technologies. DOE has identified a preferred alternative that satisfies the purpose and need described previously. The Preferred Alternative is identified as Alternative 5, Variation c (the variation using all four sites), in the HEU EIS. Under this alternative, the commercial use of surplus HEU would be maximized, and the blending would most likely be done at some combination of commercial and DOE sites. The Preferred Alternative is as follows:

Table S–1. Alternatives for Disposition of Surplus Highly Enriched Uranium

Alternatives	Site Variations	Components	DOE Sites: Y–12 and SRS			Commercial Sites: B&W and NFS		
			Amount	Process	Duration[a]	Amount	Process	Duration[a]
1. No Action			200 t (Primarily Y–12)	storage	10 yrs			
2. No Commercial Use 100-percent waste	All four sites	200 t blended to waste	50 t/site	UNH metal[b]	24 yrs 16 yrs	50 t/site	UNH	24 yrs
3. Limited Commercial Use 25-percent fuel/ 75-percent waste	All four sites (except for 50 t of USEC material)	50 t fuel[c]				25 t/site	UF_6 UNH	6 yrs 6 yrs
		150 t waste	37.5 t/site	UNH metal[b]	18 yrs 12 yrs	37.5 t/site	UNH	18 yrs
4. Substantial Commercial Use 65-percent fuel/ 35-percent waste	a) DOE sites only	130 t fuel[c]	65 t/site	UNH	16 yrs			
		70 t waste	35 t/site	UNH metal[b]	17 yrs 11 yrs			
	b) Commercial sites only	130 t fuel[c]				65 t/site	UF_6 UNH	16 yrs 16 yrs
		70 t waste				35 t/site	UNH	17 yrs
	c) All four sites	130 t fuel[c]	32.5 t/site	UNH	16 yrs	32.5 t/site	UF_6 UNH	16 yrs 16 yrs
		70 t waste	17.5 t/site	UNH metal[b]	8 yrs 6 yrs	17.5 t/site	UNH	8 yrs

Table S–1. Alternatives for Disposition of Surplus Highly Enriched Uranium—Continued

Alternatives	Site Variations	Components	DOE Sites: Y–12 and SRS			Commercial Sites: B&W and NFS		
			Amount	Process	Duration[a]	Amount	Process	Duration[a]
	d) Single site	130 t fuel[c]	130 t/site	UNH	16 yrs	130 t/site	UF_6 UNH	16 yrs 16 yrs
		70 t waste	70 t/site	UNH metal[b]	33 yrs 23 yrs	70 t/site	UNH	33 yrs
5. Maximum Commercial Use 85-percent fuel/ 15-percent waste	a) DOE sites only	170 t fuel[c]	85 t/site	UNH	21 yrs			
		30 t waste	15 t/site	UNH metal[b]	7 yrs 5 yrs			
	b) Commercial sites only	170 t fuel[c]				85 t/site	UF_6 UNH	21 yrs 21 yrs
		30 t waste				15 t/site	UNH	7 yrs
	c) All four sites	170 t fuel[c]	42.5 t/site	UNH	21 yrs	42.5 t/site	UF_6 UNH	21 yrs 21 yrs
		30 t waste	7.5 t/site	UNH metal[b]	4 yrs 2 yrs	7.5 t/site	UNH	4 yrs
	d) Single site	170 t fuel[c]	170 t/site	UNH	21 yrs	170 t/site	UF_6 UNH	21 yrs 21 yrs
		30 t waste	30 t/site	UNH metal[b]	14 yrs 10 yrs	30 t/site	UNH	14 yrs

[a] Some indicated durations are revised substantially from those in the Draft EIS, in response to comments received. Whereas the Draft EIS based its projections of commercial blending durations on maximum possible blending capabilities of the facilities (up to 40 t/yr total in the four-sites variations), the durations indicated here (based on a total of 8 t/yr for commercial material) reflect more realistic assumptions concerning DOE's ability to make material available, market conditions, and legislative requirements to avoid adverse material impacts on the domestic uranium industry. Waste blending is based on processing rates of 3.1 t/yr for metal blending at Y–12 and 2.1 t/yr for UNH blending at other sites (about 9 t/yr for all four sites together).

[b] The Y–12 Plant only.

[c] The proposal to transfer 50 t of HEU to USEC is a component of each of the commercial use Alternatives (3, 4, and 5). Included within this proposal, and as part of Alternatives 3, 4, and 5, is the proposed transfer to USEC of title to 7,000 t of NU.

- To gradually blend down surplus HEU and sell as much as possible (up to 85 percent) of the resulting commercially usable LEU (including as much off-spec[5] LEU as practical) for use as reactor fuel, (including 50 t of HEU that are proposed to be transferred to USEC over a 6-year period[6]), using a combination of four sites (Y–12, SRS, B&W, and NFS) and two possible blending technologies (blending as UF_6 and UNH) that best serves programmatic, economic, and environmental needs, following the ROD and continuing over an approximate 15- to 20-year period, with continued storage of the HEU until blend down.

- To eventually blend down surplus HEU that has no commercial value, using a combination of four sites (Y–12, SRS, B&W, and NFS) and two blending technologies (blending as UNH and metal) that best serves programmatic, economic, and environmental needs, to dispose of the resulting LEU as LLW, and to continue to store the surplus HEU until blend down occurs.

Because a portion of the surplus HEU is in forms, such as residues and weapons components, that would require considerable time to make available for blending, it is anticipated that no more than 70 percent of the surplus HEU could be blended down and commercialized over the next 10- to 15-year period.

A portion of the surplus HEU is in the form of irradiated fuel (the total quantity of which remains classified). The irradiated fuel is not directly weapons-usable, is under safeguards and security, and poses no proliferation threat. Therefore, DOE is not proposing to process the irradiated fuel to separate the HEU for down blending as part of any of the alternatives in the HEU EIS. There are no current or anticipated DOE plans to process irradiated fuel solely for the purposes of extracting HEU. However, activities associated with the irradiated fuel for the purposes of stabilization, facility cleanup, treatment, waste management, safe disposal, or environment, safety, and health reasons could result in the separation of HEU in weapons-usable form that could pose a proliferation threat and thus be within the scope of the HEU EIS. Under the Preferred Alternative, DOE would recycle any such recovered HEU and blend it to LEU pursuant to the HEU EIS.[7] (If the No Action Alternative were selected in the ROD for this EIS, such "recovered" HEU would continue to be stored pursuant to the Storage and Disposition PEIS or other appropriate NEPA analyses.) To provide a conservative analysis presenting maximum potential impacts, the HEU EIS includes such HEU (currently in the form of irradiated

[5] Off-spec material is material that, when blended to LEU, would not meet industry standard (American Society for Testing Materials) specifications for isotopic content of commercial nuclear reactor fuel. The ultimate disposition of the off-spec material will depend on the ability and willingness of nuclear fuel fabricators and nuclear utilities to use and the Nuclear Regulatory Commission to license the use of off-spec fuel. (For instance, fuel with a higher than usual proportion of the isotope U-236, which inhibits the fission process that is needed for reactors to produce heat and electricity, can still be used in nuclear fuel if the fuel is at a somewhat higher enrichment level. High levels of U-234 can have implications for worker radiation exposures during fuel fabrication.) Utilities have expressed some interest in the use of such material, but the practical extent of that interest is not yet determined.

[6] The proposal to transfer 50 t of HEU and 7,000 t of NU to USEC is specifically authorized by Section 3112(c) of Public Law 104-134. Those proposed transfers are components of each of the commercial use alternatives (3, 4, and 5). The delivery to commercial end users of the surplus uranium transferred to USEC could not begin before 1998 pursuant to the statute. Because the proposed transfer of 7,000 t of NU from DOE to USEC is part of the same proposed transaction as the transfer of 50 t of HEU, the environmental impacts of that transfer are assessed in Section 4.9 of the HEU EIS and in this Summary. DOE may propose to sell additional remaining inventories of NU and those decisions will be considered in separate NEPA reviews, if necessary.

[7] For example, weapons-usable HEU is anticipated to be recovered from dissolving and stabilizing targets and spent fuel at SRS pursuant to the analysis and decisions in the EIS (October 1995) and RODs (December 1995 and February 1996) on *Interim Management of Nuclear Materials* at SRS, and from the proposed demonstration of electrometallurgical treatment at Argonne National Laboratory-West pursuant to the analysis in the *Environmental Assessment for Electrometallurgical Treatment Research and Demonstration Project in the Fuel Conditioning Facility at Argonne National Laboratory–West* (May 1996) (Finding of No Significant Impact, May 15, 1996). As part of the proposed electrometallurgical treatment demonstration, HEU derived from the demonstration would be blended down to LEU at Argonne National Laboratory-West; therefore, such material would not be blended down as part of the HEU EIS.

fuel) in the material to be blended to LEU, as if such HEU had been separated from the irradiated fuel pursuant to health and safety, stabilization, or other non-defense activities. However, such HEU may actually remain in its present form (without the HEU ever being separated) and be disposed of as high-level waste (HLW) in a repository or alternative pursuant to the *Nuclear Waste Policy Act*.[8]

With respect to the surplus HEU that could be blended to commercial fuel feed for power reactors, including the 50 t of HEU proposed to be transferred to USEC, the decisions and associated contracts concerning 1) which facility(ies) would blend the material, and 2) marketing of the fuel, may be made by USEC, by a private successor to USEC, by other private entities acting as marketing agents for DOE, or by DOE.

The Department of Energy has concluded that the Preferred Alternative would best serve the purpose and need for the HEU disposition program for several reasons. DOE considers all of the action alternatives (2 through 5) to be roughly equivalent in terms of serving the nonproliferation objective of the program. Both 4-percent LEU in the form of commercial spent nuclear fuel and 0.9-percent LEU oxide for disposal as LLW—and any allocation between them—fully serve the nonproliferation objective, as both processing of the spent fuel and re-enrichment of the 0.9-percent LEU to make new weapons-usable material would be technologically difficult and expensive. However, alternatives that include commercial use better serve the economic recovery objective of the program by allowing for peaceful, beneficial reuse of the material. Commercial use would reduce the amount of blending that would be required for disposition (a 14 to 1 blending ratio of blendstock to HEU as opposed to 70 to 1 for waste) and minimize Government waste disposal costs that would be incurred if all (or a greater portion of) the material were blended to waste. The sale of LEU derived from surplus HEU would yield returns on prior investments to the Federal Treasury. Finally, the analysis in the HEU EIS indicates that commercial use of LEU derived from surplus HEU would minimize overall environmental impacts because blending for commercial use involves generally lower impacts, and because adverse environmental impacts from uranium mining, milling, conversion, and enrichment would be avoided by using this material rather than mined uranium to produce nuclear fuel.

[Text deleted.]

An indirect impact of the Preferred Alternative would be the creation of spent nuclear fuel (through the use of LEU fuel derived from surplus HEU in power reactors). However, since the nuclear fuel derived from surplus HEU would replace nuclear fuel that would have been created from newly mined uranium (or NU) without this action, there would be no additional spent fuel generated. Because LEU derived from HEU supplants LEU from NU, the environmental impacts of uranium mining, milling, conversion, and enrichment to generate an equivalent amount of commercial reactor fuel would be avoided (see Section 4.7 of the HEU EIS). The domestic spent fuel would be stored and potentially disposed of in a repository or other alternative, pursuant to the *Nuclear Waste Policy Act* as amended (42 U.S.C. 10101 *et seq.*).

[Text deleted.]

With respect to the ultimate disposal of LLW material, certain DOE LLW is currently disposed of at commercial facilities and other DOE LLW is stored and disposed of at DOE sites. A location where LLW derived from DOE's surplus HEU can be disposed of has not been designated. Disposal of DOE LLW would be pursuant to DOE's *Waste Management Programmatic Environmental Impact Statement for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste* (DOE/EIS-0200-D, draft issued in August 1995) (Waste Management PEIS) and associated ROD(s), and any subsequent NEPA documents tiered from or supplementing the Waste Management PEIS. Waste

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[8] If HEU currently in irradiated fuel remains in its current form, it would be managed pursuant to the analyses and decisions in the *Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Environmental Impact Statement* (April 1995) and the associated RODs (60 FR 28680, June 1, 1995, amended by 61 FR 9441, March 8, 1996), and subsequent, project-specific or site-specific NEPA documentation. Such spent fuel could be disposed of as HLW in a repository pursuant to the *Nuclear Waste Policy Act* (42 USC 10101 *et seq.*). DOE is in the process of characterizing the Yucca Mountain Site in Nevada as a potential repository under that Act.

material derived from surplus HEU would be required to meet LLW acceptance criteria of the DOE's Office of Environmental Management. For purposes of analysis of LLW transportation impacts only, this EIS assumes the use of the existing LLW facility at the Nevada Test Site (NTS) as a representative facility. Other sites being analyzed in the Waste Management PEIS for disposal of LLW include ORR, SRS, and the Hanford Site in Washington. No LLW would be transferred to NTS (or any alternative LLW facility) until completion of the Waste Management PEIS (or other applicable project or site-specific NEPA documentation such as the NTS Site-Wide EIS) and in accordance with decisions in the associated ROD(s). [Text deleted.] Additional options for disposal of LLW may be identified in other documents.

Continued storage of surplus HEU prior to blending may be required for some time. The storage, pending disposition (for up to 10 years) of surplus HEU at the Y–12 Plant (where most of the HEU is stored or destined to be stored), is analyzed in the *Environmental Assessment for the Proposed Interim Storage of Enriched Uranium Above the Maximum Historical Storage Level at the Y–12 Plant, Oak Ridge, Tennessee*, (DOE/EA–0929, September 1994) (Y–12 EA). Impacts from storage, as analyzed in the Y–12 EA and incorporated by reference herein, are briefly summarized in the HEU EIS. Should the surplus HEU disposition actions continue beyond 10 years, subsequent storage of surplus HEU pending disposition will be pursuant to and consistent with the ROD associated with the Storage and Disposition PEIS or tiered NEPA documents.[9]

Screening Process Alternatives

The Department of Energy used a screening process along with public input to identify a range of reasonable options for the disposition of surplus HEU.[10] The process was conducted by a screening committee that consisted of five DOE technical program managers, assisted by technical advisors from DOE's National Laboratories and other support staff. The committee was responsible for identifying the reasonable alternatives to be evaluated. It compared alternatives against screening criteria, considered input from the public, and used technical reports and analyses from the National Laboratories and industry to develop a final list of alternatives.

The first step in the screening process was to develop criteria against which to judge potential alternatives. The criteria were developed for the screening process based on the President's nonproliferation policy of September 1993, the January 1994 *Joint Statement by the President of the Russian Federation and the President of the United States of America on Non-proliferation of Weapons of Mass Destruction and the Means of Their Delivery,* and the analytical framework established by the National Academy of Sciences in its 1994 report, *Management and Disposition of Excess Weapons Plutonium*. These criteria reflect domestic and policy interests of the United States, including nonproliferation; security; environment, safety, and health; timeliness and technological viability; cost-effectiveness; international cooperation; and additional benefits. The criteria were discussed at the public scoping workshops, and participants were invited to comment further using questionnaires. The questionnaires allowed participants to rank criteria based on relative importance, comment on the appropriateness of the criteria, and suggest new criteria. Details on how the screening process was developed, applied, and the results obtained were published in a separate report, *Summary Report of the Screening Process to Determine Reasonable Alternatives for Long-Term Storage and Disposition of Weapons-Usable Fissile Materials* (DOE/MD-0002, March 29, 1995).

The Department of Energy began with nine potential alternatives for the disposition of surplus HEU. These alternatives were evaluated in the screening process to identify those reasonable alternatives that merited further evaluation in the HEU EIS. As a result of the screening

[9] Under the No Action Alternative for the Storage and Disposition PEIS, if storage of surplus HEU pending disposition (or no action) continued beyond 10 years, storage facilities at Y–12 would be maintained to ensure safe facility operation, or surplus HEU material might be moved out of the Y–12 Plant at the end of the 10-year period with the completion of the relocation within the following 5 years. Subsequent NEPA review would be conducted as required.

[10] The disposition of surplus HEU was originally within the scope of the Storage and Disposition PEIS. Separate analyses were conducted for Pu, HEU, and other fissile materials during the screening process to identify reasonable alternatives for each. Therefore, the results of the screening process are not affected by the separation of the disposition of surplus HEU from the Storage and Disposition PEIS.

process, five alternatives were identified as reasonable alternatives for further analysis:

- No HEU disposition action (continued storage)
- Direct sale of HEU to a commercial vendor for subsequent blending to LEU
- Blending HEU to 19-percent assay LEU and selling as commercial reactor fuel feed material
- Blending HEU to 4-percent LEU and selling as commercial reactor fuel feed material
- Blending HEU to 0.9-percent LEU for disposal as waste

Following the screening process, the five alternatives identified as reasonable were further refined. The blend to 0.9 percent and discard as waste alternative, which was originally intended to address only material not suitable for use as commercial fuel, was expanded to include all surplus HEU. Although this would not recover the material's economic value, it would meet nonproliferation goals. [Text deleted.]

The blend to LEU (19 percent or less enrichment) and sell alternative was eliminated from analysis because LEU with an enrichment level of 19 percent cannot be used commercially as reactor fuel without further blending; it presents criticality concerns (for transportation and storage before down blending) that would need to be accommodated; and, as an interim blending level, it is not as economical as blending directly to 4 percent in a one-step process.

Characterization of Surplus Highly Enriched Uranium Material

The surplus HEU material in inventory varies in levels of enrichment and purity (contamination with undesirable isotopes and chemicals). The predominant decision affecting the process choices for any batch of surplus HEU would depend on its disposition as fuel or waste.

An important factor in determining the disposition of any specific batch of HEU would be whether it can be blended to meet the chemical and isotopic specifications of the American Society for Testing and Materials (ASTM) for commercial reactor fuel. Of particular concern are the ASTM specifications for concentrations of the isotopes U-234 and U-236 relative to U-235 in the blended LEU product. U-234 is a major contributor to radiation exposure, which could be of concern during fuel fabrication, and U-236 inhibits the nuclear reaction in reactor cores, reducing core lifetime or requiring higher enrichments to achieve a normal core life. A substantial amount of the surplus HEU could meet those ASTM specifications when blended with NU or LEU. The surplus HEU material could be characterized as commercial, off-spec, or non-commercial depending upon its ability to be used as reactor fuel.

Commercial Material—If the HEU material has a low ratio of undesirable isotopes (U-234 and U-236), it is considered a commercial quality material (in-spec). The selection of uranium blendstock of adequate quality and form will allow production of LEU that meets the ASTM specifications for use in fabrication of commercial reactor fuel.

Off-Spec Material—If the ratio of U-234 and U-236 is high in the HEU material relative to U-235 content (off-spec), then the ability to blend to the ASTM commercial fuel specifications may be limited. If customers are found (for example, private or public utilities) who are willing to use off-spec LEU, then this surplus HEU could be blended to commercial reactor fuel feed.

Non-Commercial Material—This is material that cannot be economically recovered from its existing form, such as HEU in spent fuel, HEU in low concentrations in waste or residues, and HEU in equipment that will not undergo decontamination and decommissioning in the foreseeable future. Some of this HEU material is also in dismantled weapons components that cannot be recovered because the technology has not yet been developed to recover the HEU.

Figure S–3 provides a material flow diagram for the disposition of surplus HEU.

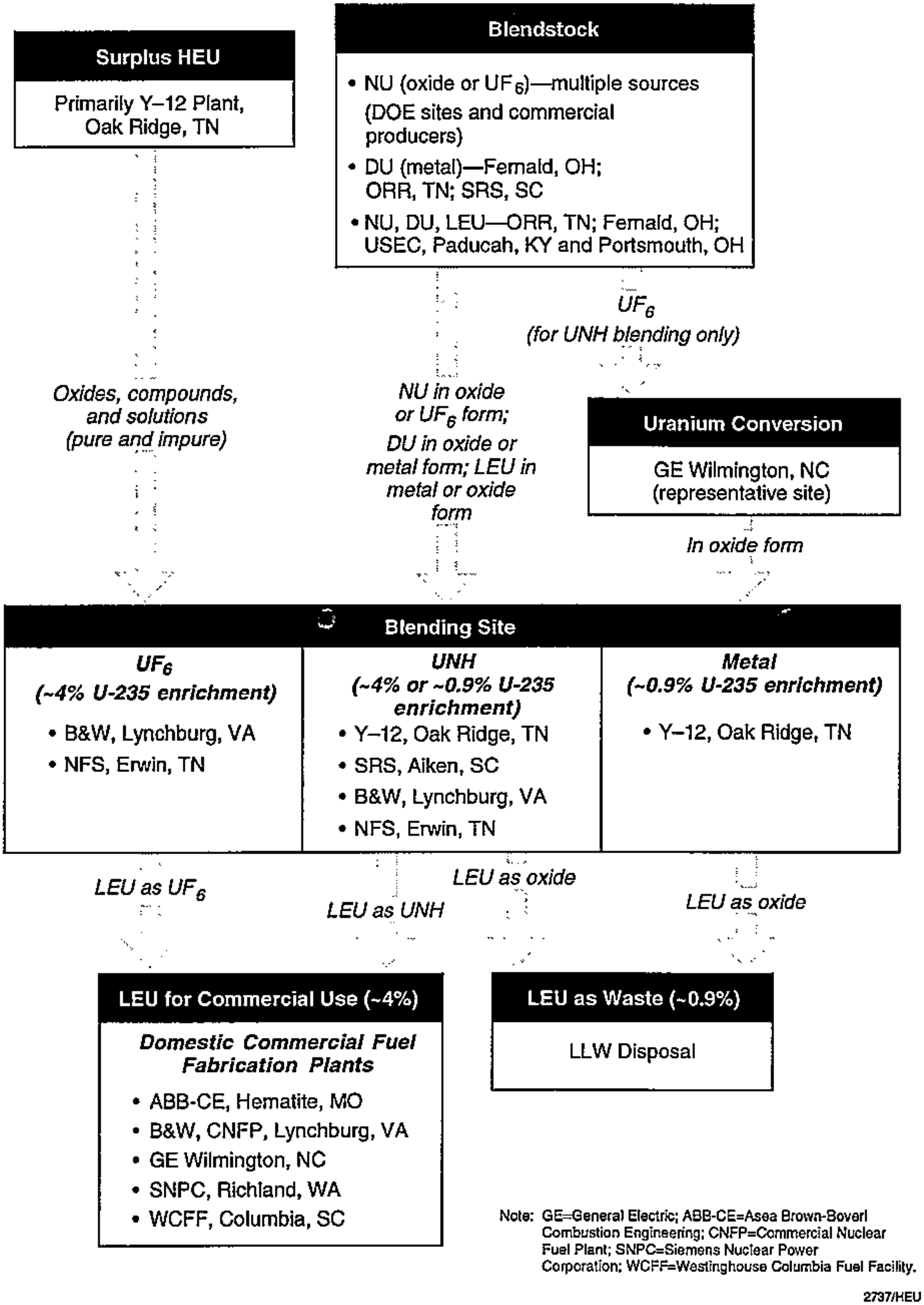


Figure S–3. Material Flow Diagram for Surplus Highly Enriched Uranium Disposition.

Highly Enriched Uranium Disposition Alternatives

The screening process alternatives were further refined by combining the direct sale of surplus HEU (buyer to blend HEU to LEU) alternative and the blend HEU to 4-percent LEU and sell as commercial reactor fuel feed alternative. This was done because the potential environmental impacts of these two alternatives are the same. They differ only in whether the surplus HEU is sold before or after blending.

Finally, the alternatives were further refined to account for various combinations of blending technologies, candidate sites, and end products. The possible list of combinations is virtually infinite; therefore, DOE has selected reasonable alternatives that not only represent the spectrum of reasonable alternatives, but also include logical choices for consideration at the time the ROD is issued. These alternatives, listed in Table S–1, are described in detail in the following section. Timeframes shown in Table S–1 reflect assumptions concerning DOE's ability to make material available, market conditions, and legislative requirements to avoid adverse material impact on the domestic uranium industry. A graphical representation of the time required to complete alternative based on the use of 1, 2, or 4 blending sites, is shown in Figure S–4.

Several blending technologies and facilities are likely to be used for different portions of the surplus inventory, and the decisions regarding those technologies and facilities are likely to be made in part by USEC or other private entities outside DOE. Thus, specific decisions concerning the locations where the surplus HEU disposition action will be implemented will be multidimensional and will likely involve multiple decisionmakers. The alternatives as described are not intended to represent exclusive choices among which DOE (or other decisionmakers) must choose, but rather are proffered to define representative points within the matrix of possible reasonable alternatives.[11] Section 4.5.6 of the HEU EIS explains how impacts would change if the actual allocation between alternatives, end products (commercial fuel feed or waste), blending processes, and blending sites differed from the representative reasonable alternatives.

To provide a conservative analysis presenting maximum potential impacts, the alternatives explained below address the disposition of the entire surplus HEU inventory (nominally 200 t). For the reasons explained previously in the Preferred Alternative section, a portion of this inventory may not be available for blend down since it is currently in the form of irradiated fuel.

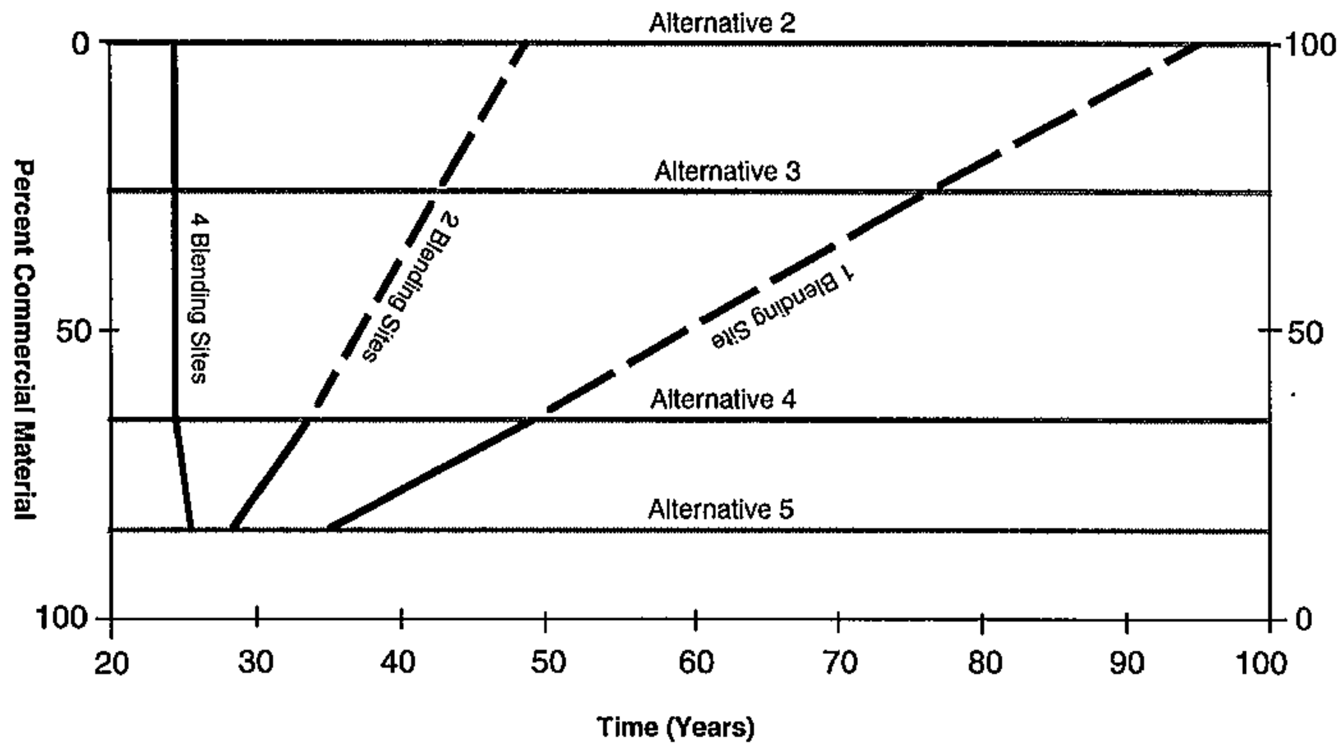
For the commercial use alternatives, LEU material with commercial value would be transported following blending to fuel fabricators for use in fabricating commercial nuclear reactor fuel. Currently, there are five potential domestic commercial facilities[12] that could process LEU derived from surplus HEU into commercial nuclear reactor fuel and over 100 domestic commercial electrical power nuclear reactors that could potentially use the commercial nuclear reactor fuel. The exact allocation, site-specific location, and timing of the eventual processing and commercial nuclear reactor use are not known at this time, have not been specifically proposed, and would be contingent upon the needs and specifications of the potential customers for the fuel. The domestic spent fuel would be stored, and potentially disposed of in a repository or other alternative, pursuant to the *Nuclear Waste Policy Act* as amended (42 U.S.C. 10101 *et seq.*).

No Action

Under the No Action Alternative, DOE would continue to store surplus HEU (primarily at DOE's Y–12 Plant). Storage of surplus HEU (until disposition) is analyzed for a period of up to 10 years

[11] For example, while the alternatives assess blending either 85, 65, or 25 percent of the material to commercial fuel, another percentage might more accurately represent ultimate disposition. Similarly, while two of the variations assume that material is divided evenly among the four possible facilities (25 percent to each), some other distribution among three or four facilities is possible. [Text deleted.] Such variations would be within the range of alternatives analyzed in this EIS.

[12] At this time, the five potential domestic commercial fuel fabricators are: 1) Asea Brown-Boveri Combustion Engineering, Hematite, Missouri; 2) B&W, Lynchburg, Virginia; 3) General Electric Nuclear Production, Wilmington, North Carolina; 4) Siemens Nuclear Power Corporation, Richland, Washington; and 5) Westinghouse Columbia Fuel Facility, Columbia, South Carolina. Foreign fuel fabricators and foreign commercial electrical power nuclear reactors might also receive material, but are not as likely as domestic fabricators and reactors.



Source: Table 2.1.2–1.

Assumptions:
1) Commercial blending periods are based on 6 t/yr total (constrained by material availability, market conditions, and legislative requirements).
2) Waste blending periods based on 2.1 t/yr at each site (constrained by facility processing rates for UNH blending).
3) Commercial use alternatives (3 through 5) assume all commercial material would be blended first, then waste material.

3227/HEU

Figure S–4. Time Required to Complete Various Alternatives Based on Number of Blending Sites Used.

in the Y–12 EA. Should the surplus HEU disposition actions continue beyond 10 years, subsequent storage of surplus HEU pending disposition will be pursuant to and consistent with the ROD associated with the Storage and Disposition PEIS or tiered NEPA documents.[13] Current operations at each of the potential HEU blending sites (Y–12, SRS, B&W, and NFS) would continue.

No Commercial Use (0/100 Fuel/Waste Ratio)

Under this alternative, DOE would blend the entire stockpile of surplus HEU (200 t) to LEU and dispose of it as waste. This would include surplus HEU with or without commercial value. The blending would be performed at all four sites. Although this alternative would not recover any of the economic value of HEU for the Government, it is evaluated for all surplus HEU to provide a comprehensive evaluation of a full range of alternatives in the HEU EIS.

[Figure deleted.]

Surplus HEU could be blended to waste as either UNH or as metal at a rate per site of up to 2.1 t/yr or 3.1 t/yr, respectively. All blending sites have UNH blending capability. Only the Y–12 Plant at ORR has the capability to perform metal blending. [Text deleted.]

The blending of surplus HEU for waste would not be initiated before an LLW disposal facility were identified to accept the LLW. Surplus HEU would remain in storage at the Y–12 Plant or at another storage facility pursuant to the Storage and Disposition PEIS pending identification of the LLW disposal facility.

Limited Commercial Use (25/75 Fuel/Waste Ratio)

Under this alternative, 50 t of surplus HEU would be blended to commercial fuel, while the remaining 75 percent (150 t) would be blended and then disposed of as waste. The title to 50 t of surplus HEU would be transferred to USEC. USEC (or a successor private corporation) then would select the commercial site or sites for blending 50 t of surplus HEU to LEU for use in commercial fuel. The remaining 150 t would be blended to waste.

This alternative would blend 50 t of HEU at the two commercial sites. The 50 t would be distributed equally between the commercial sites, each blending 25 t of material.[14] The remaining 150 t of surplus HEU material would be blended to waste using all four blending sites. Each DOE site and commercial site would receive 37.5 t of waste material for blending.

[Text deleted.]

Substantial Commercial Use (65/35 Fuel/Waste Ratio)

This alternative assumes that 35 percent of the surplus HEU would be blended to LLW and disposed of as waste, leaving 65 percent of the material available for commercial use. The title to 50 t of surplus HEU would be transferred to USEC. USEC (or a successor private corporation) then would select blending sites for blending 50 t of surplus HEU to LEU for use in commercial fuel. The remaining quantity of potentially commercially usable HEU (80 t), could be blended at any or all of the four sites. The LEU product would be sold for use in commercial reactor fuel. The remaining 70 t of surplus HEU would be blended to waste.

There are four variations of this alternative using different combinations of sites. These particular combinations of sites are representative only. The actual distribution among blending sites may differ, depending on programmatic, commercial, or other considerations. The first variation would blend all of the HEU at the two DOE sites, with the HEU split equally between them. ORR and SRS would each blend 65 t of HEU to LEU for commercial fuel and 35 t of HEU to LEU for disposal as waste. The second variation would blend all of the HEU at the

[13]Under the No Action Alternative for the Storage and Disposition PEIS, if storage of surplus HEU pending disposition (or no action) continued beyond 10 years, storage facilities at Y–12 would be maintained to ensure safe facility operation, or surplus HEU material might be moved out of the Y–12 Plant at the end of the 10-year period with the completion of the relocation within the following 5 years. Subsequent NEPA review would be conducted as required.

[14]This distribution and the distributions for Alternatives 4 and 5 are assumed only for purpose of analysis. It is not intended to foreclose the selection of another distribution that might include DOE sites or only one site.

two commercial sites, with the HEU split equally between them. B&W and NFS would each blend 65 t of HEU to LEU for commercial fuel and 35 t of HEU to LEU for disposal as waste. The third variation would blend the HEU at all four sites, with the HEU split equally among them. Each site would blend 32.5 t of HEU to LEU for commercial fuel and 17.5 t of HEU to LEU for disposal as waste. The fourth variation would blend all of the HEU at a single site. The site would blend 130 t of HEU to LEU for commercial fuel and 70 t of HEU to LEU for disposal as waste.

[Text deleted.]

Maximum Commercial Use (85/15 Fuel/Waste Ratio—Preferred Alternative)

Under this alternative, it is assumed that only 15 percent of the surplus HEU would be blended and disposed of as waste. The title to 50 t of surplus HEU would be transferred to USEC. USEC (or successor corporation) then would select blending sites for blending 50 t of surplus HEU to LEU for use in commercial fuel. The remaining quantity of potentially commercially usable HEU (120 t) could be blended at any or all of the four sites. The LEU product would be sold for use in commercial reactor fuel. The remaining 30 t of surplus HEU would be blended to waste.

There are four variations of this alternative using different combinations of sites. They are the same as those assessed for the previous alternative. The first variation would blend all of the HEU at the two DOE sites, with the HEU split equally between them. ORR and SRS would each blend 85 t of HEU to LEU for commercial fuel and 15 t of HEU to LEU for disposal as waste. The second variation would blend all of the HEU at the two commercial sites, with the HEU split equally between them. B&W and NFS would each blend 85 t of HEU to LEU for commercial fuel, and 15 t of HEU to LEU for disposal as waste. The third variation would blend all of the HEU at all four sites, with the HEU split equally among them. Each site would blend 42.5 t of HEU to LEU for commercial fuel and 7.5 t of HEU to LEU for disposal as waste. The fourth variation would blend all of the HEU at a single site. The site would blend 170 t of HEU to LEU for commercial fuel and 30 t of HEU to LEU for disposal as waste.

[Text deleted.]

Candidate Sites

Four candidate sites are analyzed in the HEU EIS for disposition (using one or more of the blending processes) of surplus HEU. They are DOE's Y–12 Plant at ORR, SRS, and two privately owned and operated facilities, B&W and NFS. The Y–12 Plant is the interim storage site for most of the surplus HEU. B&W and NFS have Nuclear Regulatory Commission (NRC) licenses to process HEU. All of these sites are currently performing, or until recently have performed, national security activities involving HEU.

All candidate sites currently have technically viable HEU conversion and blending capabilities and could begin, in the relatively near future, to blend surplus HEU to proliferation-resistant forms consistent with the President's nonproliferation policy. New sites and facilities are not considered reasonable for blending, given the availability of existing sites and facilities, because new facilities would require capital investment and may not be cost effective. Moreover, new construction would pose additional impacts to the environment, although impacts from normal operations would be similar.

The Y–12 Plant has both molten metal and UNH blending capabilities. The commercial vendor sites, B&W and NFS, have only UNH blending capability at this time. UNH facilities at Y–12 and SRS are currently not in operation and may require upgrading before conversion and blending operations can resume. B&W and NFS hold NRC licenses for their HEU operations, including blending. [Text deleted.]

No capability currently exists for conversion of HEU to UF_6 at the candidate sites; therefore, new processing equipment would need to be installed to provide capability for UF_6 blending of surplus HEU. B&W and NFS are analyzed as reasonable representative sites for new UF_6 conversion and blending capability because those are the only commercial sites that currently have NRC licenses to process HEU. UF_6 conversion and blending equipment could be installed in existing buildings at those facilities, and they have indicated they would consider possible installation of such equipment.[15]

Y–12 Plant, Oak Ridge, Tennessee. The Y–12 Plant is located on a 1,770-hectare (ha) (4,370-acre) site within the city boundaries of Oak Ridge, approximately 19 kilometers (km) (12 miles [mi]) west of Knoxville, Tennessee. ORR's Y–12 Plant is the primary location of several Defense Program missions, including maintaining the capabilities to fabricate components (primarily uranium and lithium) for nuclear weapons, storing uranium and lithium parts, dismantling nuclear weapon components returned from the national stockpile, processing special nuclear materials, and providing special production support for DOE design agencies and other departmental programs. Y–12 currently has capabilities for UNH and metal blending.

Molten metal blending is performed in the Building 9212 Casting Facility. The casting facility has 12 vacuum induction furnaces, but due to use of the facility for other missions and routine maintenance requirements, it is assumed that 6 of the 12 furnaces with 75-percent availability would be available to perform HEU blending. Blending can occur at a maximum rate of 3.1 t/yr for molten metal blending of 50-percent assay HEU to 0.9-percent assay LEU with DU operating 21 shifts per week. Use of all 12 vacuum induction furnaces with 75-percent availability would double the blending capacity.

Uranyl nitrate hexahydrate blending is performed in the Building 9212-Chemical Recovery Facility. The blending process consists of feed size reduction, oxidation, nitric acid dissolution, purification, UNH blending, and drying and crystallizing to produce UNH crystals. Blending can occur at a rate of 5.6 t/yr for UNH blending of 50-percent assay HEU to 4-percent assay LEU, operating 21 shifts per week or 1.5 t/yr of 50-percent HEU assay to 0.9-percent LEU for waste disposal. This capacity can be doubled if a second denitrator, which has been purchased by Y–12 but not yet installed, is added to the system.

Since capabilities exist at Y–12 to perform HEU blending operations, no additional facilities need to be constructed. Minor modifications to existing buildings, such as the installation of a second denitrator that has already been acquired, may be needed to increase throughput capabilities. Y–12 facilities are currently not operating in order to improve conduct of operations, and must successfully complete an Operational Readiness Review prior to restart based on DOE O 425.1, *Startup and Restart of Nuclear Facilities.* Blending operations are expected to resume in 1997.

Savannah River Site, Aiken, South Carolina. The Savannah River Site occupies an area of approximately 80,130 ha (198,000 acres) located 32 km (20 mi) south of Aiken, South Carolina. Its primary mission was to produce strategic isotopes (Pu-239 and tritium) used in the development and production of nuclear weapons for national defense. The current mission is to store, treat, stabilize, and dispose of waste materials; manage and dispose of nuclear materials and facilities; restore the environment and manage natural resources; develop mission-supportive partnerships; and support national security and nuclear materials requirements. SRS currently has the capability for UNH blending.

Except as noted below, SRS has the capability to blend HEU to either 4-percent or 0.9-percent LEU. The facilities for UNH processes are located in the F- and H-Canyons. [Text deleted.]

The existing facility that could be used to solidify blended down UNH solutions at SRS (the FA-Line) is not designed to be critically safe for processing solutions with enrichment levels higher than about 1 percent. Thus, SRS could perform UNH blending of HEU to 0.9-percent LEU and subsequent solidification, but it could not, at present, solidify (crystallize and/or oxidize) HEU that is blended to commercial enrichment levels (4 to 5 percent). There are about 20 t of surplus HEU at SRS. (The quantities of the various forms of surplus HEU at SRS remain classified.) While it is virtually all off-spec material, including solutions and some irradiated fuel, most of it is considered to be potentially suitable for commercial use. (In connection with the *Final*

[15]If either or both B&W and NFS should decide to construct additional facilities for UF_6 conversion and blending, construction impacts would likely include land disturbance and minor air emissions from construction equipment, and the applicable NRC license would need to be amended. Any such construction would be based on the business judgment of these commercial facilities and would not be necessitated by DOE's proposed action. Environmental impacts would be analyzed by those facilities as part of the NEPA review associated with the NRC licensing process.

Environmental Impact Statement Interim Management of Nuclear Materials EIS [DOE/EIS-0220, October, 1995] and the associated ROD(s), the Department will dissolve and stabilize some of the irradiated fuel in the F-Canyon and/or H-Canyon at SRS to make it suitable for safe storage. If carried out, that process would result in the separation of the HEU, thus making it available to the HEU disposition program.)

One or more of several options for providing for solidification of UNH solutions at commercial enrichment levels at SRS may be proposed in the future, although none is being proposed by DOE at this time.[16] DOE could complete a partially built Uranium Solidification Facility in the H-Area at SRS or build a new facility. Another possibility is that a private, commercial entity or another Federal agency would build such a facility either within the SRS (on land leased from DOE) or nearby. Such a private facility would need to be licensed by the NRC. To conservatively estimate impacts, the HEU EIS includes the impacts of the solidification process as if it could occur at SRS. If a solidification facility were proposed and constructed, impacts would likely include land disturbance and minor air emissions from construction equipment. If construction of such a facility were proposed, additional NEPA review, as appropriate, would be conducted by DOE (or in connection with NRC licensing proceedings for a private facility). Using existing facilities, blended down LEU UNH solution (at 4- to 5-percent enrichment) could be transported to another facility (such as Y–12, B&W, NFS, or a fuel fabricator) for solidification.[17] Alternatively, all of the SRS material could be blended to about 0.9-percent enrichment and solidified at SRS. (This was the alternative considered in the Interim Management of Nuclear Materials EIS.)

Other minor facility upgrades, such as loading dock modifications for F- and H-Canyons to facilitate the transfer of UNH solutions, would be required to provide blending of HEU to LEU as UNH. [Text deleted.] Blending could theoretically occur at a rate of 37 t/yr of HEU for UNH blending of 50-percent assay HEU to 4-percent assay LEU or 7.5 t/yr to 0.9-percent assay LEU (both canyons, all dissolvers). Actual throughput would likely be significantly lower since the HEU blend down program would have to share the resources (facilities and personnel) with other nuclear materials stabilization activities. The proportion of resources available to the HEU blend down program, and the associated throughput, would be determined by programmatic and budget decisions made to coordinate all nuclear materials stabilization activities. SRS has a complete environmental, safety, and health program to process and handle HEU.[18]

Babcock & Wilcox Site, Lynchburg, Virginia. The B&W facility is located on approximately 212 ha (524 acres) in the northeastern portion of Campbell County, approximately 8 km (5 mi) east of Lynchburg, Virginia. Only UNH blending capability exists at B&W and the facilities are located at the Naval Nuclear Fuel Division. The current primary mission of B&W is fuel fabrication and purification

[16]The list of possible alternatives is not intended to be, and should not be construed to be, an exhaustive list of all reasonable alternatives for solidification of UNH at commercial enrichment levels at SRS, should such solidification be proposed.

[17]The approximately 20 t of HEU solutions at SRS could be blended to approximately 617 t of 4-percent UNH solution. The UNH solution could be transported from SRS using NRC-certified liquid cargo tank trailers (for example, DOE-specification MC-312, NRC Certificate of Compliance Number 5059), or other DOT-approved Type A fissile packaging to one of several offsite facilities that could perform the solidification of the material. The SRS site is in close proximity to existing commercial fuel fabrication facilities in both South Carolina and North Carolina that could perform the solidification. The South Carolina facility (97 km [61 mi] from SRS) is assumed as a representative solidification site for the purpose of analysis only (it is not proposed at this time). This project (transportation for solidification of 617 t of LEU solution) would require about 350 truckloads of 16,800 kg (37,000 pounds each) of UNH solution (includes 1.8 t uranium per truckload). The impact from nonradiological accidents would be about 3.7×10^{-3} fatalities for the entire project. The risk from radiological accidents is estimated to be 3.9×10^{-5} fatalities for the entire project. The impacts from normal (accident-free) transportation, including handling and air pollution would be about 1.9×10^{-2} fatalities. The combined impact for the total campaign would be about 2.3×10^{-2} fatalities. The location of such off-site solidification and the extent of any transportation may depend in part on future proposals concerning the off-spec material at SRS and/or construction of a UNH solidification facility. Additional NEPA review would be conducted, as appropriate.

[18]As part of ongoing activities to upgrade the Safety Authorization Basis for the nuclear facilities at SRS, DOE is further evaluating the structural integrity and seismic response of the canyon facilities. These analyses are expected to be completed in July 1996.

of HEU and scrap uranium and the removal and recovery of materials generated in manufacturing waste streams to prevent environmental degradation. The capacity of B&W for recovery and purification is about 24 t/yr of HEU.

Babcock & Wilcox is one of only two commercially licensed facilities in the United States capable of providing HEU processing services. The license includes activities associated with both the recovery and the blending of HEU. Current processes are for uranium in UNH form. B&W is licensed to possess or maintain onsite up to 60,000 kilograms (kg) (132,000 pounds [lb]) of U-235 in any required chemical or physical form (except UF_6) and at any enrichment. The total quantities of HEU and uranium oxide blendstock required for the proposed action might exceed these limits for the alternatives in the HEU EIS. Therefore, it might be necessary to increase the licensed possession limits or to schedule and stage the receipt and processing of these materials so that the quantity of uranium onsite would not exceed any NRC requirements.

Babcock & Wilcox can perform the recovery and blending of HEU to LEU as UNH with existing facilities without construction of additional buildings or infrastructure. No capabilities exist for the conversion of HEU to UF_6, and interior modifications to existing B&W facilities—mainly new equipment installation—would be required along with NRC license modification before the UF_6 blending process could be performed.

Nuclear Fuel Services, Inc., Erwin, Tennessee. The NFS facility is located on approximately 25.5 ha (63 acres) in Erwin, Tennessee, immediately northwest of the community of Banner Hill. The primary mission of NFS has been to convert HEU into a classified product used in the fabrication of naval nuclear fuel. NFS was also involved in research on and development of improved manufacturing techniques, recovery and purification of scrap uranium, and removal and recovery of materials generated in manufacturing waste streams to prevent environmental degradation. The capacity of NFS for recovery and purification is about 10 t/yr of HEU at 93-percent enrichment. Only UNH blending capability exists at NFS, which would occur in the 300-Complex Area.

The NFS facility is one of only two commercially licensed facilities in the United States capable of providing HEU processing services. The license includes both the recovery and blending of HEU. NFS facilities blend uranium in UNH form. NFS is licensed to possess up to 7,000 kg (15,000 lb) of U-235 in any chemical or physical form and at any enrichment. The total quantities of the HEU and uranium oxide blendstock required for the proposed action might exceed these limits; therefore it might be necessary to increase the licensed possession limits or to schedule and stage the receipt and processing of these materials so that the quantity of uranium on site would not exceed NRC requirements.

New construction of facilities would not be required at NFS to blend HEU to LEU as UNH. No capabilities exist for the conversion of HEU to UF_6, and modifications to the interior of buildings, mainly new equipment installation, would be required along with license modification before the UF_6 blending process could be performed.

Environmental Impacts

The HEU EIS assesses the direct, indirect, and cumulative environmental consequences of reasonable alternatives under consideration for each of the potentially affected DOE and commercial blending candidate sites.

Basis for Analysis

A number of key assumptions form the basis for the analyses of impacts presented in the HEU EIS. If these assumptions change substantially, DOE will conduct additional NEPA review as appropriate.

- The EIS analyses are based on the disposition of a nominal 200 t of HEU. This amount includes HEU that is currently surplus, as well as additional HEU (not yet identified) that may be declared surplus in the future. The analysis also addresses the expected impacts that would result from the proposed transfer of 7,000 t of NU to USEC.

- The EIS addresses all surplus HEU, in various forms including metals and alloys, oxides and compounds, and solutions, with enrichment levels of 20 percent or greater by weight of the isotope U-235. To assess potential environmental impacts, the blending analyses in the EIS are based on the assumption that surplus HEU is enriched to 50-percent U-235. That assumption is based on an assessment of the relevant portion of materials in the surplus inventory. The relative impacts of blending HEU of different enrichment levels are expected to be either unchanged or essentially proportional, depending on the resource. Therefore, it is reasonable to use 50 percent as the enrichment level for purposes of analysis in the HEU EIS.

- Surplus HEU can be blended down to approximately 4-percent (more or less depending on market demand) LEU for fabrication as fuel in commercial reactors. The representative enrichment level of 4 percent was selected for commercial fuel based on current fuel vendor experience, which ranges between 3 and 5 percent.

- If the enrichment level is reduced to approximately 0.9 percent (depending upon waste acceptance criteria), LEU approaches an NU enrichment state and becomes suitable for disposal as LLW. This enrichment level was selected for waste disposal based on current LLW disposal experience both in the United States and Europe where similar types of waste have been disposed of with an enrichment level slightly greater than 1-percent U-235. This low enrichment level ensures that an inadvertent criticality would not occur. The actual enrichment level of the waste material would be dictated ultimately by the waste acceptance criteria for the selected LLW disposal site.

- The data for UNH and UF_6 blending (for commercial fuel) were based on an HEU throughput of 10 t/yr with an average starting U-235 enrichment of 50-percent HEU blended to a final enrichment of 4-percent U-235 LEU. The data for blending HEU as UNH to 0.9-percent enrichment LEU were based on an HEU throughput of 2.1 t/yr with an average U-235 enrichment of 50 percent. The data for metal blending were based on an HEU throughput of 3.1 t/yr with an average of 50 percent U-235 enrichment level blended to 0.9-percent U-235 enrichment. Since HEU exists in a variety of forms (metal, oxides, alloys, compounds, and solutions), conservative scenarios (those that exhibit the highest potential for environmental impact) were assumed for preprocessing of HEU prior to blending. The assumed blending rates are based on dilution ratios for blending and reasonable judgment about anticipated blending capability and capacity. Actual blending rates will be based on market conditions, blending facility capabilities and capacities, DOE's ability to make the material available, blending contract limitations, and legislative requirements to avoid adverse material impacts on the domestic uranium industry. The blending rates analyzed do not always correspond to the actual capacities of the four sites, but are rates that have been selected for analysis so a comparison can be done of impacts among the sites. All the sites could process material at the analyzed rates.

- Surplus HEU is currently located at 10 DOE sites around the country (See Figure S–1). Most of the unirradiated surplus HEU that is not already at the Y–12 Plant is being moved there for pre-storage processing and interim storage. Therefore, for the purposes of the HEU EIS, it is assumed that most of the surplus HEU will originate from the Y–12 Plant. Two locations where surplus HEU exists (Portsmouth and SRS) may not relocate their HEU to Y–12. Surplus HEU could either be blended at these sites (in the case of SRS) or sent directly to commercial blending sites. The environmental impacts of the proposed transfer of HEU to the Y–12 Plant and its storage there are analyzed in the Y–12 EA.

- Several types of blendstock material could be used during the blending of HEU, such as DU, NU, or LEU. LEU in UF_6 form would be shipped from ORR; Paducah, Kentucky; or Portsmouth (or Piketon), Ohio. The DOE site in Fernald, Ohio, has LEU in metal and oxide form. DU blendstock is available in metal, oxide, and UF_6 forms and may be obtained from Portsmouth, Paducah, Y–12, SRS, Hanford, or Fernald. The NU blendstock could be purchased from domestic uranium producers or obtained from one of the same DOE sites where LEU is available. For the purposes of the EIS transportation analyses, one route (Hanford to all potential blending sites) is used as representative for all the potential shipping routes associated with both the domestic and DOE NU blendstock suppliers, because it is the longest distance from the blending sites.

- The Department of Energy's NTS is used as a representative site to evaluate transportation impacts from the blending sites to a waste disposal site. If another LLW disposal facility is identified, the route-specific transportation impacts may be provided in tiered NEPA documentation, as appropriate.

[Text deleted.]

- No construction of new facilities is proposed or, with the possible exception of SRS, would be required; any expanded capabilities can be accommodated through modification or addition of process equipment in existing facilities. SRS currently does not have a solidification or crystallization facility to convert UNH solutions (for 4 percent enrichment) to UNH crystals as described previously in the candidate sites section. However, impacts were assessed (for UNH blending) in the HEU EIS as if solidification could be performed at SRS. Should new facilities be proposed to add solidification capability at SRS, there would be land disturbance and minor air emissions associated with construction (among other things), and appropriate NEPA review would be conducted at that time if necessary.

- The B&W site and NFS are analyzed for siting new UF_6 capability because these are the only commercial sites that have NRC licenses to process HEU. The addition of new equipment in existing facilities would be required to provide UF_6 capability at those sites. UF_6 blending would not be used to blend surplus HEU to waste, because the process is similar to UNH but includes additional steps. It would only be used to make fuel for the commercial reactor industry. It would not be reasonable to add UF_6 blending capability at DOE sites for blending to commercial fuel feed, and this alternative is not discussed in the EIS due to the capital investment required, the limited use, if any, of such capability for other DOE missions, and environmental concerns that would need to be accommodated. [Text deleted.]

MAJOR COMMENTS RECEIVED ON THE *DISPOSITION OF SURPLUS HIGHLY ENRICHED URANIUM DRAFT ENVIRONMENTAL IMPACT STATEMENT*

The Department of Energy issued the HEU Draft EIS for public comment in October 1995, and provided a public comment period from October 27, 1995 until January 12, 1996. Public workshops on the HEU Draft EIS were held in Knoxville, Tennessee, on November 14, 1995, and in Augusta, Georgia, on November 16, 1995.

During the 78-day public comment period on the HEU Draft EIS, DOE received comments on the document by mail, fax, telephone recording, electronic mail, and orally at the two public workshops. Altogether, DOE received 468 written or recorded comments from 197 individuals or organizations, plus 220 oral comments provided by some of the 130 individuals who attended the public workshops. All of the comments are presented in Volume II of the HEU Final EIS, the *Comment Analysis and Response Document*.

The major themes that emerged from public comments on the HEU Draft EIS were as follows:

- There was broad support for the fundamental objective of transforming surplus HEU to non-weapons-usable form by blending it down to LEU (for either fuel or waste). However, a few commentors argued that surplus HEU should be retained in its present form for possible future use, either in weapons or breeder reactors.

- Among those who submitted comments, there was substantial opposition to commercial use of LEU fuel derived from surplus HEU because the commentors believed that such use increases proliferation risk by creating commercial spent nuclear fuel, which includes plutonium. Commentors who opposed commercial use generally supported blending surplus HEU to LEU for disposal as waste.

- Substantial concern was expressed by elements of the uranium fuel cycle industry that the entry into the market of LEU fuel derived from surplus HEU from Russian and U.S. weapons programs would depress uranium prices and possibly lead to the closure of U.S. uranium mines, conversion plants, or enrichment plants.

- Several electric utilities that operate nuclear plants and one uranium supplier expressed the belief that LEU fuel derived from surplus HEU would enter the market at a time when worldwide production is expected to fall considerably short of demand and prices are expected to be rising substantially, which in fact has occurred over the course of completing the HEU EIS. These commentors believed that the likely impact of market sales of LEU fuel derived from surplus HEU would be to moderate sharp price escalation.

- Several commentors argued that "blend and store" options should have been evaluated in the EIS.

- Many commentors expressed support for or opposition to the use of particular facilities for surplus HEU disposition actions.

- A few commentors expressed concern regarding the projected worker latent cancer fatality consequences for facility accidents.

- Numerous commentors wanted to see a formal economic analysis of the alternatives included in the EIS.

CHANGES IN THE *DISPOSITION OF SURPLUS HIGHLY ENRICHED URANIUM FINAL ENVIRONMENTAL IMPACT STATEMENT* IN RESPONSE TO COMMENTS

In response to comments received on the HEU Draft EIS as well as other changes in circumstances, the HEU Final EIS has been modified in the following respects:

- The discussion of potential impacts on the uranium industry (Section 4.8 of the HEU Final EIS) has been augmented to reflect the enactment of the *USEC Privatization Act* (Public Law 104-134), and to better reflect the cumulative impacts in light of the U.S.-Russian Agreement to purchase Russian HEU blended down to LEU.

- The discussion of the rates of disposition actions that could result in commercial sales of LEU has been modified in Table S–1 (and Table 2.1.2–1 in the HEU EIS) and throughout the document to better reflect the current assessment of the time required for DOE to make surplus HEU available for disposition, and the legislative requirement to avoid adverse material impacts on the domestic uranium mining, conversion, or enrichment industries (Public Law 104-134, Section 3112(d)(2)(B)).

- The assessment of impacts to noninvolved workers and the public from accidental releases (radiological) was revised to improve realism in the calculation of doses and the results were incorporated into Chapters 2 and 4 of the HEU Final EIS.

- The HEU Final EIS has been modified to reflect the fact that SRS has effectively lost the ability to perform metal blending and currently lacks the ability to solidify and crystallize material at the 4-percent enrichment level. SRS is now assessed only for UNH blending, and the fact that other arrangements must be made for solidification of commercial-enrichment material is reflected.

- A separate Floodplain Assessment (and Proposed Statement of Findings) has been added to the HEU Final EIS (Section 4.13) pursuant to 10 CFR Part 1022. This assessment is based, in large part, on information that was presented in the water resources sections of the HEU Draft EIS. The discussion of potential flooding at the NFS site has been expanded in response to comments.

- Several changes have been made to the cumulative impacts section (Section 4.6) to reflect changes in the status of other projects and their associated NEPA documents.

- Numerous other minor technical and editorial changes have been made to the document.

UNCHANGED DEPARTMENT OF ENERGY POLICY POSITIONS

Some DOE policy positions have remained unchanged between the Draft and the HEU Final EIS notwithstanding significant comments that counseled a different approach:

- A substantial number of comments opposed commercial use of LEU fuel derived from surplus HEU. These commentors maintained that commercial use increases proliferation risks by creating plutonium-containing spent nuclear fuel. DOE does not agree, however, that spent nuclear fuel poses proliferation risks.[19] Furthermore, reactors that might use LEU fuel derived from surplus HEU would simply use other fuel obtained from NU if the LEU fuel derived from surplus HEU did not exist, so there would be no increase in spent fuel and no increase in Pu created in that spent fuel.

- Most of the comments that opposed commercial use of LEU derived from surplus HEU also expressed opposition to commercial nuclear power in general. Because of the rate that LEU derived from surplus HEU would be made available (due to market prices, market supply, DOE's ability to make the material available, and legislative requirements), the proposed HEU disposition would be neutral in its impacts on commercial nuclear power. The program would not depend on or require any resurgence in the construction of nuclear power plants in the United States.[20] Furthermore, commercial use of LEU (derived from surplus HEU) would make beneficial use of a valuable resource, offsetting the costs of disposition actions, and minimizing adverse environmental impacts (when

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[19]Although spent fuel contains Pu, which if separated is a weapons-usable fissile material, spent fuel is extremely radioactive and hazardous to handle and, thus, it is difficult and costly to separate Pu from spent fuel. In accordance with recommendations of the National Academy of Sciences, it is the policy of the United States to make weapons-usable fissile materials at least as proliferation-resistant as commercial spent fuel.

[20]Discussion of the merits of commercial nuclear power production is beyond the scope of this document.

compared to blending down to waste, for example).

- Numerous commentors expressed a wish to participate in all aspects of DOE's decisionmaking, including the evaluation of economic considerations. An economic analysis of the alternatives has been prepared to aid the decisionmaker, and is available for public comment separately from the HEU Final EIS. (This analysis has been disseminated to all commentors who expressed an interest in it.)

- The Department of Energy received comments suggesting that the alternative of blending some or all of the HEU to 19-percent LEU and storing it should be evaluated. This option was considered by the screening committee for fissile materials disposition as a specific option (the screening process is explained in Chapter 2 of the HEU Final EIS). However, this alternative is not reasonable because it would delay final disposition, present criticality concerns (for transportation and storage before blending down) that would need to be accommodated, delay recovery of the economic value of the material, and add storage costs. Furthermore, this option would be practically applicable to only a small portion (20 t or about 40 t if an SRS crystallization facility is subsequently proposed and constructed) of the current surplus HEU inventory.[21]

[21] Of the approximately 175 t of current surplus HEU inventory, approximately 62 t is irradiated fuel and other non-commercial material, 10 t is under IAEA safeguards, and 63 t has either already been transferred or is proposed to be transferred to USEC. The remaining 40 t of potentially commercial HEU includes 20 t of metal at (or destined for) Y–12 and another 20 t at SRS which is in forms (such as solutions) that could not be stabilized (after blending down) for transportation to other sites without construction of a solidification or crystallization facility, and/or without added transportation and safety concerns that would need to be accommodated. SRS material could most reasonably be blended using UNH on site. Since SRS does not currently have a solidification or crystallization facility to make the blended down material stable for storage, it appears reasonable to consider the blend to 19 percent and store option only for the 20 t at Y–12.

Summary of Alternatives Analysis

The analysis of the impacts of the alternatives in Tables S–2 and S–3 is based on four particular points on the fuel/waste spectrum: 0-percent, 25-percent, 65-percent, and 85-percent fuel use. The reader could calculate a reasonable estimate of the impacts of other points on the fuel/waste spectrum by interpolating the results as presented. For example, the impacts of a 75/25 fuel/waste ratio for a given set of sites would be between those presented for Alternatives 4 (65/35) and 5 (85/15) for the same sites.

The impacts for particular sites could also be approximated for different combinations of sites than those analyzed below. To determine the impacts of blending a different quantity of material at a particular site, the assumed quantity can be divided by the appropriate process rate (10 t/yr for blending to fuel as UF_6 or UNH, 3.1 t/yr for blending to waste as metal, and 2.1 t/yr for blending to waste as UNH) to yield the time period necessary to blend that quantity at that rate. Multiplying the resultant time period by the annual impact figures for resource areas that are additive (site infrastructure, water, radiological exposure, waste management, and transportation) yields the total impacts for that quantity and site. For the remaining resources (air quality, socioeconomics, and chemical exposure), the annual impact would be the maximum of any blending process used in that blending scenario for that site.

The analyses are based in part on DOE's ability to supply HEU to one or more sites at the process blending rates. If, as is expected, DOE is unable to supply material to multiple sites at the blending rates analyzed (for example, 10 t/yr to all four sites), the impacts in a given year would be reduced accordingly; however, since the impacts in this section are based upon blending the entire 200 t, the total campaign impacts would be similar to those described in the EIS, only spread over a longer time period.

[Text deleted.]

The analyses support several preliminary conclusions. For most resource areas, the impacts decrease as the portion of material blended for commercial use increases. This conclusion is based on the analysis of impacts from blending operations and transportation of materials only. It does not include the impacts from the endpoints: use of commercial nuclear fuel in reactors (and management of the resulting spent fuel) or disposal of LLW. These impacts are or will be assessed as part of the licensing process for nuclear plants, or as existing or anticipated environmental documents for sites for disposal of the LLW and spent fuel (such as the sitewide EIS for NTS, and an anticipated EIS concerning a potential repository for commercial spent fuel). Since the use of LEU derived from HEU in reactors would supplant the use of LEU from mined uranium, the preferred alternative would involve no incremental use of nuclear fuel (or spent fuel to be managed) than that which would otherwise occur. In contrast, the LLW to be disposed of from HEU that is blended to waste does represent an incremental quantity of LLW that would not have been disposed of in the absence of this proposed action. This distinction, together with the avoided environmental impacts from uranium mining, milling, and enrichment, further enhances the preferability of maximizing commercial use of surplus HEU.

The analyses show some differences between the impacts of the different blending processes. For example, for blending to waste, metal blending generates considerably more process LLW than does UNH blending.

Impacts on Uranium Mining and Nuclear Fuel Cycle Industries

The impacts of surplus HEU disposition on the uranium mining, conversion, and enrichment sectors will depend in large part on the degree to which supply and demand in the nuclear fuel market is balanced during the period of delivery to the market. Because the disposition of U.S. surplus HEU—taken together with the purchase of LEU derived from Russian HEU pursuant to the U.S.-Russian HEU Agreement—would increase the supply of LEU, there is the potential for adverse material impacts on domestic markets.

The *USEC Privatization Act*, which was signed into law in April 1996, authorizes sales from DOE's stockpiles of uranium, including LEU derived from HEU. Such sales may not be made unless the Secretary determines that the sale will not have an adverse material impact on the domestic uranium mining, conversion, or enrichment industry, taking into account the sales of uranium under the Russian HEU Agreement and the Suspension Agreement (Public Law 104-134, Section 3112(d)). The Act also specifies numerical limits, with certain exceptions, on annual deliveries to commercial end-users of material from Russian HEU obtained pursuant to the Russian HEU Agreement and material from the 50 t of U.S. HEU that is proposed to be transferred to USEC as part of Alternatives 3, 4, and 5 in this EIS.

The transfer of U.S.-origin HEU to commercial end users is not expected to have an adverse material impact on the nuclear fuel cycle industries. Although some impacts to each of the industry sectors (uranium mining and milling, uranium conversion, and uranium enrichment) would result from the proposed action, these impacts are likely to be minor and temporary. There are several factors that will ameliorate potential adverse economic impacts to these sectors.

- The *USEC Privatization Act* limits the delivery of both U.S. and Russian HEU to end users so as to avoid adverse material impacts on domestic production.
- Transfer of the U.S. HEU to end users would peak when Russian transfers are still small, thus limiting the cumulative impacts.
- Short term demand for uranium products (oxide, UF_6, and LEU) is currently strong, with producers in each of the affected sectors operating at highest capacities.

The cumulative impacts from the U.S.-origin HEU and the Russian HEU would vary over the period of delivery. During the period from 1995 to 2000, impacts to the nuclear fuel cycle industries would be minimal because of the limitations on deliveries to end users pursuant to the *USEC Privatization Act*. The largest cumulative impacts to these industries would occur during the period from 2000 to 2009, during which deliveries of U.S.-origin HEU to end users would peak under the Preferred Alternative and delivery allowances of Russian HEU would also increase on a yearly basis. During this period, the surplus U.S. and Russian HEU could displace up to 40 percent of the domestic uranium oxide production. However, most of the displacement would be due to the Russian HEU.[22]

The impacts on the conversion and enrichment sectors would appear to be smaller than for the uranium mining and milling sector. World demand for conversion services is projected to be strong during this period, and as stated earlier, all commercial plants are expected to be operating at almost full capacity in the foreseeable future. The enrichment sector would also suffer some displacement of its services. However, the loss of some market in the short term is not expected to result in significant employment impacts. After the year 2009, the U.S.-origin HEU would be almost fully commercialized, and any impacts to domestic nuclear fuel cycle industries would be solely attributable to the Russian HEU.

IMPACTS OF TRANSFERRING NATURAL URANIUM TO THE UNITED STATES ENRICHMENT CORPORATION

The proposal to transfer title to 50 t of surplus HEU to USEC includes the transfer of title to 7,000 t of NU now owned by DOE. This material is in the form of UF_6 and is part of a larger quantity of UF_6 that is in storage at DOE's Portsmouth and Paducah gaseous diffusion plants, which are currently being leased to USEC for uranium enrichment operations.[23] The NU was originally purchased by DOE to be enriched for use in nuclear weapons, but is no longer needed for that purpose.

The most likely disposition of the 7,000 t of NU is eventual use as feedstock for enrichment to nuclear power plant fuel, the usual business of the enrichment plants. If it is so used, and follows the typical path of NU that is enriched for commercial use, it would probably be enriched to about 2-percent U-235 at the Paducah plant, and would then be transported to the Portsmouth plant for additional enrichment to an appropriate commercial enrichment, generally about 4 percent. From there the enriched UF_6 would be transported to a commercial fuel fabrication plant for conversion and fabrication of nuclear fuel. The ongoing normal operations of the enrichment plants, including transportation of materials, are covered by existing NEPA documents.[24]

The shipment of 7,000 t of NU (0.71-percent enrichment) in UF_6 form from Paducah to the Portsmouth plant has been evaluated in the HEU EIS. The total health risk would be 0.129 fatalities for the entire 7,000 t. If the material is enriched to 2-percent LEU before transport, the 7,000 t of NU would be reduced to 2,490 t. The total health risk would be 0.0458 fatalities for the 2,490 t. These impacts include the loading and unloading of trucks and the return of empty vehicles to the origin.

ENVIRONMENTAL JUSTICE IN MINORITY AND LOW-INCOME POPULATIONS

An environmental justice analysis was performed to assess whether the proposed action or alternatives could cause disproportionate adverse health impacts on minority and low-income populations residing in communities around the candidate sites. The analysis was conducted using a two-step process. First, a demographic analysis was performed for all of the 1990 Census tracts located within an 80-km (50-mi) radius of the candidate sites. The demographic data were also summarized for the region of influence (ROI), the area most directly affected by the proposed actions and the area where at least 90 percent of the workers reside. The second step

[22]Also contributing to cumulative impacts would be the 7,000 t of NU that is proposed to be transferred to USEC along with 50 t of HEU. The marginal impact of this material on the uranium mining and conversion sectors is expected to be modest, as the rate of its delivery to end users is limited by the *USEC Privatization Act* (Section 3112 (c)(2)), and it is expected to be commercialized in the early years before Russian shipments increase to substantial levels. The NU would not impact the enrichment sector, as it would still need to be enriched.

[23]Any future proposal to sell the remaining inventory of NU in the form of UF_6 would be to conduct separate NEPA review as appropriate.

[24]Energy Research and Development Administration (ERDA), 1977, *Final Environmental Statement, Portsmouth Gaseous Diffusion Plant Expansion, Piketon, OH*, ERDA-1549, Washington, DC; ERDA, 1977, *Final Environmental Impact Statement, Portsmouth Gaseous Diffusion Plant Site, Piketon, OH*, ERDA-1555, Washington, DC; U.S. Department of Energy, 1982, *Final Environmental Impact Assessment of the Paducah Gaseous Diffusion Plant Site, Paducah, KY*, DOE/EA-0155, Washington, DC.

involved performing public health impact analyses to assess whether vulnerable populations would be disproportionately affected by facility operations through routine and accidental releases of radiation and toxic emissions.

Selected demographic characteristics of the ROI for each of the four candidate sites are analyzed to show Census tracts where racial minority populations comprise 50 percent or more (simple majority) of the total population in the Census tract, or where racial minority populations comprise less than 50 percent, but greater than 25 percent, of the total population in the Census tract, or where low-income populations (income of less than $8,080 for a family of two) comprise 25 percent or more of the total population in the Census tract). [Text deleted.]

Any impacts to surrounding communities would most likely result from toxic/hazardous air pollutants and radiological emissions. Public and occupational health impacts from normal operations show that air emissions and releases are low and are within regulatory limits. The analysis also shows that cumulative effects of continuous operation over time would result in low levels of exposure to workers and the public. The public health impact analysis conducted for all alternatives estimates that the maximum additional cancer fatalities from accident-free operational activities would occur at ORR from either the blending of HEU to LEU as UNH for commercial fuel or the blending of HEU to LEU as metal. Under all blending alternatives, the maximum radiation dose to the maximally exposed individual of the public is 2.0 millirem (mrem) annually, and the fatal cancer risk is 2.0×10^{-5} for 20 years for normal operations. For postulated accidents, the maximum latent cancer fatalities per accident to the maximally exposed individual of the public ranges from 5.7×10^{-4} to 1.9×10^{-2}; the total campaign risk (cancer fatality probability for the total campaign) ranges from 1.4×10^{-6} to 1.7×10^{-5}. The maximum latent cancer fatalities per accident for the alternatives in the population within 80 km (50 mi) ranges from 6.9×10^{-2} to 1.4; the total campaign risk ranges from 1.6×10^{-4} to 1.2×10^{-3}. The probability of the severe accidents is about 10^{-4} per year and ranges from about 10^{-3} to 10^{-5}. Given the low probability of these accidents, there would not be any disproportionate risk of significant adverse impacts to particular populations, including low-income and minority populations, from accidents. Except for SRS, the analysis of the demographics data for the communities surrounding the candidate sites indicates that even if there were high and adverse health risks to these communities, the impacts would not appear to disproportionately affect minority or low-income populations.

Comparison of Alternatives

A comparison of the site-specific environmental impacts of the surplus HEU disposition alternatives is presented in this section. The combined impacts of each alternative for the disposition of the 200 t of surplus HEU inventory, which may involve multiple technologies, sites, and end products, are summarized. The annual operational impacts of each of the blending technologies for various resources at all candidate sites are fully described in Sections 4.3 and 4.4 of the HEU EIS.

For each alternative analyzed other than the no action alternative, there are two potential processes for blending to commercial fuel (UNH and UF_6) and two potential processes for blending to waste (UNH and metal). The impacts and, in the case of blending to waste, the processing rate of the respective processes differ. In other words, the magnitude of expected impacts and the time required to complete disposition actions depend on the process selected.

Material could be blended to waste at the two DOE sites using UNH blending; however, at ORR either UNH or metal blending could be used for blending to waste. Similarly, material could be blended to commercial fuel feed at the two commercial sites using either UNH or UF_6 blending. To provide conservatism in the site-specific analyses below, where there is such a choice of applicable processes at a site (that is, blending to waste at DOE's ORR [Y–12 Plant] and blending to commercial fuel feed at the commercial sites), the value given for each resource area is based on whichever process produces the greatest impact.

For blending to waste at DOE sites, the UNH process would produce the greatest impact in all resource areas except three. The metal process would produce the greatest impacts for liquid LLW generated, solid LLW generated, and solid LLW after treatment. Therefore, the analyses below conservatively use the metal impacts for these three resource areas and the UNH impacts for all other resource areas at Y–12.

For blending to commercial fuel feed at the commercial sites, the UF_6 process would produce the greatest impacts in all resource areas except three. The UNH process would produce the greatest impacts for liquid hazardous waste generated, solid nonhazardous waste after treatment, and transportation. The analyses below conservatively use the UNH impacts for these three resource areas, and the UF_6 impacts for all other resource areas.

The analyses indicate that all four sites have the capacity to process material with minimal impacts to workers, the public, or the environment during normal operations. For the two DOE sites, the generation of waste based on an increased usage of utilities represents small increases—less than 5 percent over current operations. For the two commercial sites, the generation of waste based on an increased usage of utilities represents increases of over 20 percent, but both facilities have adequate capacities to accommodate the increases since neither site is currently operating at full capacity. The NFS site would require a large increase in water usage (166 percent) and fuel requirements (933 percent). [Text deleted.] Because the quantity of water and fuel used in the past for similar operations is comparable to that used for the proposed action and in the analyses in the HEU EIS, it is anticipated that the increase in these requirements can easily be accommodated at NFS.

A comparison of the incremental environmental impacts of the HEU disposition alternatives is summarized in Tables S–2 and S–3. Table S–2 compares the total campaign and maximum incremental impacts for each resource and alternative at each of the four alternative blending sites. Table S–3 presents the summary comparison of total campaign maximum incremental impacts for each alternative. In addition, impacts associated with no action are included for a baseline comparison.

Impacts shown in Tables S–2 and S–3 are based on the maximum impact for each resource at each site (that is, the maximum electricity needed for either UNH or UF_6 blending to fuel or UNH or metal blending to waste) using a 10 t/yr processing rate for commercial blending and a 2.1 or 3.1 t/yr processing rate for blending to waste. These processing rates (analyzed in the HEU EIS) were also used to determine the duration of commercial blending for each alternative. If two sites were used for commercial blending, a total of 20 t would be blended annually (10 t/yr at each site) and would take 4 years to blend 80 t of HEU, whereas, in the case of 4 sites, a total of 40 t/yr would be blended continuing over a period of 2 years to blend 80 t. However, as shown in Table S–1, DOE expects to make only 8 t of surplus HEU available for commercial use annually due to material availability, market conditions, and legislative requirements which would reduce the annual processing rate for each site when multiple sites are used. Therefore, because total campaign impacts presented in Table S–2 use incremental impacts estimated for each resource using the processing rates analyzed in this EIS, they represent upper bound total campaign impacts. If surplus HEU is made available at less than the combined capacity of blending sites, it would take longer to blend the surplus inventory to commercial fuel. In such a case, total campaign impacts are anticipated to be roughly the same, but would be realized at lower rates over a longer period of time.

Table S–2. Summary Comparison of Maximum Incremental Impacts for Each Alternative and Candidate Site

Alternative 1: No Action

Site Infrastructure Baseline Characteristics (No Action)

Site	Y–12	SRS	B&W	NFS
Electricity (MWh/yr)	420,500	659,000	64,700	21,800
Electric peak load (MWe)	62	130	14.3	3.5
Diesel/oil (l/yr)	0	28,400,000	470,000	36,000
Natural gas (m^3/yr)	66,000,000	0	2,850,000	12,900
Coal (t/yr)	2,940	210,000	0	0
Steam generation (kg/hr)	99,000	85,400	1,460	6,260
Water usage (l/yr)	7,530,000,000	153,687,000,000	195,000,000	57,000,000

Note: MWh=megawatt hour; MWe=megawatt electric; l=liter; m^3=cubic meter.

Source: Derived from tables in Section 4.2 of the EIS.

Estimated Ambient Concentrations of Criteria Pollutants From Existing Sources at Each Candidate Site Boundary (No Action)

Pollutant	Averaging Time	Most Stringent Regulations or Guidelines (μg/m³)	Y–12 (μg/m³)	SRS (μg/m³)	B&W (μg/m³)	NFS (μg/m³)
Carbon monoxide (CO)	8 hours	10,000[a]	5	22	4	1.97
	1 hour	40,000[a]	11	171	13.1	2.52
Lead (Pb)	Calendar Quarter	1.5[a]	0.05	0.0004	[b]	[b]
Nitrogen dioxide (NO_2)	Annual	100[a]	3	5.7	3.5	0.62
Particulate matter (PM_{10})	Annual	50[a]	1	3	0.02	0.03
	24 hours	150[a]	2	50.6	0.16	0.21
Sulfur dioxide (SO_2)	Annual	80[a]	2	14.5	0.34	0.02
	24 hours	365[a]	32	196	2.28	0.15
	3 hours	1,300[a]	80	823	11.8	0.35
Mandated by South Carolina, Tennessee, and Virginia						
Total suspended particulates (TSP)	Annual	60[c]	1[d]	12.6	0.03	0.03[d]
	24 hours	150[c]	2	47[d,e]	0.22	0.21
Gaseous fluorides (as HF)	1 month	0.8[c]	0.2	0.09	[b,d]	0.02
	1 week	1.6[c]	0.3	0.39	[b,d]	<0.06
	24 hours	2.9[c]	<0.6	1.04	[b,d]	0.06
	12 hours	3.7[c]	<0.6	1.99	[b,d]	0.1
	8 hours	250[c]	0.6	<2.99[d]	[b,d]	0.11

[a] Federal standard.

[b] No emissions from processes used at the site.

[c] State standard or guideline.

[d] No State standard.

[e] Based on maximum measured SRS ambient monitoring data for 1985.

[Text deleted.]

Note: Ozone, as a criteria pollutant, is not directly emitted or monitored by the candidate sites. Pollutant concentrations shown for Y–12 include other ORR operations; m^3=cubic meter.

Source: Derived from tables in Section 4.2 of the EIS.

Table S–2. Summary Comparison of Maximum Incremental Impacts for Each Alternative and Candidate Site—Continued

Socioeconomic Parameters Baseline Characteristics (No Action)

Site	ORR	SRS	B&W	NFS
Employment	15,273	19,208	1,846	325
Payroll (million $)	523	1,149[a]	80	13.2
Regional Economic Area				
Employment				
1995	462,900	243,800	321,400	253,800
2000	488,700	259,400	334,700	265,500
Unemployment (%)				
1994	4.9	6.7	4.9	5.9
Per capita income				
1995 ($)	18,200	17,800	18,000	16,800
2000 ($)	19,214	18,930	18,788	17,594
Region of Influence				
Population				
1995	519,300	477,600	219,900	322,600
2000	548,200	508,300	229,000	337,600
Housing units				
1995	222,000	189,400	90,500	135,700
2000	234,400	201,600	94,300	141,900
[Text deleted.]				

[a] Total payroll for 1992 is based on 1990 employee wage and 1992 total number of employees (SRS 1995a:4).

Source: Derived from tables in Section 4.2 of the EIS.

Potential Radiological Impacts to Workers and the Public Resulting From Normal Operations Baseline Characteristics (No Action)

Receptor	ORR	SRS	B&W	NFS
Natural background radiation dose (mrem/yr)	295	298	329	340
Average worker (mrem/yr)	4	17.9	10	50
Fatal cancer risk for 20 years	3.2×10^{-5}	1.4×10^{-4}	8.0×10^{-5}	4.0×10^{-4}
Maximum worker exposure (mrem/yr)	2,000	3,000	3,300	470[a]
Maximally exposed member of public (mrem/yr)	2[b]	0.32	5.0×10^{-2}	3.3×10^{-2}
Fatal cancer risk for 20 years	2.0×10^{-5}	3.2×10^{-6}	5.0×10^{-7}	3.3×10^{-7}
Total worker dose (person-rem/yr)	68	216	18	16.3
Number of fatal cancers for 20 years	0.54	1.7	0.14	0.13
Total population dose (person-rem/yr)	28	21.5	0.35	0.2
Number of fatal cancers for 20 years	0.28	0.22	3.5×10^{-3}	2.0×10^{-3}

[a] Representative of one-half year.

[b] Representative of air and liquid media only; an additional 1 mrem/yr may be incurred due to direct exposure.

Note: mrem=millirem; rem=roentgen equivalent man.

Source: Derived from tables in Section 4.2 of the EIS.

Table S–2. Summary Comparison of Maximum Incremental Impacts for Each Alternative and Candidate Site—Continued

Potential Hazardous Chemical Impacts[a] to Workers and the Public Resulting From Normal Operations Baseline Characteristics (No Action)

Receptor	ORR	SRS	B&W	NFS
Maximally Exposed Individual				
Hazard index[b]	3.95×10^{-2}	5.16×10^{-3}	1.15×10^{-5}	9.55×10^{-2}
Cancer risk[c]	0	1.31×10^{-7}	1.68×10^{-8}	0
Onsite Worker				
Hazard index[d]	0.154	1.16	4.07×10^{-3}	7.57×10^{-3}
Cancer risk[e]	0	1.94×10^{-4}	3.94×10^{-5}	0

[a] Includes any background emissions that would be present at the site in the absence of site operations plus site emissions that exist at the present time.

[b] Hazard index=sum of individual hazard quotients (noncancer adverse health effects) for maximally exposed individual.

[c] Lifetime cancer risk=(emissions concentrations) x (0.286 [converts concentrations to doses]) x (slope factor).

[d] Hazard index=sum of individual hazard quotients (noncancer adverse health effects) for workers.

[e] Lifetime cancer risk=(emissions for 8-hr.) x (0.286 [converts concentrations to doses]) x (0.237 [fraction of year exposed]) x (0.571 [fraction of lifetime working]) x (slope factor).

Source: Derived from tables in Section 4.2 of the EIS.

Baseline Characteristics for Annual Waste Generated (No Action)

Waste Category	ORR	SRS	B&W	NFS
Low-Level				
Liquid (m^3)	2,576	0	50,005	18,900
Solid (m^3)	8,030	14,100	620	3,000
Mixed Low-Level				
Liquid (m^3)	84,210	115	0	<1
Solid (m^3)	960	18	14	<1
Hazardous				
Liquid (m^3)	32,640	Included in solid	55,115	<1
Solid (m^3)	1,434	74	0	<1
Nonhazardous				
Liquid (m^3)	1,743,000	700,000	576,160	56,700
Solid (m^3)	52,730	6,670	1,700	2,300

Note: m^3=cubic meter

Source: Derived from tables in Section 4.2 of the EIS.

Table S–2. Summary Comparison of Maximum Incremental Impacts for Each Alternative and Candidate Site—Continued

Alternative 2: No Commercial Use (0/100 Fuel/Waste Ratio)

Total Campaign[a] Site Infrastructure Incremental Impacts Using All Four Sites (200 t to waste)

Characteristic	Y–12	SRS	B&W	NFS	Total
Electricity (MWh)	119,000	119,000	119,000	119,000	476,000
Diesel/oil (l)	1,352,000	2,024,000	8,004,000	8,004,000	19,384,000
Natural gas (m^3)	471,000	0[b]	471,000	471,000	1,413,000
Coal (t)	8,640	8,640	0[c]	0[c]	17,280
Steam (kg)	207,000	207,000	207,000	207,000	828,000

[a] Total campaign refers to the time required to complete blending disposition actions evaluated for Alternatives 2 through 5. Annual values are presented in Section 2.2.2.

[b] Natural gas is not available at SRS; therefore, liquid petroleum gas (approximately 671,000 l) would be substituted for a natural gas requirement of 471,000 m^3.

[c] Fuel oil is considered the primary fuel at B&W and NFS; therefore, blending facility coal requirements have been converted to a fuel oil energy equivalent. Fuel oil energy content is assumed to be 40,128 BTUs/l, and the coal energy content is assumed to be 30.9 million BTUs/t.

Note: BTU=British thermal unit.

Source: Derived from tables in Section 4.3 of the EIS.

Maximum Air Quality Incremental Impacts Using All Four Sites (200 t to waste)

Pollutant	Averaging Time	Most Stringent Regulation or Guidelines ($\mu g/m^3$)	Y–12 ($\mu g/m^3$)	SRS ($\mu g/m^3$)	B&W ($\mu g/m^3$)	NFS ($\mu g/m^3$)
Carbon monoxide (CO)	8 hours	10,000[a]	11.5	0.07	5.22	0.6
	1 hour	40,000[a]	53	0.14	16.96	0.77
Lead (Pb)	Calendar Quarter	1.5[a]	b	b	b	b
Nitrogen dioxide (NO_2)	Annual	100[a]	1.33	0.01	0.1	0.02
Particulate matter (PM_{10})	Annual	50[a]	0.03	<0.01	0.02	<0.01
	24 hours	150[a]	0.37	<0.01	0.16	0.02
Sulfur dioxide (SO_2)	Annual	80[a]	2.46	0.02	0.27	0.04
	24 hours	365[a]	29.3	0.32	1.82	0.27
	3 hours	1,300[a]	161	0.71	9.41	0.64
Mandated by South Carolina, Tennessee, and Virginia						
Total suspended particulates (TSP)	Annual	60[c]	6.74[d]	0.05	0.02	<0.01[d]
	24 hours	150[c]	80.16	0.88[d]	0.16	0.02
Gaseous fluorides (as HF)	1 month	0.8[c]	b	b	b, d	b
	1 week	1.6[c]	b	b	b, d	b
	24 hours	2.9[c]	b	b	b, d	b
	12 hours	3.7[c]	b	b	b, d	b
	8 hours	250[c]	b	b, d	b, d	b

[a] Federal standard.

[b] No emissions from UNH and metal blending process.

[c] State standard or guideline.

[d] No State standard.

Note: Ozone, as a criteria pollutant, is not directly emitted or monitored by the candidate sites. Pollutant concentrations shown for Y–12 include other ORR operations.

Source: Derived from tables in Section 4.3 of the EIS.

Table S–2. Summary Comparison of Maximum Incremental Impacts for Each Alternative and Candidate Site—Continued

Total Campaign Water Resources Incremental Impacts Using All Four Sites (200 t to waste)

Resource	Y–12	SRS	B&W	NFS	Total
Water (million l)	452	452	452	452	1,808
Wastewater (million l)[a]	446	446	446	446	1,784

[a] Includes sanitary and nonhazardous, nonradioactive (other) liquid discharges after treatment.

Source: Derived from tables in Section 4.3 of the EIS.

Maximum Socioeconomic Incremental Impacts Using All Four Sites (200 t to waste)

Characteristic	Y–12	SRS	B&W	NFS
Direct employment	125	125	125	125
Indirect employment	319	245	283	251
Total jobs	444	370	408	376
Unemployment rate change (percent)	-0.09	-0.14	-0.12	-0.14

Source: Derived from tables in Section 4.3 of the EIS.

Total Campaign Normal Operations Radiological Exposure Incremental Impacts Using All Four Sites (200 t to waste)

Receptor	Y–12	SRS	B&W	NFS	Total
Involved Workers					
Total dose to involved workforce[a] (person-rem)	269	269	269	269	1,076
Risk (cancer fatalities per campaign)	0.108	0.108	0.108	0.108	0.43
Maximally Exposed Individual (Public)					
Dose to maximally exposed individual member of the public (mrem)	0.928	5.95×10^{-2}	4.52×10^{-2}	3.33	NA[b]
Risk (cancer fatality per campaign)	4.64×10^{-7}	2.98×10^{-8}	2.26×10^{-8}	1.67×10^{-6}	NA[b]
Population Within 80 km					
Dose to population within 80 km[c] (person-rem)	3.81	3.81	0.405	28.6	36.6
Risk (cancer fatalities per campaign)	1.91×10^{-3}	1.91×10^{-3}	2.03×10^{-4}	1.43×10^{-2}	1.83×10^{-2}

[a] The involved workforce is 125 for UNH blending and 72 for metal blending.

[b] The dose and the latent cancer fatality for the maximally exposed individual cannot be totaled because they are based on maximum exposure to an individual at each site using site-specific information.

[c] The population within 80 km (50 mi) in the year 2010 is 1,040,000 for Y–12; 710,000 for SRS; 730,000 for B&W, and 1,260,000 for NFS.

Note: NA=not applicable.

Source: Derived from tables in Section 4.3 of the EIS.

Table S–2. Summary Comparison of Maximum Incremental Impacts for Each Alternative and Candidate Site—Continued

Maximum Facility Accidents Incremental Impacts Using All Four Sites (200 t to waste)[a]

Receptor	Y–12	SRS	B&W	NFS
Campaign accident frequency[b]	$2.4x10^{-3}$	$2.4x10^{-3}$	$2.4x10^{-3}$	$2.4x10^{-3}$
Noninvolved Workers[c]				
Latent cancer fatalities per accident	0.4	$8.7x10^{-2}$	0.94	$8.4x10^{-2}$
Risk (cancer fatalities per campaign)	$9.4x10^{-4}$	$2.1x10^{-4}$	$2.2x10^{-3}$	$2.0x10^{-4}$
Maximally Exposed Individual (Public)				
Latent cancer fatality per accident	$5.0x10^{-4}$	$3.1x10^{-6}$	$5.7x10^{-4}$	$1.3x10^{-4}$
Risk (cancer fatality per campaign)	$1.2x10^{-6}$	$7.3x10^{-9}$	$1.4x10^{-6}$	$3.0x10^{-7}$
Population Within 80 km[d]				
Latent cancer fatalities per accident	$6.9x10^{-2}$	$1.6x10^{-2}$	$4.0x10^{-2}$	$5.8x10^{-2}$
Risk (cancer fatalities per campaign)	$1.6x10^{-4}$	$3.8x10^{-5}$	$9.5x10^{-5}$	$1.4x10^{-4}$

[a] The risk values for this alternative are based on the most conservative combination of the options within the alternative (that is, blending 50 t HEU to 0.9-percent LEU as UNH waste at each site).

[b] Values shown represent probability for the life of campaign and are calculated by multiplying annual frequency (10^{-4}) by the total number of years of operation.

[c] The noninvolved workers are workers on site but not associated with operations of the blending and conversion facilities. Involved workers, those that are near an accident, would likely be exposed to lethal doses of radiation, if such an accident were to occur.

[d] The population within 80 km (50 mi) in the year 2010 is 1,040,000 for Y–12; 710,000 for SRS; 730,000 for B&W; and 1,260,000 for NFS.

Source: Derived from tables in Section 4.3 of the EIS.

Maximum Chemical Exposure Incremental Impacts Using All Four Sites (200 t to waste)

Receptor	Y–12	SRS	B&W	NFS
Maximally Exposed Individual (Public)				
Hazard index[a]	$1.92x10^{-3}$	$2.13x10^{-4}$	$6.90x10^{-6}$	$1.01x10^{-2}$
Cancer risk[b]	$2.66x10^{-15}$	$2.30x10^{-16}$	$7.43x10^{-18}$	$1.08x10^{-14}$
Onsite Worker				
Hazard index[c]	$6.30x10^{-3}$	$5.65x10^{-3}$	$2.34x10^{-3}$	$3.21x10^{-3}$
Cancer risk[d]	$8.18x10^{-14}$	$7.35x10^{-14}$	$3.06x10^{-14}$	$4.19x10^{-14}$

[Text deleted.]

[a] Hazard index=sum of individual hazard quotients (noncancer adverse health effects) for maximally exposed individual.

[b] Lifetime cancer risk=(emissions concentrations) x (0.286 [converts concentrations to doses]) x (slope factor).

[c] Hazard index=sum of individual hazard quotients (noncancer adverse health effects) for workers.

[d] Lifetime cancer risk=(emissions for 8-hr) x (0.286 [converts concentrations to doses]) x (0.237 [fraction of year exposed]) x (0.571 [fraction of lifetime working]) x (slope factor).

Source: Derived from tables in Section 4.3 of the EIS.

Table S–2. Summary Comparison of Maximum Incremental Impacts for Each Alternative and Candidate Site—Continued

Total Campaign Waste Generation Incremental Impacts Using All Four Sites (200 t to waste)

Waste Category[a]	Y–12	SRS	B&W	NFS	Total
Low-Level					
Liquid (m^3)	4,510	452	452	452	5,866
Solid (m^3)	8,780	1,640	1,640	1,640	13,700
Mixed Low-Level					
Liquid (m^3)	167	167	167	167	668
Solid (m^3)	0	0	0	0	0
Hazardous					
Liquid (m^3)	262	262	262	262	1,048
Solid (m^3)	0	0	0	0	0
Nonhazardous (Sanitary)					
Liquid (m^3)	428,000	428,000	428,000	428,000	1,712,000
Solid (m^3)	19,500	19,500	19,500	19,500	78,000
Nonhazardous (Other)					
Liquid (m^3)	18,200	18,200	18,200	18,200	72,800
Solid (m^3)	0	0	0	0	0
Solid Low-Level (m^3)[b]	5,810	881	881	881	8,453
Solid Nonhazardous (m^3)[b]	14,100	14,100	14,100	14,100	56,400
LEU Low-Level (m^3)[c]	9,820	9,730	9,730	9,730	39,010

[a] Waste volumes are based on the blending process which produces the highest volume for each category.

[b] Process waste after treatment.

[c] End product waste as a result of blending. Includes irradiated fuel that is currently in the surplus HEU inventory (quantity is classified), which potentially could be disposed of as high-level waste.

Source: Derived from tables in Section 4.3 of the EIS.

Total Campaign Transportation Risk Incremental Impacts Using All Four Sites (200 t to waste)

Receptor	Y–12	SRS	B&W	NFS	Total
Accident-Free Operations					
Fatalities to the public from radiological effects	0.13	0.15	0.15	0.14	0.58
Fatalities to the crew from radiological effects	0.11	0.11	0.11	0.11	0.44
Fatalities to the public from nonradiological effects	1.1×10^{-2}	1.5×10^{-2}	1.7×10^{-2}	1.2×10^{-2}	5.5×10^{-2}
Accidents					
Fatalities to the public from radiological effects[a]	4.3×10^{-3}	4.8×10^{-3}	5.0×10^{-3}	4.8×10^{-3}	1.88×10^{-2}
Fatalities to the public from nonradiological effects	0.4	0.48	0.5	0.45	1.83
Fatalities to the crew from nonradiological effects	0.11	0.14	0.14	0.12	0.51
Total Fatalities	0.77	0.9	0.93	0.84	3.43

[a] The transportation crew and the public are considered as one population for the purposes of radiological accidents.

Source: Derived from tables in Appendix G of the EIS.

Table S–2. Summary Comparison of Maximum Incremental Impacts for Each Alternative and Candidate Site—Continued

Alternative 3: Limited Commercial Use (25/75 Fuel/Waste Ratio)

Total Campaign[a] Site Infrastructure Incremental Impacts Using All Four Sites (50 t to fuel and 150 t to waste)

Characteristic	Y–12	SRS	B&W	NFS	Total
Electricity (MWh)	89,000	89,000	152,000	152,000	482,000
Diesel/oil (l)	1,017,000	1,522,000	7,211,000	7,211,000	16,961,000
Natural gas (m^3)	354,000	0[b]	406,000	406,000	1,166,000
Coal (t)	6,480	6,480	0[c]	0[c]	12,960
Steam (kg)	155,400	155,400	177,100	177,100	665,000

[a] Total campaign refers to the time required to complete blending disposition actions evaluated for Alternatives 2 through 5. Annual values are presented in Section 2.2.2.

[b] Natural gas is not available at SRS; therefore, liquid petroleum gas (approximately 504,000 l) would be substituted for a natural gas requirement of 354,000 m^3.

[c] Fuel oil is considered the primary fuel at B&W and NFS; therefore, blending facility coal requirements have been converted to a fuel oil energy equivalent. Fuel oil energy content is assumed to be 40,128 BTUs/l, and the coal energy content is assumed to be 30.9 million BTUs/t. A coal requirement of 7,845 t equals 6,040,000 l of fuel oil.

Source: Derived from tables in Section 4.3 of the EIS.

Maximum Air Quality Incremental Impacts Using All Four Sites (50 t to fuel and 150 t to waste)

Pollutant	Averaging Time	Most Stringent Regulation or Guidelines ($\mu g/m^3$)	Y–12 ($\mu g/m^3$)	SRS ($\mu g/m^3$)	B&W ($\mu g/m^3$)	NFS ($\mu g/m^3$)
Carbon monoxide (CO)	8 hours	10,000[a]	11.5	0.07	5.43	0.62
	1 hour	40,000[a]	53	0.14	17.63	0.8
Lead (Pb)	Calendar Quarter	1.5[a]	b	b	b	b
Nitrogen dioxide (NO_2)	Annual	100[a]	1.33	0.01	0.14	0.03
Particulate matter (PM_{10})	Annual	50[a]	0.03	<0.01	0.03	<0.01
	24 hours	150[a]	0.37	<0.01	0.19	0.03
Sulfur dioxide (SO_2)	Annual	80[a]	2.46	0.02	0.4	0.05
	24 hours	365[a]	29.3	0.32	2.74	0.4
	3 hours	1,300[a]	161	0.71	14.11	0.96
Mandated by South Carolina, Tennessee, and Virginia						
Total suspended particulates (TSP)	Annual	60[c]	6.74[d]	0.05	0.03	<0.01[d]
	24 hours	150[c]	80.16	0.88[d]	0.19	0.03

Table S–2. Summary Comparison of Maximum Incremental Impacts for Each Alternative and Candidate Site—Continued

Maximum Air Quality Incremental Impacts Using All Four Sites (50 t to fuel and 150 t to waste)—Continued

Pollutant	Averaging Time	Most Stringent Regulation or Guidelines (μg/m³)	Y–12 (μg/m³)	SRS (μg/m³)	B&W (μg/m³)	NFS (μg/m³)
Gaseous fluorides (as HF)	1 month	0.8[c]	[b]	[b]	trace [d, e]	trace[e]
	1 week	1.6[c]	[b]	[b]	trace[d, e]	trace[e]
	24 hours	2.9[c]	[b]	[b]	trace[d, e]	trace[e]
	12 hours	3.7[c]	[b]	[b]	trace[d, e]	trace[e]
	8 hours	250[c]	[b]	[b, d]	trace[d, e]	trace[e]

[a] Federal standard.

[b] No lead emissions from any of the blending processes and no gaseous fluoride emissions from UNH and metal blending processes.

[c] State standard or guideline.

[d] No State standard.

[e] Hydrofluorination is anticipated to be a closed system with a scrubber filter exhaust system. Therefore, emission of gaseous fluorides is estimated to be a trace amount.

Note: Ozone, as a criteria pollutant, is not directly emitted or monitored by the candidate site. Pollutant concentrations shown for Y–12 include other ORR operations.

Source: Derived from tables in Section 4.3 of the EIS.

Total Campaign Water Resources Incremental Impacts Using All Four Sites (50 t to fuel and 150 t to waste)

Resource	Y–12	SRS	B&W	NFS	Total
Water (million l)	340	340	390	390	1,460
Wastewater (million l)[a]	336	336	384	384	1,440

[a] Includes sanitary and nonhazardous, nonradioactive (other) liquid discharges after treatment.

Source: Derived from tables in Section 4.3 of the EIS.

Maximum Socioeconomic Incremental Impacts Using All Four Sites (50 t to fuel and 150 t to waste)

Characteristic	Y–12	SRS	B&W	NFS
Direct employment	125	125	126	126
Indirect employment	319	245	285	253
Total jobs	444	370	411	379
Unemployment rate change (percent)	-0.09	-0.14	-0.12	-0.14

Source: Derived from tables in Section 4.3 of the EIS.

Table S–2. Summary Comparison of Maximum Incremental Impacts for Each Alternative and Candidate Site—Continued

Total Campaign Normal Operations Radiological Exposure Incremental Impacts Using All Four Sites (50 t to fuel and 150 t to waste)

Receptor	Y–12	SRS	B&W	NFS	Total
Involved Workers					
Total dose to involved workforce[a] (person-rem)	202	202	238	238	880
Risk (cancer fatalities per campaign)	$8.08x10^{-2}$	$8.08x10^{-2}$	$9.52x10^{-2}$	$9.52x10^{-2}$	0.352
Maximally Exposed Individual (Public)					
Dose to maximally exposed individual member of the public (mrem)	0.698	$4.48x10^{-2}$	$4.27x10^{-2}$	3.13	NA[b]
Risk (cancer fatality per campaign)	$3.49x10^{-7}$	$2.24x10^{-8}$	$2.14x10^{-8}$	$1.57x10^{-6}$	NA[b]
Population Within 80 km					
Dose to population within 80 km[c] (person-rem)	2.86	2.86	0.384	27.2	33.3
Risk (cancer fatalities per campaign)	$1.43x10^{-3}$	$1.43x10^{-3}$	$1.92x10^{-4}$	$1.36x10^{-2}$	$1.67x10^{-2}$

[a] The involved workforce is 125 for UNH blending, 126 for UF_6 blending, and 72 for metal blending.

[b] The dose and the latent cancer fatality for the maximally exposed individual cannot be totaled since they are based on maximum exposure to an individual at each site using site-specific information.

[c] The population within 80 km (50 mi) in the year 2010 is 1,040,000 for Y–12; 710,000 for SRS; 730,000 for B&W; and 1,260,000 for NFS.

Note: NA=not applicable.

Source: Derived from tables in Section 4.3 of the EIS.

Maximum Facility Accidents Incremental Impacts Using All Four Sites (50 t to fuel and 150 to waste)[a]

Receptor	Y–12	SRS	B&W	NFS
Campaign accident frequency[b]	$1.8x10^{-3}$	$1.8x10^{-3}$	$1.8x10^{-3}$	$1.8x10^{-3}$
Noninvolved Workers[c]				
Latent cancer fatalities per accident	0.4	$8.7x10^{-2}$	30	2.5
Risk (cancer fatalities per campaign)	$7.1x10^{-4}$	$1.6x10^{-4}$	$9.2x10^{-3}$	$7.8x10^{-4}$
Maximally Exposed Individual (Public)				
Latent cancer fatality per accident	$5.0x10^{-4}$	$3.1x10^{-6}$	$1.9x10^{-2}$	$3.0x10^{-3}$
Risk (cancer fatality per campaign)	$8.9x10^{-7}$	$5.5x10^{-9}$	$5.8x10^{-6}$	$9.9x10^{-7}$
Population Within 80 km[d]				
Latent cancer fatalities per accident	$6.9x10^{-2}$	$1.6x10^{-2}$	1	1.4
Risk (cancer fatalities per campaign)	$1.2x10^{-4}$	$2.9x10^{-5}$	$3.2x10^{-4}$	$4.6x10^{-4}$

[a] The risk values for this alternative are based on the most conservative combination of the options within the alternative (that is, blending 25 t HEU to 4-percent LEU as UF_6 fuel and 37.5 t HEU to 0.9-percent LEU as UNH waste at B&W and NFS, and 37.5 t HEU to 0.9-percent LEU as UNH waste at Y–12 and SRS).

[b] Values shown represent probability for the life of campaign and are calculated by multiplying annual frequency (10^{-4}) by the total number of years of operation.

[c] The noninvolved workers are workers on site but not associated with operations of the blending and conversion facilities. Involved workers, those that are near an accident, would likely be exposed to lethal doses of radiation, if such an accident were to occur.

[d] The population within 80 km (50 mi) in the year 2010 is 1,040,000 for Y–12; 710,000 for SRS; 730,000 for B&W; and 1,260,000 for NFS.

Source: Derived from tables in Section 4.3 of the EIS.

Table S–2. Summary Comparison of Maximum Incremental Impacts for Each Alternative and Candidate Site—Continued

Maximum Chemical Exposure Incremental Impacts Using All Four Sites (50 t to fuel and 150 t to waste)

Receptor	Y–12	SRS	B&W	NFS
Maximally Exposed Individual (Public)				
Hazard index[a]	$1.92x10^{-3}$	$2.13x10^{-4}$	$6.90x10^{-6}$	$1.01x10^{-2}$
Cancer risk[b]	$1.22x10^{-15}$	$1.36x10^{-16}$	$4.39x10^{-18}$	$6.40x10^{-15}$
Onsite Worker				
Hazard index[c]	$6.30x10^{-3}$	$5.65x10^{-3}$	$2.34x10^{-3}$	$3.21x10^{-3}$
Cancer risk[d]	$4.83x10^{-14}$	$4.34x10^{-14}$	$1.81x10^{-14}$	$2.48x10^{-14}$

[Text deleted.]

[a] Hazard index=sum of individual hazard quotients (noncancer adverse health effects) for maximally exposed individual.

[b] Lifetime cancer risk=(emissions concentrations) x (0.286 [converts concentrations to doses]) x (slope factor).

[c] Hazard index=sum of individual hazard quotients (noncancer adverse health effects) for workers.

[d] Lifetime cancer risk=(emissions for 8-hr) x (0.286 [converts concentrations to doses]) x (0.237 [fraction of year exposed]) x (0.571 [fraction of lifetime working]) x (slope factor).

Source: Derived from tables in Section 4.3 of the EIS.

Total Campaign Waste Generation Incremental Impacts Using All Four Sites (50 t to fuel and 150 t to waste)

Waste Category[a]	Y–12	SRS	B&W	NFS	Total
Low-Level					
Liquid (m^3)	3,390	369	463	463	4,685
Solid (m^3)	6,600	1,330	1,600	1,600	11,130
Mixed Low-Level					
Liquid (m^3)	125	125	523	523	1,296
Solid (m^3)	0	0	0	0	0
Hazardous					
Liquid (m^3)	197	197	417	417	1,228
Solid (m^3)	0	0	0	0	0
Nonhazardous (Sanitary)					
Liquid (m^3)	322,000	322,000	367,000	367,000	1,378,000
Solid (m^3)	14,700	14,700	16,700	16,700	62,800
Nonhazardous (Other)					
Liquid (m^3)	13,700	13,700	16,500	16,500	60,400
Solid (m^3)	0	0	3	3	6
Solid Low-Level (m^3)[b]	4,370	662	885	885	6,802
Solid Nonhazardous (m^3)[b]	10,600	10,600	12,100	12,100	45,400
LEU Low-Level (m^3)[c]	7,380	7,320	7,320	7,320	29,340

[a] Waste volumes are based on the blending process that produces the highest volume for each category.

[b] Process waste after treatment.

[c] End product waste as a result of blending. Includes irradiated fuel that is currently in the surplus inventory (quantity is classified), which potentially could be disposed of as high-level waste.

Source: Derived from tables in Section 4.3 of the EIS.

Table S–2. Summary Comparison of Maximum Incremental Impacts for Each Alternative and Candidate Site—Continued

Total Campaign Transportation Risk Incremental Impacts Using All Four Sites (50 t to fuel and 150 t to waste)

Receptor	Y–12	SRS	B&W	NFS	Total
Accident-Free Operations					
Fatalities to the public from radiological effects	0.1	0.11	0.14	0.13	0.48
Fatalities to the crew from radiological effects	0.08	0.08	0.1	0.1	0.36
Fatalities to the public from nonradiological effects	$8.2x10^{-3}$	$1.1x10^{-2}$	$1.6x10^{-2}$	$1.1x10^{-2}$	$4.6x10^{-2}$
Accidents					
Fatalities to the public from radiological effects[a]	$3.2x10^{-3}$	$3.6x10^{-3}$	$4.7x10^{-3}$	$4.5x10^{-3}$	$1.6x10^{-2}$
Fatalities to the public from nonradiological effects	0.3	0.36	0.46	0.42	1.54
Fatalities to the crew from nonradiological effects	0.09	0.1	0.13	0.12	0.43
Total Fatalities	0.58	0.67	0.85	0.78	2.89

[a] The transportation crew and the public are considered as one population for the purposes of radiological accidents.

Source: Derived from tables in Appendix G of the EIS.

Table S–2. Summary Comparison of Maximum Incremental Impacts for Each Alternative and Candidate Site—Continued

Alternative 4: Substantial Commercial Use (65/35 Fuel/Waste Ratio)

Variation a) Two Department of Energy Sites

Total Campaign[a] Site Infrastructure Incremental Impacts Using Two Department of Energy Sites (130 t to fuel and 70 t to waste)

Characteristic	Y–12	SRS	Total
Electricity (MWh)	109,000	109,000	218,000
Diesel/oil (l)	1,318,000	1,947,000	3,265,000
Natural gas (m^3)	441,000	0[b]	441,000
Coal (t)	8,410	8,410	16,820
Steam (kg)	201,600	201,600	403,200

[a] Total campaign refers to the time required to complete blending disposition actions evaluated for Alternatives 2 through 5. Annual values are presented in Section 2.2.2.

[b] Natural gas is not available at SRS; therefore, liquid petroleum gas (approximately 628,000 l) would be substituted for a natural gas requirement of 441,000 m^3.

Source: Derived from tables in Section 4.3 of the EIS.

Maximum Air Quality Incremental Impacts Using Two Department of Energy Sites (130 t to fuel and 70 t to waste)

Pollutant	Averaging Time	Most Stringent Regulation or Guidelines (μg/m^3)	Y–12 (μg/m^3)	SRS (μg/m^3)
Carbon monoxide (CO)	8 hours	10,000[a]	11.5	0.07
	1 hour	40,000[a]	53	0.14
Lead (Pb)	Calendar Quarter	1.5[a]	b	b
Nitrogen dioxide (NO_2)	Annual	100[a]	1.33	0.01
Particulate matter (PM_{10})	Annual	50[a]	0.03	<0.01
	24 hours	150[a]	0.37	<0.01
Sulfur dioxide (SO_2)	Annual	80[a]	2.46	0.02
	24 hours	365[a]	29.3	0.32
	3 hours	1,300[a]	161	0.71
Mandated by South Carolina and Tennessee				
Total suspended particulates (TSP)	Annual	60[c]	6.74[d]	0.05
	24 hours	150[c]	80.16	0.88[d]

Table S–2. Summary Comparison of Maximum Incremental Impacts for Each Alternative and Candidate Site—Continued

Maximum Air Quality Incremental Impacts Using Two Department of Energy Sites (130 t to fuel and 70 t to waste)—Continued

Pollutant	Averaging Time	Most Stringent Regulation or Guidelines (μg/m³)	Y–12 (μg/m³)	SRS (μg/m³)
Gaseous fluorides (as HF)	1 month	0.8[c]	[b]	[b]
	1 week	1.6[c]	[b]	[b]
	24 hours	2.9[c]	[b]	[b]
	12 hours	3.7[c]	[b]	[b]
	8 hours	250[c]	[b]	[b, d]

[a] Federal standard.

[b] No emissions from UNH and metal blending processes.

[c] State standard or guideline.

[d] No State standard.

Note: Ozone, as a criteria pollutant, is not directly emitted or monitored by the candidate sites. Pollutant concentrations shown for Y–12 include other ORR operations.

Source: Derived from tables in Section 4.3 of the EIS.

Total Water Resources Incremental Impacts Using Two Department of Energy Sites (130 t to fuel and 70 t to waste)

Resource	Y–12	SRS	Total
Water (million l)	441	441	882
Wastewater (million l)[a]	433	433	866

[a] Includes sanitary and nonhazardous, nonradioactive (other) liquid discharges after treatment.

Source:Derived from tables in Section 4.3 of the EIS.

Maximum Socioeconomic Incremental Impacts Using Two Department of Energy Sites (130 t to fuel and 70 t to waste)

Characteristic	Y–12	SRS
Direct employment	125	125
Indirect employment	319	245
Total jobs	444	370
Unemployment rate change (percent)	- 0.09	- 0.14

Source: Derived from tables in Section 4.3 of the EIS.

Table S–2. Summary Comparison of Maximum Incremental Impacts for Each Alternative and Candidate Site—Continued

Total Campaign Normal Operations Radiological Exposure Incremental Impacts Using Two Department of Energy Sites (130 t to fuel and 70 t to waste)

Receptor	Y–12	SRS	Total
Involved Workers			
Total dose to involved workforce[a] (person-rem)	262	262	524
Risk (cancer fatalities per campaign)	0.105	0.105	0.21
Maximally Exposed Individual (Public)			
Dose to maximally exposed individual member of the public (mrem)	0.905	5.80×10^{-2}	NA[b]
Risk (cancer fatality per campaign)	4.53×10^{-7}	2.90×10^{-8}	NA[b]
Population Within 80 km			
Dose to population within 80 km[c] (person-rem)	3.71	3.71	7.42
Risk (cancer fatalities per campaign)	1.86×10^{-3}	1.86×10^{-3}	3.71×10^{-3}

[a] The involved workforce is 125 for UNH blending and 72 for metal blending.

[b] The dose and the latent cancer fatality for the maximally exposed individual cannot be totaled because they are based on maximum exposure to an individual at each site using site-specific information.

[c] The population within 80 km (50 mi) in the year 2010 is 1,040,000 for Y–12 and 710,000 for SRS.

Note: NA=not applicable.

Source: Derived from tables in Section 4.3 of the EIS.

Maximum Facility Accidents Incremental Impacts Using Two Department of Energy Sites (130 t to fuel and 70 to waste)[a]

Receptor	Y–12	SRS
Campaign accident frequency[b]	1.7×10^{-3}	1.7×10^{-3}
Noninvolved Workers[c]		
Latent cancer fatalities per accident	0.4	8.7×10^{-2}
Risk (cancer fatalities per campaign)	7.5×10^{-4}	1.7×10^{-4}
Maximally Exposed Individual (Public)		
Latent cancer fatality per accident	5.0×10^{-4}	3.1×10^{-6}
Risk (cancer fatality per campaign)	9.5×10^{-7}	5.8×10^{-9}
Population Within 80 km[d]		
Latent cancer fatalities per accident	6.9×10^{-2}	1.6×10^{-2}
Risk (cancer fatalities per campaign)	1.3×10^{-4}	3.1×10^{-5}

[a] The risk values for this alternative are based on the most conservative combination of the options within the alternative (that is, blending 65 t HEU to 4-percent as LEU as UNH fuel and 35 t HEU to 0.9-percent LEU as UNH waste at each site).

[b] Values shown represent probability for the life of campaign and are calculated by multiplying annual frequency (10^{-4}) by the total number of years of operation.

[c] The noninvolved workers are workers on site but not associated with operations of the blending and conversion facilities. Involved workers, those that are near an accident, would likely be exposed to lethal doses of radiation, if such an accident were to occur.

[d] The population within 80 km (50 mi) in the year 2010 is 1,040,000 for Y–12 and 710,000 for SRS.

Source: Derived from tables in Section 4.3 of the EIS.

Table S–2. Summary Comparison of Maximum Incremental Impacts for Each Alternative and Candidate Site—Continued

Maximum Chemical Exposure Incremental Impacts Using Two Department of Energy Sites (130 t to fuel and 70 t to waste)

Receptor	Y–12	SRS
Maximally Exposed Individual (Public)		
Hazard index[a]	3.84×10^{-3}	4.26×10^{-4}
Cancer risk[b]	4.01×10^{-15}	4.47×10^{-16}
Onsite Worker		
Hazard index[c]	1.26×10^{-2}	1.13×10^{-2}
Cancer risk[d]	1.60×10^{-13}	1.43×10^{-13}

[Text deleted.]

[a] Hazard index=sum of individual hazard quotients (noncancer adverse health effects) for maximally exposed individual.

[b] Lifetime cancer risk=(emissions concentrations) x (0.286 [converts concentrations to doses]) x (slope factor).

[c] Hazard index=sum of individual hazard quotients (noncancer adverse health effects) for workers.

[d] Lifetime cancer risk=(emissions for 8-hr) x (0.286 [converts concentrations to doses]) x (0.237 [fraction of year exposed]) x (0.571 [fraction of lifetime working]) x (slope factor).

Source: Derived from tables in Section 4.3 of the EIS.

Maximum Waste Generation Incremental Impacts Using Two Department of Energy Sites (130 t to fuel and 70 t to waste)

Waste Category[a]	Y–12	SRS	Total
Low-Level			
Liquid (m^3)	3,310	460	3,770
Solid (m^3)	6,650	1,650	8,300
Mixed Low-Level			
Liquid (m^3)	416	416	832
Solid (m^3)	0	0	0
Hazardous			
Liquid (m^3)	756	756	1,512
Solid (m^3)	0	0	0
Nonhazardous (Sanitary)			
Liquid (m^3)	418,000	418,000	836,000
Solid (m^3)	19,000	19,000	38,000
Nonhazardous (Other)			
Liquid (m^3)	17,700	17,700	35,400
Solid (m^3)	0	0	0
Solid Low-Level (m^3)[b]	4,380	917	5,297
Solid Nonhazardous (m^3)[b]	13,700	13,700	27,400
LEU Low-Level (m^3)[c]	6,890	6,830	13,720

[a] Waste volumes are based on the blending process that produces the highest volume for each category.

[b] Process waste after treatment.

[c] End product waste as a result of blending. Includes HEU irradiated fuel that is currently in the surplus inventory (quantity is identified), which potentially could be disposed of as high-level waste.

Source: Derived from tables in Section 4.3 of the EIS.

Table S–2. Summary Comparison of Maximum Incremental Impacts for Each Alternative and Candidate Site—Continued

Total Campaign Transportation Risk Incremental Impacts Using Two Department of Energy Sites (130 t to fuel and 70 t to waste)

Receptor	Y–12	SRS	Total
Accident-Free Operations			
Fatalities to the public from radiological effects	0.15	0.18	0.33
Fatalities to the crew from radiological effects	0.11	0.12	0.23
Fatalities to the public from nonradiological effects	1.4×10^{-2}	1.7×10^{-2}	3.1×10^{-2}
Accidents			
Fatalities to the public from radiological effects[a]	5.2×10^{-3}	5.8×10^{-3}	1.1×10^{-2}
Fatalities to the public from nonradiological effects	0.48	0.56	1.04
Fatalities to the crew from nonradiological effects	0.14	0.16	0.3
Total Fatalities	0.9	1.04	1.94

[a] The transportation crew and the public are considered as one population for the purposes of radiological accidents.

Source: Derived from tables in Appendix G of the EIS.

Variation b) Two Commercial Sites

Total Campaign Site Infrastructure Incremental Impacts Using Two Commercial Sites (130 t to fuel and 70 t to waste)

Characteristic	B&W	NFS	Total
Electricity (MWh)	246,000	246,000	492,000
Diesel/oil (l)	8,713,000	8,713,000	17,426,000
Natural gas (m^3)	468,000	468,000	936,000
Coal (t)	0[a]	0[a]	0
Steam (kg)	201,600	201,600	403,200

[a] Fuel oil is considered the primary fuel at B&W and NFS; therefore, blending facility coal requirements have been converted to a fuel oil energy equivalent. Fuel oil energy content is assumed to be 40,128 BTUs/l, and the coal energy content is assumed to be 30.9 million BTUs/t. A coal requirement of 9,590 t equals 7,400,000 l of fuel oil.

Source: Derived from tables in Section 4.3 of the EIS.

Maximum Air Quality Incremental Impacts Using Two Commercial Sites (130 t to fuel and 70 t to waste)

Pollutant	Averaging Time	Most Stringent Regulation or Guidelines (μg/m^3)	B&W (μg/m^3)	NFS (μg/m^3)
Carbon monoxide (CO)	8 hours	10,000[a]	5.43	0.62
	1 hour	40,000[a]	17.63	0.8
Lead (Pb)	Calendar Quarter	1.5[a]	[b]	[b]
Nitrogen dioxide (NO_2)	Annual	100[a]	0.14	0.03
Particulate matter (PM_{10})	Annual	50[a]	0.03	<0.01
	24 hours	150[a]	0.19	0.03
Sulfur dioxide (SO_2)	Annual	80[a]	0.4	0.05
	24 hours	365[a]	2.74	0.4
	3 hours	1,300[a]	14.11	0.96

Table S–2. Summary Comparison of Maximum Incremental Impacts for Each Alternative and Candidate Site—Continued

Maximum Air Quality Incremental Impacts Using Two Commercial Sites (130 t to fuel and 70 t to waste)—Continued

Pollutant	Averaging Time	Most Stringent Regulation or Guidelines (μg/m³)	B&W (μg/m³)	NFS (μg/m³)
Mandated by Tennessee and Virginia				
Total suspended particulates (TSP)	Annual	60[c]	0.03	<0.01[d]
	24 hours	150[c]	0.19	0.03
Gaseous fluorides (as HF)	1 month	1.2[c]	trace[d, e]	trace[e]
	1 week	1.6[c]	trace[d, e]	trace[e]
	24 hours	2.9[c]	trace[d, e]	trace[e]
	12 hours	3.7[c]	trace[d, e]	trace[e]
	8 hours	250[c]	trace[d, e]	trace[e]

[a] Federal standard

[b] No emissions from UF_6 and UNH blending processes.

[c] State standard or guideline.

[d] No State standard.

[e] Hydrofluorination is anticipated to be closed with scrubber filter exhaust system. Therefore, emission of gaseous fluorides is estimated to be a trace amount.

Note: Ozone, as a criteria pollutant, is not directly emitted or monitored by the candidate sites.

Source: Derived from tables in Section 4.3 of the EIS.

Total Campaign Water Resources Incremental Impacts Using Two Commercial Sites (130 t to fuel and 70 t to waste)

Resource	B&W	NFS	Total
Water (million l)	447	447	894
Wastewater (million l)[a]	435	435	870

[a] Includes sanitary and nonhazardous, nonradioactive (other) liquid discharges after treatment.

Source: Derived from tables in Section 4.3 of the EIS.

Maximum Socioeconomic Incremental Impacts Using Two Commercial Sites (130 t to fuel and 70 t to waste)

Characteristic	B&W	NFS
Direct employment	126	126
Indirect employment	285	253
Total jobs	411	379
Unemployment rate change (percent)	-0.12	-0.14

Source: Derived from tables in Section 4.3 of the EIS.

Table S–2. Summary Comparison of Maximum Incremental Impacts for Each Alternative and Candidate Site—Continued

Total Campaign Normal Operations Radiological Exposure Incremental Impacts Using Two Commercial Sites (130 t to fuel and 70 t to waste)

Receptor	B&W	NFS	Total
Involved Workers			
Total dose to involved workforce[a] (person-rem)	283	283	566
Risk (cancer fatalities per campaign)	0.113	0.113	0.226
Maximally Exposed Individual (Public)			
Dose to maximally exposed individual member of the public (mrem)	5.45×10^{-2}	3.96	NA[b]
Risk (cancer fatality per campaign)	2.73×10^{-8}	1.98×10^{-6}	NA[b]
Population Within 80 km			
Dose to population within 80 km[c] (person-rem)	0.492	35	35.5
Risk (cancer fatalities per campaign)	2.46×10^{-4}	1.75×10^{-2}	1.78×10^{-2}

[a] The involved workforce is 125 for UNH blending and 126 for UF_6 blending.

[b] The dose and the latent cancer fatality for the maximally exposed individual cannot be totaled because they are based on maximum exposure to an individual at each site using site-specific information.

[c] The population within 80 km (50 mi) in the year 2010 is 730,000 for B&W and 1,260,000 for NFS.

Source: Derived from tables in Section 4.3 of the EIS.

Maximum Facility Accidents Incremental Impacts Using Two Commercial Sites (130 t to fuel and 70 to waste)[a]

Receptor	B&W	NFS
Campaign accident frequency[b]	1.7×10^{-3}	1.7×10^{-3}
Noninvolved Workers[c]		
Latent cancer fatalities per accident	30	2.5
Risk (cancer fatalities per campaign)	2.1×10^{-2}	1.8×10^{-3}
Maximally Exposed Individual (Public)		
Latent cancer fatality per accident	1.9×10^{-2}	3.0×10^{-3}
Risk (cancer fatality per campaign)	1.3×10^{-5}	2.2×10^{-6}
Population Within 80 km[d]		
Latent cancer fatalities per accident	1	1.4
Risk (cancer fatalities per campaign)	7.2×10^{-4}	1.0×10^{-3}

[a] The risk values for this alternative are based on the most conservative combination of the options within the alternative (that is, blending 65 t HEU to 4-percent LEU as UF_6 fuel and 35 t HEU to 0.9-percent LEU as UNH waste at each site).

[b] Values shown represent probability for the life of campaign and are calculated by multiplying annual frequency (10^{-4}) by the total number of years of operation.

[c] The noninvolved workers are workers onsite but not associated with operations of the blending and conversion facilities. Involved workers, those that are near an accident, would likely be exposed to lethal doses of radiation, if such an accident were to occur.

[d] The population within 80 km (50 mi) in the year 2010 is 730,000 for B&W and 1,260,000 for NFS.

Source: Derived from tables in Section 4.3 of the EIS.

Table S–2. Summary Comparison of Maximum Incremental Impacts for Each Alternative and Candidate Site—Continued

Maximum Chemical Exposure Incremental Impacts Using Two Commercial Sites (130 t to fuel and 70 t to waste)

Receptor	B&W	NFS
Maximally Exposed Individual (Public)		
Hazard index[a]	1.38×10^{-5}	2.02×10^{-2}
Cancer risk[b]	1.45×10^{-17}	2.11×10^{-14}
Onsite Worker		
Hazard index[c]	4.68×10^{-3}	6.42×10^{-3}
Cancer risk[d]	5.97×10^{-14}	8.18×10^{-14}

[Text deleted.]

[a] Hazard index=sum of individual hazard quotients (noncancer adverse health effects) for maximally exposed individual.

[b] Lifetime cancer risk=(emissions concentrations) x (0.286 [converts concentrations to doses]) x (slope factor).

[c] Hazard index=sum of individual hazard quotients (noncancer adverse health effects) for workers.

[d] Lifetime cancer risk=(emissions for 8-hr) x (0.286 [converts concentrations to doses]) x (0.237 [fraction of year exposed]) x (0.571 [fraction of lifetime working]) x (slope factor).

Source: Derived from tables in Section 4.3 of the EIS.

Total Campaign Waste Generation Incremental Impacts Using Two Commercial Sites (130 t to fuel and 70 t to waste)

Waste Category[a]	B&W	NFS	Total
Low-Level			
Liquid (m^3)	636	636	1,272
Solid (m^3)	2,100	2,100	4,200
Mixed Low-Level			
Liquid (m^3)	1,150	1,150	2,300
Solid (m^3)	0	0	0
Hazardous			
Liquid (m^3)	756	756	1,512
Solid (m^3)	0	0	0
Nonhazardous (Sanitary)			
Liquid (m^3)	418,000	418,000	836,000
Solid (m^3)	19,000	19,000	38,000
Nonhazardous (Other)			
Liquid (m^3)	20,300	20,300	40,600
Solid (m^3)	7	7	14
Solid Low-Level (m^3)[b]	1,200	1,200	2,400
Solid Nonhazardous (m^3)[b]	13,700	13,700	27,400
LEU Low-Level (m^3)[c]	6,830	6,830	13,660

[a] Waste volumes are based on the blending process that produces the highest volume for each category.

[b] Process waste after treatment.

[c] End product waste as a result of blending. Includes irradiated fuel that is currently in the surplus HEU inventory (quantity is classified), which potentially could be disposed of as high-level waste.

Source: Derived from tables in Section 4.3 of the EIS.

Table S–2. Summary Comparison of Maximum Incremental Impacts for Each Alternative and Candidate Site—Continued

Total Campaign Transportation Risk Incremental Impacts Using Two Commercial Sites (130 t to fuel and 70 t to waste)

Receptor	B&W	NFS	Total
Accident-Free Operations			
Fatalities to the public from radiological effects	0.18	0.16	0.34
Fatalities to the crew from radiological effects	0.12	0.12	0.24
Fatalities to the public from nonradiological effects	1.9×10^{-2}	1.5×10^{-2}	3.4×10^{-2}
Accidents			
Fatalities to the public from radiological effects[a]	6.0×10^{-3}	5.6×10^{-3}	1.16×10^{-2}
Fatalities to the public from nonradiological effects	0.57	0.53	1.1
Fatalities to the crew from nonradiological effects	0.16	0.15	0.31
Total Fatalities	1.06	0.98	2.04

[a] The transportation crew and the public are considered as one population for the purposes of radiological accidents.

Source: Derived from tables in Appendix G of the EIS.

Variation c) All Four Sites

Total Campaign[a] Site Infrastructure Incremental Impacts Using All Four Sites (130 t to fuel and 70 t to waste)

Characteristic	Y–12	SRS	B&W	NFS	Total
Electricity (MWh)	54,700	54,700	124,000	124,000	357,400
Diesel/oil (l)	659,000	973,000	4,364,000	4,364,000	10,360,000
Natural gas (m^3)	220,000	0[b]	234,000	234,000	688,000
Coal (t)	4,210	4,210	0[c]	0[c]	8,420
Steam (kg)	100,800	100,800	100,800	100,800	403,200

[a] Total campaign refers to the time required to complete blending disposition actions evaluated for Alternatives 2 through 5. Annual values are presented in Section 2.2.2.

[b] Natural gas is not available at SRS; therefore liquid petroleum gas (approximately 313,000 l) would be substituted for a natural gas requirement of 220,000 m^3.

[c] Fuel oil is considered the primary fuel at B&W and NFS; therefore, blending facility coal requirements have been converted to a fuel oil energy equivalent. Fuel oil energy content is assumed to be 40,128 BTUs/l, and the coal energy content is assumed to be 30.9 million BTUs/t. A coal requirement of 4,800 t equals 3,700,000 l of fuel oil.

Source: Derived from tables in Section 4.3 of the EIS.

Table S–2. Summary Comparison of Maximum Incremental Impacts for Each Alternative and Candidate Site—Continued

Maximum Air Quality Incremental Impacts Using All Four Sites (130 t to fuel and 70 t to waste)

Pollutant	Averaging Time	Most Stringent Regulation or Guidelines (µg/m³)	Y–12 (µg/m³)	SRS (µg/m³)	B&W (µg/m³)	NFS (µg/m³)
Carbon monoxide (CO)	8 hours	10,000[a]	11.5	0.07	5.43	0.62
	1 hour	40,000[a]	53	0.14	17.63	0.8
Lead (Pb)	Calendar Quarter	1.5[a]	[b]	[b]	[b]	[b]
Nitrogen dioxide (NO_2)	Annual	100[a]	1.33	0.01	0.14	0.03
Particulate matter (PM_{10})	Annual	50[a]	0.03	<0.01	0.03	<0.01
	24 hours	150[a]	0.37	<0.01	0.19	0.03
Sulfur dioxide (SO_2)	Annual	80[a]	2.46	0.02	0.4	0.05
	24 hours	365[a]	29.3	0.32	2.74	0.4
	3 hours	1,300[a]	161	0.71	14.11	0.96
Mandated by South Carolina, Tennessee, and Virginia						
Total suspended particulates (TSP)	Annual	60[c]	6.74[d]	0.05	0.03	<0.01[d]
	24 hours	150[c]	80.16	0.88[d]	0.19	0.03
Gaseous fluorides (as HF)	1 month	0.8[c]	[b]	[b]	trace[d, e]	trace[e]
	1 week	1.6[c]	[b]	[b]	trace[d, e]	trace[e]
	24 hours	2.9[c]	[b]	[b]	trace[d, e]	trace[e]
	12 hours	3.7[c]	[b]	[b]	trace[d, e]	trace[e]
	8 hours	250[c]	[b]	[b, d]	trace[d, e]	trace[e]

[a] Federal standard.

[b] No lead emissions from any of the blending processes and no gaseous fluorides from UNH and metal blending processes.

[c] State standard or guideline.

[d] No State standard.

[e] Hydrofluorination is anticipated to be a closed system with scrubber filter exhaust system. Therefore, emission of gaseous fluorides is estimated to be a trace amount.

Note: Ozone, as a criteria pollutant, is not directly emitted or monitored by the candidate sites. Pollutant concentrations shown for Y–12 include other ORR operations.

Source: Derived from tables in Section 4.3 of the EIS.

Total Campaign Water Resources Incremental Impacts Using All Four Sites (130 t to fuel and 70 t to waste)

Resource	Y–12	SRS	B&W	NFS	Total
Water (million l)	220	220	224	224	888
Wastewater (million l)[a]	216	216	218	218	868

[a] Includes sanitary and nonhazardous, nonradioactive (other) liquid discharges after treatment.

Source: Derived from tables in Section 4.3 of the EIS.

Table S–2. Summary Comparison of Maximum Incremental Impacts for Each Alternative and Candidate Site—Continued

Maximum Socioeconomic Incremental Impacts Using All Four Sites (130 t to fuel and 70 t to waste)

Characteristic	Y–12	SRS	B&W	NFS
Direct employment	125	125	126	126
Indirect employment	319	245	285	253
Total jobs	444	370	411	379
Unemployment rate change (percent)	-0.09	-0.14	-0.12	-0.14

Source: Derived from tables in Section 4.3 of the EIS.

Total Campaign Normal Operations Radiological Exposure Incremental Impacts for All Four Sites (130 t to fuel and 70 t to waste)

Receptor	Y–12	SRS	B&W	NFS	Total
Involved Workers					
Total dose to involved workforce[a] (person-rem)	131	131	141	141	544
Risk (cancer fatalities per campaign)	5.24×10^{-2}	5.24×10^{-2}	5.65×10^{-2}	5.65×10^{-2}	0.218
Maximally Exposed Individual (Public)					
Dose to maximally exposed individual member of the public (mrem)	0.452	2.90×10^{-2}	2.73×10^{-2}	1.98	NA[b]
Risk (cancer fatality per campaign)	2.26×10^{-7}	1.45×10^{-8}	1.37×10^{-8}	9.94×10^{-7}	NA[b]
Population Within 80 km					
Dose to population within 80 km[c] (person-rem)	1.86	1.86	0.246	17.5	21.5
Risk (cancer fatalities per campaign)	9.30×10^{-4}	9.30×10^{-4}	1.24×10^{-4}	8.80×10^{-3}	1.08×10^{-2}

[a] The involved workforce is 125 for UNH blending, 126 for UF_6 blending, and 72 for metal blending.

[b] The dose and the latent cancer fatality for the maximally exposed individual can not be totaled because they are based on maximum exposure to an individual at each site using site specific information.

[c] The population within 80 km (50 mi) in the year 2010 is 1,040,000 for Y–12; 710,000 for SRS; 730,000 for B&W; and 1,260,000 for NFS.

Note: NA=not applicable.

Source: Derived from tables in Section 4.3 of the EIS.

Table S–2. Summary Comparison of Maximum Incremental Impacts for Each Alternative and Candidate Site—Continued

Maximum Facility Accidents Incremental Impacts Using All Four Sites (130 t to fuel and 70 t to waste)[a]

Receptor	Y–12	SRS	B&W	NFS
Campaign accident frequency[b]	$8.3x10^{-3}$	$8.3x10^{-3}$	$8.3x10^{-3}$	$8.3x10^{-3}$
Noninvolved Workers[c]				
Latent cancer fatalities per accident	0.4	$8.7x10^{-2}$	30	2.5
Risk (cancer fatalities per campaign)	$3.8x10^{-4}$	$8.3x10^{-5}$	$1.1x10^{-2}$	$9.0x10^{-4}$
Maximally Exposed Individual (Public)				
Latent cancer fatality per accident	$5.0x10^{-4}$	$3.1x10^{-6}$	$1.9x10^{-2}$	$3.0x10^{-3}$
Risk (cancer fatality per campaign)	$4.7x10^{-7}$	$2.9x10^{-9}$	$6.8x10^{-6}$	$1.1x10^{-6}$
Population Within 80 km[d]				
Latent cancer fatalities per accident	$6.9x10^{-2}$	$1.6x10^{-2}$	1	1.4
Risk (cancer fatalities per campaign)	$6.5x10^{-5}$	$1.5x10^{-5}$	$3.7x10^{-4}$	$5.1x10^{-4}$

[a] The risk values for this alternative are based on the most conservative combination of the options within the alternative (that is, blending 32.5 t HEU to 4-percent LEU as UNH fuel and 17.5 t HEU to 0.9-percent LEU as UNH waste at Y–12 and SRS, and 32.5 t HEU to 4-percent LEU as UF_6 fuel and 17.5 t HEU to 0.9-percent LEU and UNH waste at B&W and NFS).

[b] Values shown represent probability for the life of campaign and are calculated by multiplying annual frequency (10^{-4}) by the total number of years of operation.

[c] The noninvolved workers are workers on site but not associated with operations of the blending and conversion facilities. Involved workers, those that are near an accident, would likely be exposed to lethal doses of radiation, if such an accident were to occur.

[d] The population within 80 km (50 mi) in the year 2010 is 1,040,000 for Y–12; 710,000 for SRS; 730,000 for B&W; and 1,260,000 for NFS.

Source: Derived from tables in Section 4.3 of the EIS.

Maximum Chemical Exposure Incremental Impacts Using All Four Sites (130 t to fuel and 70 t to waste)

Receptor	Y–12	SRS	B&W	NFS
Maximally Exposed Individual (Public)				
Hazard index[a]	$1.92x10^{-3}$	$2.13x10^{-4}$	$6.90x10^{-6}$	$1.01x10^{-2}$
Cancer risk[b]	$1.00x10^{-15}$	$1.12x10^{-16}$	$3.62x10^{-18}$	$5.28x10^{-15}$
Onsite Worker				
Hazard index[c]	$6.30x10^{-3}$	$5.65x10^{-3}$	$2.34x10^{-3}$	$3.21x10^{-3}$
Cancer risk[d]	$3.98x10^{-14}$	$3.58x10^{-14}$	$1.49x10^{-14}$	$2.05x10^{-14}$

[Text deleted.]

[a] Hazard index=sum of individual hazard quotients (noncancer adverse health effects) for maximally exposed individual.

[b] Lifetime cancer risk=(emissions concentrations) x (0.286 [converts concentrations to doses]) x (slope factor).

[c] Hazard index=sum of individual hazard quotients (noncancer adverse health effects) for workers.

[d] Lifetime cancer risk=(emissions for 8-hr) x (0.286 [converts concentrations to doses]) x (0.237 [fraction of year exposed]) x (0.571 [fraction of lifetime working]) x (slope factor).

Source: Derived from tables in Section 4.3 of the EIS.

Table S–2. Summary Comparison of Maximum Incremental Impacts for Each Alternative and Candidate Site—Continued

Total Campaign Waste Generation Incremental Impacts Using All Four Sites (130 t to fuel and 70 t to waste)

Waste Category[a]	Y–12	SRS	B&W	NFS	Total
Low-Level					
Liquid (m^3)	1,640	230	319	319	2,508
Solid (m^3)	3,300	824	1,050	1,050	6,224
Mixed Low-Level					
Liquid (m^3)	210	210	583	583	1,586
Solid (m^3)	0	0	0	0	0
Hazardous					
Liquid (m^3)	382	382	382	382	1,528
Solid (m^3)	0	0	0	0	0
Nonhazardous (Sanitary)					
Liquid (m^3)	209,000	209,000	209,000	209,000	836,000
Solid (m^3)	9,510	9,510	9,510	9,510	38,040
Nonhazardous (Other)					
Liquid (m^3)	8,870	8,870	10,100	10,100	37,940
Solid (m^3)	0	0	3	3	6
Solid Low-Level (m^3)[b]	2,170	459	601	601	3,831
Solid Nonhazardous (m^3)[b]	6,860	6,860	6,860	6,860	27,440
LEU Low-Level (m^3)[c]	3,420	3,400	3,400	3,400	13,620

[a] Waste volumes are based on the blending process which produces the highest volume for each category.
[b] Process waste after treatment.
[c] End product waste as a result of blending. Includes irradiated fuel that is currently in the surplus HEU inventory (quantity is classified), which potentially could be disposed of as high-level waste.
Source: Derived from tables in Section 4.3 of the EIS.

Total Campaign Transportation Risk Impacts Using All Four Sites (130 t to fuel and 70 t to waste)

Receptor	Y–12	SRS	B&W	NFS	Total
Accident-Free Operations					
Fatalities to the public from radiological effects	0.08	0.09	0.09	0.08	0.34
Fatalities to the crew from radiological effects	0.06	0.06	0.06	0.06	0.24
Fatalities to the public from nonradiological effects	7.0×10^{-3}	9.0×10^{-3}	9.7×10^{-3}	7.4×10^{-3}	3.3×10^{-2}
Accidents					
Fatalities to the public from radiological effects[a]	2.6×10^{-3}	2.9×10^{-3}	3.0×10^{-3}	2.8×10^{-3}	1.13×10^{-2}
Fatalities to the public from nonradiological effects	0.24	0.28	0.28	0.26	1.06
Fatalities to the crew from nonradiological effects	0.07	0.08	0.08	0.07	0.3
Total Fatalities	0.46	0.52	0.52	0.48	1.98

[a] The transportation crew and the public are considered as one population for the purposes of radiological accidents.
Source: Derived from tables in Appendix G of the EIS.

Variation d) Single Site

The incremental impacts of blending all surplus HEU to LEU at a single DOE site are the same as either the total or maximum impacts presented in Variation a. Blending all at a single commercial site can be obtained from Variation b. The only exception is the normal operations dose and risk to the maximally exposed individual of the public and the population within 80 km (50 mi). The dose to the maximally exposed individual for Y–12, SRS, B&W, and NFS is 1.81, 0.116, 0.109, and 7.92 mrem, respectively. The risk of cancer fatalities per campaign is 9.06×10^{-7}, 5.80×10^{-8}, 5.46×10^{-8}, and 3.96×10^{-6}, respectively. The dose to the population within 80 km (50 mi) for Y–12, SRS, B&W, and NFS is 7.41, 7.41, 0.982, and 69.9 person-rem, respectively. The risk of cancer fatalities per campaign is 3.7×10^{-3}, 3.7×10^{-3}, 4.9×10^{-4}, and 3.5×10^{-2}, respectively.

Table S–2. Summary Comparison of Maximum Incremental Impacts for Each Alternative and Candidate Site—Continued

Alternative 5: Maximum Commercial Use (85/15 Fuel/Waste Ratio)

Variation a) Two Department Of Energy Sites

Total Campaign[a] Site Infrastructure Incremental Impacts Using Two Department of Energy Sites (170 t to fuel and 30 t to waste)

Characteristic	Y–12	SRS	Total
Electricity (MWh)	69,700	69,700	139,400
Diesel/oil (l)	886,000	1,293,000	2,179,000
Natural gas (m^3)	286,000	0[b]	286,000
Coal (t)	5,680	5,680	11,360
Steam (kg)	136,000	136,000	272,000

[a] Total campaign refers to the time required to complete blending disposition actions evaluated for Alternatives 2 through 5. Annual values are presented in Section 2.2.2.

[b] Natural gas is not available at SRS; therefore, liquid petroleum gas (approximately 407,000 l) would be substituted for a natural gas requirement of 286,000 m^3.

Source: Derived from tables in Section 4.3 of the EIS.

Maximum Air Quality Incremental Impacts Using Two Department of Energy Sites (170 t to fuel and 30 t to waste)

Pollutant	Averaging Time	Most Stringent Regulation or Guidelines ($\mu g/m^3$)	Y–12 ($\mu g/m^3$)	SRS ($\mu g/m^3$)
Carbon monoxide (CO)	8 hours	10,000[a]	11.5	0.07
	1 hour	40,000[a]	53	0.14
Lead (Pb)	Calendar Quarter	1.5[a]	[b]	[b]
Nitrogen dioxide (NO_2)	Annual	100[a]	1.33	0.01
Particulate matter (PM_{10})	Annual	50[a]	0.03	<0.01
	24 hours	150[a]	0.037	<0.01
Sulfur dioxide (SO_2)	Annual	80[a]	2.46	0.02
	24 hours	365[a]	29.3	0.32
	3 hours	1,300[a]	161	0.71

Table S–2. Summary Comparison of Maximum Incremental Impacts for Each Alternative and Candidate Site—Continued

Maximum Air Quality Incremental Impacts Using Two Department of Energy Sites (170 t to fuel and 30 t to waste)—Continued

Pollutant	Averaging Time	Most Stringent Regulation or Guidelines (μg/m³)	Y–12 (μg/m³)	SRS (μg/m³)
Mandated by South Carolina and Tennessee				
Total suspended particulates (TSP)	Annual	60[c]	6.74[d]	0.05
	24 hours	150[c]	80.16	0.88[d]
Gaseous fluorides (as HF)	1 month	0.8[c]	[b]	[b]
	1 week	1.6[c]	[b]	[b]
	24 hours	2.9[c]	[b]	[b]
	12 hours	3.7[c]	[b]	[b]
	8 hours	250[c]	[b]	[b, d]

[a] Federal standard.

[b] No lead emissions from any of the blending processes and no gaseous fluoride emissions from UNH and metal blending processes.

[c] State standard or guideline.

[d] No State standard.

Note: Ozone, as a criteria pollutant, is not directly emitted or monitored by the candidate sites. Pollutant concentrations shown for Y–12 include other ORR operations.

Source: Derived from tables in Section 4.3 of the EIS.

Total Campaign Water Resources Incremental Impacts Using Two Department of Energy Sites (170 t to fuel and 30 t to waste)

Resource	Y–12	SRS	Total
Water (million l)	296	296	592
Wastewater (million l)[a]	291	291	582

[a] Includes sanitary and nonhazardous, nonradioactive (other) liquid discharges after treatment.

Source: Derived from tables in Section 4.3 of the EIS.

Maximum Socioeconomic Incremental Impacts Using Two Department of Energy Sites (170 t to fuel and 30 t to waste)

Characteristic	Y–12	SRS
Direct employment	125	125
Indirect employment	319	245
Total jobs	444	370
Unemployment rate change (percent)	-0.09	-0.14

Source: Derived from tables in Section 4.3 of the EIS.

Table S–2. Summary Comparison of Maximum Incremental Impacts for Each Alternative and Candidate Site—Continued

Total Campaign Normal Operations Radiological Exposure Incremental Impacts Using Two Department of Energy Sites (170 t to fuel and 30 t to waste)

Receptor	Y–12	SRS	Total
Involved Workers			
Total dose to involved workforce[a] (person-rem)	176	176	352
Risk (cancer fatalities per campaign)	7.05×10^{-2}	7.05×10^{-2}	0.141
Maximally Exposed Individual (Public)			
Dose to maximally exposed individual member of the public (mrem)	0.608	3.90×10^{-2}	NA[b]
Risk (cancer fatality per campaign)	3.04×10^{-7}	1.95×10^{-8}	NA[b]
Population Within 80 km			
Dose to population within 80 km[c] (person-rem)	2.5	2.5	5
Risk (cancer fatalities per campaign)	1.25×10^{-3}	1.25×10^{-3}	2.50×10^{-3}

[a] The involved workforce is 125 for UNH blending and 72 for metal blending.

[b] The dose and the latent cancer fatality for the maximally exposed individual cannot be totaled because they are based on maximum exposure to an individual at each site using site-specific information.

[c] The population within 80 km (50 mi) in the year 2010 is 1,040,000 for Y–12 and 710,000 for SRS.

Note: NA=not applicable.

Source: Derived from tables in Section 4.3 of the EIS.

Maximum Facility Accidents Incremental Impacts Using Two Department of Energy Sites (170 t to fuel and 30 t to waste)[a]

Receptor	Y–12	SRS
Campaign accident frequency[b]	8.5×10^{-4}	8.5×10^{-4}
Noninvolved Workers[c]		
Latent cancer fatalities per accident	0.4	8.7×10^{-2}
Risk (cancer fatalities per campaign)	4.0×10^{-4}	8.9×10^{-5}
Maximally Exposed Individual (Public)		
Latent cancer fatality per accident	5.0×10^{-4}	3.1×10^{-6}
Risk (cancer fatality per campaign)	5.1×10^{-7}	3.1×10^{-9}
Population Within 80 km[d]		
Latent cancer fatalities per accident	6.9×10^{-2}	1.6×10^{-2}
Risk (cancer fatalities per campaign)	6.9×10^{-5}	1.6×10^{-5}

[a] The risk values for this alternative are based on the most conservative combination of the options within the alternative (that is, blending 85 t HEU to 4 percent as UNH fuel and 15 t HEU to 0.9-percent LEU as UNH waste at each site).

[b] Values shown represent probability for the life of campaign and are calculated by multiplying annual frequency (10^{-4}) by the total number of years of operation.

[c] The noninvolved workers are workers on site but not associated with operations of the blending and conversion facilities. Involved workers, those that are near an accident, would likely be exposed to lethal doses of radiation, if such an accident were to occur.

[d] The population within 80 km (50 mi) in the year 2010 is 1,040,000 for Y–12 and 710,000 for SRS.

Source: Derived from tables in Section 4.3 of the EIS.

Table S–2. Summary Comparison of Maximum Incremental Impacts for Each Alternative and Candidate Site—Continued

Maximum Chemical Exposure Incremental Impacts Using Two Department of Energy Sites (170 t to fuel and 30 t to waste)

Receptor	Y–12	SRS
Maximally Exposed Individual (Public)		
Hazard index[a]	3.84×10^{-3}	4.26×10^{-4}
Cancer risk[b]	2.69×10^{-15}	2.99×10^{-16}
Onsite Worker		
Hazard index[c]	1.26×10^{-2}	1.13×10^{-2}
Cancer risk[d]	1.08×10^{-13}	9.66×10^{-14}

[Text deleted.]

[a] Hazard index=sum of individual hazard quotients (noncancer adverse health effects) for maximally exposed individual.

[b] Lifetime cancer risk=(emissions concentrations) x (0.286 [converts concentrations to doses]) x (slope factor).

[c] Hazard index=sum of individual hazard quotients (noncancer adverse health effects) for workers.

[d] Lifetime cancer risk=(emissions for 8-hr) x (0.286 [converts concentrations to doses]) x (0.237 [fraction of year exposed]) x (0.571 [fraction of lifetime working]) x (slope factor).

Source: Derived from tables in Section 4.3 of the EIS.

Total Campaign Waste Generation Incremental Impacts Using Two Department of Energy Sites (170 t to fuel and 30 t to waste)

Waste Category[a]	Y–12	SRS	Total
Low-Level			
Liquid (m^3)	1,530	322	1,852
Solid (m^3)	3,260	1,140	4,400
Mixed Low-Level			
Liquid (m^3)	441	441	882
Solid (m^3)	0	0	0
Hazardous			
Liquid (m^3)	826	826	1,652
Solid (m^3)	0	0	0
Nonhazardous (Sanitary)			
Liquid (m^3)	281,000	281,000	561,000
Solid (m^3)	12,800	12,800	25,600
Nonhazardous (Other)			
Liquid (m^3)	12,000	12,000	24,000
Solid (m^3)	0	0	0
Solid Low-Level (m^3)[b]	2,120	654	2,774
Solid Nonhazardous (m^3)[b]	9,220	9,220	18,440
LEU Low-Level (m^3)[c]	2,930	2,900	5,830

[a] Waste volumes are based on the blending process that produces the highest volume for each category.

[b] Process waste after treatment.

[c] End product waste as a result of blending. Includes irradiated fuel that is currently in the surplus HEU inventory (quantity is classified), which potentially could be disposed of as high-level waste.

Source: Derived from tables in Section 4.3 of the EIS.

Table S–2. Summary Comparison of Maximum Incremental Impacts for Each Alternative and Candidate Site—Continued

Total Campaign Transportation Risk Incremental Impacts Using Two Department of Energy Sites (170 t to fuel and 30 t to waste)

Receptor	Y–12	SRS	Total
Accident-Free Operations			
Fatalities to the public from radiological effects	0.12	0.14	0.26
Fatalities to the crew from radiological effects	0.08	0.08	0.16
Fatalities to the public from nonradiological effects	1.1×10^{-2}	1.4×10^{-2}	2.5×10^{-2}
Accidents			
Fatalities to the public from radiological effects[a]	4.1×10^{-3}	4.7×10^{-3}	8.8×10^{-3}
Fatalities to the public from nonradiological effects	0.38	0.43	0.81
Fatalities to the crew from nonradiological effects	0.11	0.12	0.23
Total Fatalities	0.7	0.79	1.49

[a] The transportation crew and the public are considered as one population for the purposes of radiological accidents.
Source: Derived from tables in Appendix G of the EIS.

Variation b) Two Commercial Sites

Total Campaign Site Infrastructure Incremental Impacts Using Two Commercial Sites (170 t to fuel and 30 t to waste)

Characteristic	B&W	NFS	Total
Electricity (MWh)	248,000	248,000	496,000
Diesel/oil (l)	6,438,000	6,438,000	12,876,000
Natural gas (m^3)	322,000	322,000	644,000
Coal (t)	0[a]	0[a]	0
Steam (kg)	136,000	136,000	272,000

[a] Fuel oil is considered the primary fuel at B&W and NFS; therefore, blending facility coal requirements have been converted to a fuel oil energy equivalent. Fuel oil content is assumed to be 40,128 BTUs/l, and the coal energy content is assumed to be 30.9 million BTUs/t. A coal requirement of 7,230 t equals 5,600,000 l of fuel oil.
Source: Derived from tables in Section 4.3 of the EIS.

Maximum Air Quality Incremental Impacts Using Two Commercial Sites (170 t to fuel and 30 t to waste)

Pollutant	Averaging Time	Most Stringent Regulation or Guidelines (μg/m³)	B&W (μg/m³)	NFS (μg/m³)
Carbon monoxide (CO)	8 hours	10,000[a]	5.43	0.62
	1 hour	40,000[a]	17.63	0.8
Lead (Pb)	Calendar Quarter	1.5[a]	[b]	[b]
Nitrogen dioxide (NO_2)	Annual	100[a]	0.14	0.03
Particulate matter (PM_{10})	Annual	50[a]	0.03	<0.01
	24 hours	150[a]	0.19	0.03
Sulfur dioxide (SO_2)	Annual	80[a]	0.4	0.05
	24 hours	365[a]	2.74	0.4
	3 hours	1,300[a]	14.11	0.96

Table S–2. Summary Comparison of Maximum Incremental Impacts for Each Alternative and Candidate Site—Continued

Maximum Air Quality Incremental Impacts Using Two Commercial Sites (170 t to fuel and 30 t to waste)—Continued

Pollutant	Averaging Time	Most Stringent Regulation or Guidelines (μg/m^3)	B&W (μg/m^3)	NFS (μg/m^3)
Mandated by Tennessee and Virginia				
Total suspended particulates (TSP)	Annual	60[c]	0.03	<0.01[d]
	24 hours	150[c]	0.19	0.03
Gaseous fluorides (as HF)	1 month	1.2[c]	trace[d, e]	trace[e]
	1 week	1.6[c]	trace[d, e]	trace[e]
	24 hours	2.9[c]	trace[d, e]	trace[e]
	12 hours	3.7[c]	trace[d, e]	trace[e]
	8 hours	250[c]	trace[d, e]	trace[e]

[a] Federal standard.

[b] No emissions from UF_6 and UNH blending processes.

[c] State standard or guideline.

[d] No State standard.

[e] Hydrofluorination is anticipated to be a closed system with scrubber filter exhaust system. Therefore, emission of gaseous fluoride is estimated to be a trace amount.

Note: Ozone, as a criteria pollutant, is not directly emitted or monitored by the candidate sites.

Source: Derived from tables in Section 4.3 of the EIS.

Total Campaign Water Resources Incremental Impacts Using Two Commercial Sites (170 t to fuel and 30 t to waste)

Resources	B&W	NFS	Total
Water (million l)	305	305	610
Wastewater (million l)[a]	295	295	590

[a] Includes sanitary and nonhazardous, nonradioactive (other) liquid discharges after treatment.

Source: Derived from tables in Section 4.3 of the EIS.

Maximum Socioeconomic Incremental Impacts Using Two Commercial Sites (170 t to fuel and 30 t to waste)

Characteristic	B&W	NFS
Direct employment	126	126
Indirect employment	285	253
Total jobs	411	379
Unemployment rate change (percent)	-0.12	-0.14

Source: Derived from tables in Section 4.3 of the EIS.

Table S–2. Summary Comparison of Maximum Incremental Impacts for Each Alternative and Candidate Site—Continued

Total Campaign Normal Operations Radiological Exposure Incremental Impacts Using Two Commercial Sites (170 t to fuel and 30 t to waste)

Receptor	B&W	NFS	Total
Involved Worker			
Total dose to involved workforce[a] (person-rem)	203	203	406
Risk (cancer fatalities per campaign)	8.12×10^{-2}	8.12×10^{-2}	0.162
Maximally Exposed Individual (Public)			
Dose to maximally exposed individual member of the public (mrem)	4.32×10^{-2}	3.12	NA[b]
Risk (cancer fatality per campaign)	2.16×10^{-8}	1.56×10^{-6}	NA[b]
Population Within 80 km			
Dose to population within 80 km[c] (person-rem)	0.393	28.1	28.5
Risk (cancer fatalities per campaign)	1.97×10^{-4}	1.41×10^{-2}	1.43×10^{-2}

[a] The involved workforce is 125 for UNH blending and 126 for UF_6 blending.

[b] The dose and the latent cancer fatality for the maximally exposed individual cannot be totaled because they are based on maximum exposure to an individual at each site using site-specific information.

[c] The population within 80 km (50 mi) in the year 2010 is 730,000 for B&W and 1,260,000 for NFS.

Note: NA=not applicable.

Source: Derived from tables in Section 4.3 of the EIS.

Maximum Facility Accidents Incremental Impacts for Two Commercial Sites (170 t to fuel and 30 t to waste)[a]

Receptor	B&W	NFS
Campaign accident frequency[b]	8.5×10^{-4}	8.5×10^{-4}
Noninvolved Workers[c]		
Latent cancer fatalities per accident	30	2.5
Risk (cancer fatalities per campaign)	2.6×10^{-2}	2.2×10^{-3}
Maximally Exposed Individual (Public)		
Latent cancer fatality per accident	1.9×10^{-2}	3.0×10^{-3}
Risk (cancer fatality per campaign)	1.7×10^{-5}	2.7×10^{-6}
Population Within 80 km[d]		
Latent cancer fatalities per accident	1	1.4
Risk (cancer fatalities per campaign)	8.9×10^{-4}	1.2×10^{-3}

[a] The risk values for this alternative are based on the most conservative combination of the options within the alternative (that is, blending 85 t HEU to 4 percent as UF_6 fuel and 15 t HEU to 0.9-percent LEU as UNH waste at each site).

[b] Values shown represent probability for the life of campaign and are calculated by multiplying annual frequency (10^{-4}) by the total number of years of operation.

[c] The noninvolved workers are workers on site but not associated with operations of the blending and conversion facilities. Involved workers, those that are near an accident, would likely be exposed to lethal doses of radiation, if such an accident were to occur.

[d] The population within 80 km (50 mi) in the year 2010 is 730,000 for B&W and 1,260,000 for NFS.

Source: Derived from tables in Section 4.3 of the EIS.

Table S–2. Summary Comparison of Maximum Incremental Impacts for Each Alternative and Candidate Site—Continued

Maximum Chemical Exposure Incremental Impacts Using Two Commercial Sites (170 t to fuel and 30 t to waste)

Receptor	B&W	NFS
Maximally Exposed Individual (Public)		
Hazard index[a]	$1.38x10^{-5}$	$2.02x10^{-2}$
Cancer risk[b]	$9.70x10^{-18}$	$1.41x10^{-14}$
Onsite Worker		
Hazard index[c]	$4.68x10^{-3}$	$6.42x10^{-3}$
Cancer risk[d]	$4.03x10^{-14}$	$5.51x10^{-14}$

[Text deleted.]

[a] Hazard index=sum of individual hazard quotients (noncancer adverse health effects) for maximally exposed individual.

[b] Lifetime cancer risk=(emissions concentrations) x (0.286 [converts concentrations to doses]) x (slope factor).

[c] Hazard index=sum of individual hazard quotients (noncancer adverse health effects) for workers.

[d] Lifetime cancer risk=(emissions for 8-hr) x (0.286 [converts concentrations to doses]) x (0.237 [fraction of year exposed]) x (0.571 [fraction of lifetime working]) x (slope factor).

Source: Derived from tables in Section 4.3 of the EIS.

Total Campaign Waste Generation Incremental Impacts Using Two Commercial Sites (170 t to fuel and 30 t to waste)

Waste Category[a]	B&W	NFS	Total
Low-Level			
Liquid (m^3)	551	551	1,102
Solid (m^3)	1,720	1,720	3,440
Mixed Low-Level			
Liquid (m^3)	1,400	1,400	2,800
Solid (m^3)	0	0	0
Hazardous			
Liquid (m^3)	826	826	1,652
Solid (m^3)	0	0	0
Nonhazardous (Sanitary)			
Liquid (m^3)	281,000	281,000	562,000
Solid (m^3)	12,800	12,800	25,600
Nonhazardous (Other)			
Liquid (m^3)	15,200	15,200	30,400
Solid (m^3)	9	9	18
Solid Low-Level (m^3)[b]	1,020	1,020	2,040
Solid Nonhazardous (m^3)[b]	9,220	9,220	18,440
LEU Low-Level (m^3)[c]	2,900	2,900	5,800

[a] Waste volumes are based on the blending process that produces the highest volume for each category.

[b] Process waste after treatment.

[c] End product waste as a result of blending. Includes irradiated fuel that is currently in the surplus HEU inventory (quantity is classified), which potentially could be disposed of as high-level waste.

Source: Derived from tables in Section 4.3 of the EIS.

Table S–2. Summary Comparison of Maximum Incremental Impacts for Each Alternative and Candidate Site—Continued

Total Campaign Transportation Risk Incremental Impacts Using Two Commercial Sites (170 t to fuel and 30 t to waste)

Receptor	B&W	NFS	Total
Accident-Free Operations			
Fatalities to the public from radiological effects	0.14	0.13	0.27
Fatalities to the crew from radiological effects	0.08	0.08	0.16
Fatalities to the public from nonradiological effects	$1.5x10^{-2}$	$1.2x10^{-2}$	$2.7x10^{-2}$
Accidents			
Fatalities to the public from radiological effects[a]	$4.8x10^{-3}$	$4.4x10^{-3}$	$9.2x10^{-3}$
Fatalities to the public from nonradiological effects	0.43	0.41	0.84
Fatalities to the crew from nonradiological effects	0.12	0.11	0.23
Total Fatalities	0.79	0.75	1.54

[a] The transportation crew and the public are considered as one population for the purposes of radiological accidents.

Source: Derived from tables in Appendix G of the EIS.

Variation c) All Four Sites

Total Campaign[a] Site Infrastructure Incremental Impacts Using All Four Sites (170 t to fuel and 30 t to waste)

Characteristic	Y–12	SRS	B&W	NFS	Total
Electricity (MWh)	35,200	35,200	125,500	125,500	321,400
Diesel/oil (l)	449,000	655,000	3,259,000	3,259,000	7,622,000
Natural gas (m^3)	143,000	0[b]	161,000	161,000	465,000
Coal (t)	2,840	2,840	0[c]	0[c]	5,680
Steam (kg)	68,000	68,000	68,000	68,000	272,000

[a] Total campaign refers to the time required to complete blending disposition actions evaluated for Alternatives 2 through 5. Annual values are presented in Section 2.2.2.

[b] Natural gas is not available at SRS; therefore, liquid petroleum gas (approximately 204,000 l) would be substituted for a natural gas requirement of 143,000 m^3.

[c] Fuel oil is considered the primary fuel at B&W and NFS; therefore, blending facility coal requirements have been converted to fuel oil energy equivalent. Fuel oil energy content is assumed to be 40,128 BTUs/l, and the coal energy content is assumed to be 30.9 million BTUs/t. A coal requirement of 3,610 t equals 2,800,000 l of fuel oil.

Source: Derived from tables in Section 4.3 of the EIS.

Table S–2. Summary Comparison of Maximum Incremental Impacts for Each Alternative and Candidate Site—Continued

Maximum Air Quality Incremental Impacts Using All Four Sites (170 t to fuel and 30 t to waste)

Pollutant	Averaging Time	Most Stringent Regulation or Guidelines (μg/m³)	Y–12 (μg/m³)	SRS (μg/m³)	B&W (μg/m³)	NFS (μg/m³)
Carbon monoxide (CO)	8 hours	10,000[a]	11.5	0.07	5.43	0.62
	1 hour	40,000[a]	53	0.14	17.63	0.8
Lead (Pb)	Calendar Quarter	1.5[a]	[b]	[b]	[b]	[b]
Nitrogen dioxide (NO_2)	Annual	100[a]	1.33	0.01	0.14	0.03
Particulate matter (PM_{10})	Annual	50[a]	0.03	<0.01	0.03	<0.01
	24 hours	150[a]	0.37	<0.01	0.19	0.03
Sulfur dioxide (SO_2)	Annual	80[a]	2.46	0.02	0.4	0.05
	24 hours	365[a]	29.3	0.32	2.74	0.4
	3 hours	1,300[a]	161	0.71	14.11	0.96
Mandated by South Carolina, Tennessee, and Virginia						
Total suspended particulates (TSP)	Annual	60[c]	6.74[d]	0.05	0.03	<0.01[d]
	24 hours	150[c]	80.16	0.88[d]	0.19	0.03
Gaseous fluorides (as HF)	1 month	0.8[c]	[b]	[b]	trace[d, e]	trace[e]
	1 week	1.6[c]	[b]	[b]	trace[d, e]	trace[e]
	24 hours	2.9[c]	[b]	[b]	trace[d, e]	trace[e]
	12 hours	3.7[c]	[b]	[b]	trace[d, e]	trace[e]
	8 hours	250[c]	[b]	[b, d]	trace[d, e]	trace[e]

[a] Federal standard.

[b] No lead emissions from any of the blending processes and no gaseous fluoride emissions from UNH and metal blending processes.

[c] State standard or guideline.

[d] No State standard.

[e] Hydrofluorination is anticipated to be a closed system with scrubber filter exhaust system. Therefore, emission of gaseous fluorides is estimated to be a trace amount.

Note: Ozone, as a criteria pollutant, is not directly emitted or monitored by the candidate sites. Pollutant concentrations shown for Y–12 include other ORR operations.

Source: Derived from tables in Section 4.3 of the EIS.

Total Campaign Water Resources Incremental Impacts Using All Four Sites (170 t to fuel and 30 t to waste)

Resource	Y–12	SRS	B&W	NFS	Total
Water (million l)	150	150	154	154	608
Wastewater (million l)[a]	148	148	149	149	594

[a] Includes sanitary and nonhazardous, nonradioactive (other) liquid discharges after treatment.

Source: Derived from tables in Section 4.3 of the EIS.

Table S–2. Summary Comparison of Maximum Incremental Impacts for Each Alternative and Candidate Site—Continued

Maximum Socioeconomic Incremental Impacts Using All Four Sites (170 t to fuel and 30 t to waste)

Characteristic	Y–12	SRS	B&W	NFS
Direct employment	125	125	126	126
Indirect employment	319	245	285	253
Total jobs	444	370	411	379
Unemployment rate change (percent)	-0.09	-0.14	-0.12	-0.14

Source: Derived from tables in Section 4.3 of the EIS.

Maximum Normal Operations Radiological Exposure Incremental Impacts Using All Four Sites (170 t to fuel and 30 t to waste)

Receptor	Y–12	SRS	B&W	NFS	Total
Involved Worker					
Total dose to involved workforce[a] (person-rem)	89	89	103	103	384
Risk (cancer fatalities per campaign)	3.56×10^{-2}	3.56×10^{-2}	4.12×10^{-2}	4.12×10^{-2}	0.154
Maximally Exposed Individual Public					
Dose to maximally exposed individual member of the public (mrem)	0.308	1.98×10^{-2}	2.19×10^{-2}	1.58	NA[b]
Risk (cancer fatality per campaign)	1.54×10^{-7}	9.90×10^{-9}	1.10×10^{-8}	7.90×10^{-7}	NA[b]
Population Within 80 km					
Dose to population within 80 km[c] (person-rem)	1.26	1.26	0.199	14.2	16.9
Risk (cancer fatalities per campaign)	6.30×10^{-4}	6.30×10^{-4}	9.95×10^{-5}	7.10×10^{-3}	8.45×10^{-3}

[a] The involved workforce is 125 for UNH blending, 126 for UF_6 blending, and 72 for metal blending.

[b] The dose and the latent cancer fatality for the maximally exposed individual cannot be totaled because they are based on maximum exposure to an individual at each site using site-specific information.

[c] The population within 80 km (50 mi) in the year 2010 is 1,040,000 for Y–12; 710,000 for SRS; 730,000 for B&W; and 1,260,000 for NFS.

Note: NA=not applicable.

Source: Derived from tables in Section 4.3 of the EIS.

Maximum Facility Accidents Incremental Impacts Using All Four Sites (170 t to fuel and 30 t to waste)[a]

Receptor	Y–12	SRS	B&W	NFS
Campaign accident frequency[b]	4.3×10^{-4}	4.3×10^{-4}	4.3×10^{-4}	4.3×10^{-4}
Noninvolved Workers[c]				
Latent cancer fatalities per accident	0.4	8.7×10^{-2}	30	2.5
Risk (cancer fatalities per campaign)	2.0×10^{-4}	4.4×10^{-5}	1.3×10^{-2}	1.1×10^{-3}
Maximally Exposed Individual Public				
Latent cancer fatality per accident	5.0×10^{-4}	3.1×10^{-6}	1.9×10^{-2}	3.0×10^{-3}
Risk (cancer fatality per campaign)	2.6×10^{-7}	1.6×10^{-9}	8.4×10^{-6}	1.4×10^{-6}

Table S–2. Summary Comparison of Maximum Incremental Impacts for Each Alternative and Candidate Site—Continued

Maximum Facility Accidents Incremental Impacts Using All Four Sites (170 t to fuel and 30 t to waste)[a]—Continued

Receptor	Y–12	SRS	B&W	NFS
Population Within 80 km[d]				
Latent cancer fatalities per accident	6.9×10^{-2}	1.6×10^{-2}	1	1.4
Risk (cancer fatalities per campaign)	3.5×10^{-5}	8.2×10^{-6}	4.5×10^{-4}	6.3×10^{-4}

[a] The risk values for this alternative are based on the most conservative combination of the options within the alternative (that is, blending 42.5 t HEU to 4-percent LEU as UNH fuel and 7.5 t HEU to 0.9-percent LEU as UNH waste at Y–12 and SRS, and 42.5 t HEU to 4-percent LEU as UF_6 fuel and 7.5 t HEU to 0.9-percent LEU as UNH waste at B&W and NFS).

[b] Values shown represent probability for the life of campaign which are calculated by multiplying annual frequency (10^{-4}) by the total number of years of operation.

[c] The noninvolved workers are workers on site but not associated with operations of the blending and conversion facilities. Involved workers, those that are near an accident, would likely be exposed to lethal doses of radiation, if such an accident were to occur.

[d] The population within 80 km (50 mi) in the year 2010 is 1,040,000 for Y–12; 710,000 for SRS; 730,000 for B&W; and 1,260,000 for NFS.

Source: Derived from tables in Section 4.3 of the EIS.

Maximum Chemical Exposure Incremental Impacts Using All Four Sites (170 t to fuel and 30 t to waste)

Receptor	Y–12	SRS	B&W	NFS
Maximally Exposed Individual (Public)				
Hazard index[a]	1.92×10^{-3}	2.13×10^{-4}	6.90×10^{-6}	1.01×10^{-2}
Cancer risk[b]	6.84×10^{-16}	7.63×10^{-17}	2.47×10^{-18}	3.60×10^{-15}
Onsite Worker				
Hazard index[c]	6.30×10^{-3}	5.65×10^{-3}	2.34×10^{-3}	3.21×10^{-3}
Cancer risk[d]	2.71×10^{-14}	2.44×10^{-14}	1.02×10^{-14}	1.39×10^{-14}

[Text deleted.]

[a] Hazard index=sum of individual hazard quotients (noncancer adverse health effects) for maximally exposed individual.

[b] Lifetime cancer risk=(emissions concentrations) x (0.286 [converts concentrations to doses]) x (slope factor).

[Text deleted.]

[c] Hazard index=sum of individual hazard quotients (noncancer adverse health effects) for workers.

[d] Lifetime cancer risk=(emissions for 8-hr) x (0.286 [converts concentrations to doses]) x (0.237 [fraction of year exposed]) x (0.571 [fraction of lifetime working]) x (slope factor).

Source: Derived from tables in Section 4.3 of the EIS.

Table S–2. Summary Comparison of Maximum Incremental Impacts for Each Alternative and Candidate Site—Continued

Total Campaign Waste Generation Incremental Impacts Using All Four Sites (170 t to fuel and 30 t to waste)

Waste Category[a]	Y–12	SRS	B&W	NFS	Total
Low-Level					
Liquid (m^3)	767	163	279	279	1,488
Solid (m^3)	1,640	575	872	872	3,959
Mixed Low-Level					
Liquid (m^3)	223	223	709	709	1,864
Solid (m^3)	0	0	0	0	0
Hazardous					
Liquid (m^3)	418	418	418	418	1,672
Solid (m^3)	0	0	0	0	0
Nonhazardous (Sanitary)					
Liquid (m^3)	142,000	142,000	142,000	142,000	568,000
Solid (m^3)	6,480	6,480	6,480	6,480	25,920
Nonhazardous (Other)					
Liquid (m^3)	6,060	6,060	7,710	7,710	27,540
Solid (m^3)	0	0	4	4	8
Solid Low-Level (m^3)[b]	1,060	331	516	516	2,423
Solid Nonhazardous (m^3)[b]	4,670	4,670	4,670	4,670	18,680
LEU Low-Level (m^3)[c]	1,470	1,470	1,470	1,470	5,880

[a] Waste volumes are based on the blending process that produces the highest volume for each category.

[b] Process waste after treatment.

[c] End product waste as a result of blending. Includes irradiated fuel that is currently in the surplus HEU inventory (quantity is classified), which potentially could be disposed of as high-level waste.

Source: Derived from tables in Section 4.3 of the EIS.

Total Campaign Transportation Risk Incremental Impacts Using All Four Sites (170 t to fuel and 30 t to waste)

Receptor	Y–12	SRS	B&W	NFS	Total
Accident-Free Operations					
Fatalities to the public from radiological effects	0.06	0.07	0.07	0.06	0.26
Fatalities to the crew from radiological effects	0.04	0.04	0.05	0.05	0.16
Fatalities to the public from nonradiological effects	$5.7x10^{-3}$	$6.9x10^{-3}$	$7.4x10^{-3}$	$6.1x10^{-3}$	$2.6x10^{-2}$
Accidents					
Fatalities to the public from radiological effects[a]	$2.1x10^{-3}$	$2.4x10^{-3}$	$2.4x10^{-3}$	$2.2x10^{-3}$	$9.1x10^{-3}$
Fatalities to the public from nonradiological effects	0.19	0.22	0.22	0.21	0.83
Fatalities to the crew from nonradiological effects	0.05	0.06	0.06	0.06	0.23
Total Fatalities	0.35	0.40	0.41	0.39	1.55

[a] The transportation crew and the public are considered as one population for the purposes of radiological accidents.

Source: Derived from tables in Appendix G of the EIS.

Table S–2. Summary Comparison of Maximum Incremental Impacts for Each Alternative and Candidate Site—Continued

Variation d) Single Site

The incremental impacts of blending all surplus HEU to LEU at a single DOE site are the same as either the total or maximum impacts presented in Variation a. Blending all at a single commercial site can be obtained from Variation b. The only exception is the normal operations dose and risk to the maximally exposed individual of the public and the population within 80 km (50 mi). The dose to the maximally exposed individual for Y–12, SRS, B&W, and NFS is 1.22, 0.078, 0.0864, and 6.24 mrem, respectively. The risk of cancer fatalities per campaign is $6.08x10^{-7}$, $3.9x10^{-8}$, $4.32x10^{-8}$, and $3.12x10^{-6}$, respectively. The dose to the population within 80 km (50 mi) for Y–12, SRS, B&W, and NFS is 5.01, 5.01, 0.787, and 56.3 person-rem, respectively. The risk of cancer fatalities per campaign are $2.5x10^{-3}$, $2.5x10^{-3}$, $3.9x10^{-4}$, and $2.8x10^{-2}$, respectively.

Table S–3. Summary Comparison of Total Campaign[a] Incremental Environmental Impacts for the Disposition of Surplus Highly Enriched Uranium for Each Alternative

	Alternative 2 No Commercial Use 0/100 Fuel/Waste	Alternative 3 Limited Commercial Use 25/75 Fuel/Waste	Alternative 4 Substantial Commercial Use 65/35 Fuel/Waste	Alternative 5 Maximum Commercial Use 85/15 Fuel/Waste
Site Infrastructure				
Electricity (MWh)	476,000	482,000	492,000	496,000
Diesel/oil (l)	19,384,000	16,961,000	17,426,000	12,876,000
Natural gas (m^3)	1,413,000	1,166,000	936,000	644,000
Coal (t)	17,280	12,960	16,820	11,360
Steam (kg)	828,000	665,000	403,200	272,000
Air Quality and Noise				
The impacts for all four alternatives would be negligible. UNH and metal blending would be used for Alternative 2 and UNH, UF_6 and metal blending would be used for Alternatives 3, 4, and 5 and give similar incremental annual emissions. The maximum incremental annual emissions for all four alternatives would be less than 1 percent of the NAAQS standard for all criteria pollutants.				
Water				
Water (million l)	1,808	1,460	894	610
Wastewater (million l)	1,784	1,440	870	590
Socioeconomics				
The impacts for all four alternatives would be negligible. For Alternative 2, the UNH blending process to 0.9-percent LEU waste gives the maximum impacts. For Alternative 2, the maximum direct employment for any of the four sites would be 125 employees and the indirect employment would range from 245 at SRS to 319 at Y–12. The unemployment changes for all four sites range from 0.09 percent to 0.14 percent. The only difference between Alternatives 3, 4, and 5 from Alternative 2 is that the maximum direct employment at B&W and NFS would be 126 since the UF_6 blending process could be used.				
Radiological Exposure				
Involved Workers				
Total dose to involved workforce (person-rem)	1,076	880	566	406
Risk (cancer fatalities per campaign)	0.43	0.352	0.226	0.162
Maximally Exposed Individual (Public)				
Dose to maximum exposed individual member of the public (mrem)	3.33	3.13	3.96	3.12
Risk (cancer fatality per campaign)	1.67×10^{-6}	1.57×10^{-6}	1.98×10^{-6}	1.56×10^{-6}

Table S–3. Summary Comparison of Total Campaign[a] Incremental Environmental Impacts for the Disposition of Surplus Highly Enriched Uranium for Each Alternative—Continued

	Alternative 2 No Commercial Use 0/100 Fuel/Waste	Alternative 3 Limited Commercial Use 25/75 Fuel/Waste	Alternative 4 Substantial Commercial Use 65/35 Fuel/Waste	Alternative 5 Maximum Commercial Use 85/15 Fuel/Waste
Population Within 80 km				
Dose to population within 80 km (person-rem)	36.6	33.3	35.5	28.5
Risk (cancer fatalities per campaign)	$1.83x10^{-2}$	$1.67x10^{-2}$	$1.78x10^{-2}$	$1.43x10^{-2}$
Facility Accidents[b]				
Campaign accident frequency[c]	$2.4x10^{-3}$	$1.8x10^{-3}$	$1.7x10^{-3}$	$8.5x10^{-4}$
Noninvolved Workers[d]				
Latent cancer fatalities per accident	0.94	30	30	30
Risk (cancer fatalities per campaign)	$2.2x10^{-3}$	$9.2x10^{-3}$	$2.1x10^{-2}$	$2.6x10^{-2}$
Maximally Exposed Individual (Public)				
Latent cancer fatality per accident	$5.7x10^{-4}$	$1.9x10^{-2}$	$1.9x10^{-2}$	$1.9x10^{-2}$
Risk (cancer fatality per campaign)	$1.4x10^{-6}$	$5.8x10^{-6}$	$1.3x10^{-5}$	$1.7x10^{-5}$
Population Within 80 km				
Latent cancer fatalities per accident	$6.9x10^{-2}$	1.4	1.4	1.4
Risk (cancer fatalities per campaign)	$1.6x10^{-4}$	$4.6x10^{-4}$	$1.0x10^{-3}$	$1.2x10^{-3}$
Chemical Exposure				
The impacts for all four alternatives would be negligible. For all four alternatives, the maximum incremental hazard index for the maximally exposed individual (public) is $2.02x10^{-2}$, and for workers onsite it is $1.26x10^{-2}$. These values are several orders of magnitude under 1.0, the regulatory health limit. The maximum incremental cancer risk for the maximally exposed individual (public) is $2.11x10^{-14}$, and for workers onsite it is $1.08x10^{-13}$. These values are below the regulatory limit of $1.0x10^{-6}$. This represents an increase in cancer risk of 1 in 480 billion to the public and about 1 in a million to onsite workers.				
Waste Management				
Low-Level				
Liquid (m^3)	5,866	4,685	3,770	1,852
Solid (m^3)	13,700	11,130	8,300	4,400
Mixed Low-Level				
Liquid (m^3)	668	1,296	2,300	2,800
Solid (m^3)	0	0	0	0
Hazardous				
Liquid (m^3)	1,048	1,228	1,528	1,672
Solid (m^3)	0	0	0	0

Table S–3. Summary Comparison of Total Campaign[a] Incremental Environmental Impacts for the Disposition of Surplus Highly Enriched Uranium for Each Alternative—Continued

	Alternative 2 No Commercial Use 0/100 Fuel/Waste	Alternative 3 Limited Commercial Use 25/75 Fuel/Waste	Alternative 4 Substantial Commercial Use 65/35 Fuel/Waste	Alternative 5 Maximum Commercial Use 85/15 Fuel/Waste
Nonhazardous (Sanitary)				
Liquid (m^3)	1,712,000	1,378,000	836,000	568,000
Solid (m^3)	78,000	62,800	38,040	25,920
Nonhazardous (Other)				
Liquid (m^3)	72,800	60,400	40,600	30,400
Solid (m^3)	0	6	14	18
Solid Low-Level (m^3)[e]	8,453	6,802	5,297	2,774
Solid Nonhazardous (m^3)[e]	56,400	45,400	27,440	18,680
LEU Low-Level (m^3)[f]	39,010	29,340	13,720	5,900
Transportation Risk				
Accident-Free Operations				
Fatalities to the public from radiological effects	0.58	0.48	0.34	0.27
Fatalities to the crew from radiological effects	0.44	0.36	0.24	0.2
Fatalities to the public from nonradiological effects	5.5×10^{-2}	4.6×10^{-2}	3.4×10^{-2}	2.7×10^{-2}
Accidents				
Fatalities to the public from radiological effects[g]	1.88×10^{-2}	1.6×10^{-2}	1.2×10^{-2}	9.2×10^{-3}
Fatalities to the public from nonradiological effects	1.83	1.54	1.1	0.84
Fatalities to the crew from nonradiological effects	0.51	0.44	0.3	0.23
Total Fatalities	3.43	2.89	2.04	1.57

[a] Total campaign refers to the time required to complete blending disposition actions evaluated for Alternatives 2 through 5. Values shown represent total impacts over the life of campaign except for facility accidents for which maximum values are presented over the life of the campaign.

[b] Values shown for facility accidents represent maximum consequences that could possibly occur under each alternative.

[c] Values shown represent probability for the life of campaign which are calculated by multiplying annual frequency (10^{-4}) by the total number of years of operation.

[d] The noninvolved workers are workers on site but not associated with operations of the blending and conversion facilities. Involved workers, those that are near an accident, would likely be exposed to lethal doses of radiation, if such an accident were to occur.

[e] Process waste after treatment.

[f] End product waste as a result of blending includes irradiated fuel that is currently in the surplus HEU inventory (quantity is classified) which potentially could be disposed of as high-level waste.

[g] The transportation crew and the public are considered as one population for the purposes of radiological accidents.

Office of Fissile Materials Disposition, MD-4
United States Department of Energy
1000 Independence Avenue, SW
Washington, D.C. 20585

Official Business
Penalty for Private Use $300

contact: Carol M. Borgstrom, Director, Office of NEPA Policy and Assistance (EH–42), U.S. Department of Energy, 1000 Independence Avenue, S.W., Washington, D.C. 20585, Telephone: 202–586–4600 or leave a message at 800–472–2756.

SUPPLEMENTARY INFORMATION: On July 17, 1996, the Department published a notice in the Federal Register (61 FR 37247) announcing its intent to prepare an environmental impact statement for interim storage of plutonium at the RFETS and the commencement of a public scoping period that was to continue until August 16, 1996. The July 17, 1996, notice also announced a public scoping meeting scheduled for August 6, 1996. In response to a stakeholder's request, the Department is rescheduling the public scoping meeting to August 13, 1996, and, to ensure that the public has ample opportunity to provide comments after the public scoping meeting, extending the public scoping period to August 23, 1996. The Department has separately notified interested and affected stakeholders of the change in dates. Comments postmarked after August 23, 1996, will be considered to the extent practicable. Further information on the alternatives regarding interim storage of plutonium at the RFETS and on the environmental impact statement is contained in the Notice of Intent.

Issued in Washington, D.C., this 31st day of July, 1996.

Peter N. Brush,

Acting Assistant Secretary, Environment, Safety and Health.

[FR Doc. 96–19868 Filed 8–2–96; 8:45 am]

BILLING CODE 6450–01–P

Record of Decision for the Disposition of Surplus Highly Enriched Uranium Final Environmental Impact Statement

AGENCY: Department of Energy.

ACTION: Record of Decision

SUMMARY: The Department of Energy (DOE) has decided to implement a program to make surplus highly enriched uranium (HEU) non-weapons-usable by blending it down to low-enriched uranium (LEU), as specified in the Preferred Alternative in the Disposition of Surplus Highly Enriched Uranium Final Environmental Impact Statement (HEU Final EIS, DOE/EIS–0240, June 1996). DOE will gradually sell up to 85 percent of the resulting LEU over time for commercial use as fuel feed for nuclear power plants to generate electricity (including 50 metric tons of HEU and 7,000 tons of natural uranium that will be transferred to the United States Enrichment Corporation), and will dispose of the remaining LEU as low-level radioactive waste. This program applies to a nominal 200 metric tons of United States-origin HEU that the President has declared, or may declare, surplus to defense needs. The purposes of this program are to support the United States' nuclear weapons nonproliferation policy by reducing global stockpiles of excess weapons-usable fissile materials, and to recover the economic value of the materials to the extent feasible.

EFFECTIVE DATE: The decisions set forth in this Record of Decision (ROD) are effective upon being made public July 29, 1996 in accordance with DOE's National Environmental Policy Act (NEPA) Implementing Procedures and Guidelines (10 CFR Part 1021) and the Council on Environmental Quality (CEQ) regulations for implementing NEPA (40 CFR Parts 1500–1508).

ADDRESSES: Copies of the Disposition of Surplus Highly Enriched Uranium Final Environmental Impact Statement, the separate Cost Comparison for Highly Enriched Uranium Disposition Alternatives, and this ROD are available in the public reading rooms identified at the end of this Federal Register notice (section VIII of the Supplementary Information). Copies of these documents may be obtained by writing to the U.S. Department of Energy, Office of Fissile Materials Disposition, MD–4, 1000 Independence Avenue, SW., Washington, D.C. 20585, or by calling (202) 586–4513. The 72-page Summary of the HEU Final EIS, the Cost Comparison for Highly Enriched Uranium Disposition Alternatives, and this ROD are also available on the Fissile Materials Disposition Electronic Bulletin Board/World Wide Web Page at: http://web.fie.com/htdoc/fed/doe/fsl/pub/menu/any/

FOR FURTHER INFORMATION CONTACT: For information on the HEU disposition program or this ROD contact: Mr. J. David Nulton, Director, NEPA Compliance and Outreach, Office of Fissile Materials Disposition (MD–4), U.S. Department of Energy, 1000 Independence Avenue, SW., Washington, DC 20585, telephone (202) 586–4513.

For information on the DOE National Environmental Policy Act process, contact: Carol M. Borgstrom, Director, Office of NEPA Policy and Assistance (EH–42), U.S. Department of Energy, 1000 Independence Ave., SW., Washington, DC 20585, telephone (202) 586–4600 or leave a message at 1–800–472–2756.

SUPPLEMENTARY INFORMATION:

I. Synopsis of Decision

DOE issued the HEU Final EIS (DOE/EIS–0240) on June 28, 1996. In the HEU Final EIS, DOE considered the potential environmental impacts of alternatives for a program to reduce global nuclear proliferation risks by blending up to 200 metric tons of United States-origin surplus HEU down to LEU to make it non-weapons-usable. The resulting LEU could either be sold for commercial use as fuel feed for non-defense nuclear power plants, or disposed of as low-level radioactive waste (LLW). After consideration of the HEU Final EIS, public comments received on the Draft EIS, and the conclusions of a Cost Comparison for Highly Enriched Uranium Disposition Alternatives, DOE has decided to implement the proposed program as identified in the Preferred Alternative contained in the HEU Final EIS. This implementation will involve gradually blending up to 85 percent of the surplus HEU to a U–235 enrichment level of approximately 4 percent for eventual sale and commercial use over time as reactor fuel feed, and blending the remaining surplus HEU down to an enrichment level of about 0.9 percent for disposal as LLW. This would take place over an estimated 15- to 20-year period.

Three possible blending technologies may be used: uranyl nitrate hexahydrate (liquid) blending, uranium hexafluoride (gas) blending, or molten metal blending. Four potential blending facilities may be used: DOE's Y–12 Plant at the Oak Ridge Reservation in Oak Ridge, Tennessee; DOE's Savannah River Site in Aiken, South Carolina; the Babcock & Wilcox Naval Nuclear Fuel Division Facility in Lynchburg, Virginia; and the Nuclear Fuel Services, Inc. Plant in Erwin, Tennessee. As a first concrete disposition action consistent with these programmatic decisions, DOE will transfer title to 50 metric tons of its surplus HEU and 7,000 metric tons of natural uranium from its stockpiles to the United States Enrichment Corporation (USEC), for eventual sale and commercial use. This will comply with legislative directions contained in the USEC Privatization Act (Public Law 104–134, § 3112(c)).

II. Background

The end of the Cold War has created a legacy of weapons-usable fissile materials both in the United States and the former Soviet Union. Further agreements on disarmament may increase the surplus quantities of these materials. The global stockpiles of weapons-usable fissile materials pose a danger to national and international security in the form of potential proliferation of nuclear weapons and the potential for environmental, safety, and health consequences if the materials are not properly safeguarded and managed.

In September 1993, President Clinton issued a Nonproliferation and Export Control Policy in response to the growing threat of nuclear proliferation. Further, in January 1994, President Clinton and Russia's President Yeltsin issued a joint statement between the United States and Russia on nonproliferation of weapons of mass destruction and the means of their delivery. In accordance with these policies, the focus of the U.S. nonproliferation efforts in this regard is five-fold: to secure nuclear materials in the former Soviet Union; to assure safe, secure, long-term storage and disposition of surplus weapons-usable fissile materials; to establish transparent and irreversible nuclear reductions; to strengthen the nuclear nonproliferation regime; and to control nuclear exports.

To demonstrate the United States' commitment to these objectives, President Clinton announced on March 1, 1995, that approximately 200 metric tons of U.S.-origin weapons-usable fissile materials, of which 165 metric tons are HEU, had been declared surplus to the United States' defense needs.[1]

The disposition of surplus HEU, consistent with the Preferred Alternative in the Draft and Final HEU Disposition EIS and the decisions described in section VI of this ROD, is consistent with the President's policies and complies with the recently enacted USEC Privatization Act (Public Law 104–134). The sale of LEU derived from surplus HEU is also consistent with the Vice President's Reinventing Government initiatives pertaining to sales of unneeded government assets.

[1] The Secretary of Energy's Openness Initiative announcement of February 6, 1996, declared that the United States has about 213 metric tons of surplus fissile materials, including the 200 metric tons the President announced in March, 1995. Of the 213 metric tons of surplus materials, the Openness Initiative indicated that about 174.3 metric tons (hereafter referred to as approximately 175 metric tons) are HEU, including 10 metric tons previously placed under International Atomic Energy Agency (IAEA) safeguards in Oak Ridge, Tennessee. The February 1996 Openness Initiative announcement released additional details about the forms and quantities of surplus HEU at various locations, and that information is presented in Figure 1.3–1 of the HEU Final EIS.

III. National Environmental Policy Act Process

A. HEU Draft EIS

On June 21, 1994, DOE published a Notice of Intent (NOI) in the Federal Register (59 FR 31985) to prepare a Storage and Disposition of Weapons-Usable Fissile Materials Programmatic Environmental Impact Statement (Storage and Disposition PEIS), including both surplus and nonsurplus HEU. DOE subsequently concluded that a separate EIS on surplus HEU disposition would be appropriate. Accordingly, DOE published a notice in the Federal Register (60 FR 17344) on April 5, 1995, to inform the public of the proposed plan to prepare a separate EIS for the disposition of surplus HEU.

In accordance with a then-applicable DOE regulation implementing NEPA, 10 CFR 1021.312, DOE published an implementation plan (IP) for the HEU EIS in June 1995. The IP recorded the issues identified during the scoping process, indicated how they would be addressed in the HEU EIS, and provided guidance for the preparation of the HEU EIS. DOE issued the Disposition of Surplus Highly Enriched Uranium Draft Environmental Impact Statement (HEU Draft EIS, DOE/EIS–0240–D) for public comment in October 1995. On October 26, 1995, DOE published a Notice of Availability of the HEU Draft EIS in the Federal Register (60 FR 54867). The Environmental Protection Agency's Notice of Availability of the HEU Draft EIS appeared in the Federal Register (60 FR 55021) on October 27, 1995, announcing a public comment period from October 27, 1995 until December 11, 1995. In response to requests from the public, DOE on November 24, 1995 published another Notice in the Federal Register (60 FR 58056) announcing an extension of the comment period until January 12, 1996. Public workshops on the HEU Draft EIS were held in Knoxville, Tennessee, on November 14, 1995, and in Augusta, Georgia, on November 16, 1995.

During the public comment period, the public was encouraged to provide comments via mail, toll-free fax, electronic bulletin board (Internet), and toll-free telephone recording device. By these means, a total of 72 organizations and 125 individuals submitted a total of 464 comments for consideration. In addition, 224 comments were recorded from some of the 134 individuals who attended the two public workshops. All of the comments received, and the Department's responses to them, are presented in Volume II of the HEU Final EIS, the Comment Analysis and Response Document. All of the comments were considered in preparation of the HEU Final EIS, and in some cases, resulted in changes to the document.

B. Alternatives Considered

The HEU Final EIS analyzed the No Action Alternative and four reasonable alternatives for blending a nominal 200 metric tons of surplus HEU down to LEU to make it non-weapons-usable. The surplus HEU consists of numerous material forms, including metal (pure and alloyed), oxides, unirradiated fuel (including aluminum alloy fuel), nitrate solutions, and other forms. The inventory of material declared surplus also includes irradiated HEU fuel (the total quantity of which remains classified). As discussed in section VI.A of this ROD, below, the irradiated fuel is not directly weapons-usable. Thus, the irradiated fuel is not within the scope of the HEU Final EIS or this ROD unless the HEU is separated from the fission products pursuant to other DOE programs (such as stabilization for materials management).

There are two possible end products from the action alternatives considered in the HEU Final EIS: (1) LEU that can be used as commercial nuclear reactor fuel feed (at a U-235 enrichment level of about 4 percent), and (2) LEU that can be disposed of as low-level radioactive waste (at a U-235 enrichment level of about 0.9 percent). The HEU Final EIS analyzed down-blending of HEU using one or more of three blending technologies: uranyl nitrate hexahydrate (UNH) blending, molten metal blending, and uranium hexafluoride (UF_6) blending.

The HEU Final EIS analyzed the blending of HEU to LEU at four existing U.S. facilities that presently have the capability to undertake such activities. Two of them, the Y–12 Plant at the Oak Ridge Reservation in Oak Ridge, Tennessee, and the Savannah River Site (SRS) in Aiken, South Carolina, are DOE facilities that have conducted extensive HEU operations in support of nuclear weapons and other DOE programs in the past. The other two analyzed facilities are the only commercial enterprises in the United States that have licenses from the Nuclear Regulatory Commission to engage in HEU operations: the Babcock & Wilcox (B&W) facility in Lynchburg, Virginia, and the Nuclear Fuel Services, Inc. (NFS) facility in Erwin, Tennessee.

Each of the analyzed facilities presently has the capability to engage in UNH blending, which could be used either for blending for commercial use or for blending to waste. Only DOE's Y–12 Plant has the capability to conduct molten metal blending, which would only be used for blending to waste, since the metal product could not be used directly by the commercial fuel fabrication industry. The capability to conduct UF_6 conversion and blending does not currently exist at any of the facilities. It is nonetheless analyzed in the EIS as a possible blending technology that may be added at one or both of the commercial facilities, since UF_6 is the form in which commercial fuel fabricators prefer to receive LEU product, and the two commercial facilities have indicated that they may decide to add UF_6 capability by modifying existing facilities.

Because there are many possible combinations of end-products, blending technologies, and blending sites, DOE has formulated several representative, reasonable alternatives that are described and assessed in Chapters 2 and 4 of the HEU Final EIS. In addition to the No Action Alternative (continued storage of surplus HEU), there are four alternatives that represent blending different proportions of the surplus HEU for commercial use or for disposal as waste, in some cases with variations on number and locations of blending sites:

- Alternative 1—No Action (continued storage)
- Alternative 2 (No Commercial Use)—Blend 100% to waste (at all 4 sites)
- Alternative 3 (Limited Commercial Use)—Blend 75% to waste (at all 4 sites), 25% to fuel (at 2 commercial sites)
- Alternative 4 (Substantial Commercial Use)—Blend 35% to waste, 65% to fuel (at any 1 site, the 2 commercial sites, the 2 DOE sites, or all 4 sites)
- Alternative 5 (Maximum Commercial Use)—Blend 15% to waste, 85% to fuel (at any 1 site, the 2 commercial sites, the 2 DOE sites, or all 4 sites)

Each of the alternatives involving commercial use of LEU derived from surplus HEU (Alternatives 3, 4, and 5) include within them the transfer of 50 metric tons of surplus HEU and 7,000 metric tons of natural uranium from DOE stockpiles to USEC. The alternatives, which were formulated to represent reasonable choices within the matrix of possible combinations, were unchanged from the HEU Draft EIS to the HEU Final EIS.

C. Results of Environmental Analyses

The environmental analyses in sections 4.3, 4.4, and 4.5 of the HEU Final EIS estimated that incremental radiological and several other impacts for HEU disposition during normal, accident- free operations would be low for workers, the public or the environment, and well within regulatory requirements, for all alternatives, technologies, and sites. Because no new construction would be required, and the blending activities that would be conducted for this proposed action are either the same as or very similar to operations that have occurred at the analyzed facilities in the past, most of the incremental impacts from this action at the blending sites would be low. There would be increases in electrical energy consumption, fuel needs, and waste generation, depending on the site and the alternative. Section III.D, below, discusses potential floodplains impacts.

The transportation analyses in section 4.4 and Appendix G of the HEU Final EIS indicate that radiological impacts to the public and workers from transportation of materials, under both accident-free and accident conditions, would be low. Approximately one to three fatalities, depending on the alternative, could occur over the 20-year duration of the program, primarily as a result of non-radiological impacts from traffic accidents. The facility accident analyses in section 4.3 and Appendix E.5 of the HEU Final EIS indicate that the maximum credible accident from HEU blending operations, using conservative assumptions, could result in latent cancer fatalities to workers and members of the public surrounding the facility. However, the estimated likelihood of occurrence of such accidents is low, so total accident risk (consequences if the accident occurs times probability of occurrence) to the public is low.

An environmental justice analysis was performed (section 4.10 of the HEU Final EIS) to assess whether the proposed action or alternatives could cause disproportionate adverse health impacts on minority or low-income populations residing in communities around the candidate blending sites. First, a demographic analysis was performed for all of the 1990 Census tracts located within an 80-km (50-mi) radius of the candidate sites. Then public health impact analyses were performed to assess whether minority or low-income populations would be disproportionately affected by facility operations through routine and accidental releases of radiation and toxic emissions. Analyses of public and occupational health impacts from normal operations showed that air emissions and releases would be low and within regulatory limits at all candidate sites. The analyses also showed that cumulative effects of continuous operation over time would result in low levels of exposure to workers and the public. As just discussed, the overall risk from maximum postulated accidents is also low. Thus, there would not be any disproportionate risk of significant adverse impacts to particular populations, including low-income or minority populations, from accidents.

Although the EIS indicates that the projected accident-free radiological impacts and overall accident radiological risk from all alternatives would be low, section 2.4 of the HEU Final EIS, Comparison of Alternatives, shows that there would be some differences in impacts among the alternatives, depending on the extent of commercial use vs. disposal as waste of the product LEU material. Table 2.4–2 of the EIS, *Summary Comparison of Total Campaign Incremental Environmental Impacts for the Disposition of Surplus HEU for Each Alternative,* indicates that the Preferred Alternative (85 percent fuel/15 percent waste at four sites) generally would result in somewhat lower impacts from accident-free blending and transportation than would the No Commercial Use Alternative (100 percent waste). Blending for commercial use under the Preferred Alternative would result in lower impacts than blending to waste in the following resource areas: diesel/fuel oil, natural gas, coal, and steam consumption; water use and wastewater; radiological exposure from normal operations; most waste streams; and transportation (under both accident and accident-free conditions). The Maximum Commercial Use Alternative would result in higher total impacts than the No Commercial Use Alternative for the following resources areas: electricity consumed; facility accident consequences (estimated accident probability is low); and mixed low-level and hazardous wastes generated. The differences among the alternatives are negligible for air quality and noise, socioeconomics, and chemical exposure.

As discussed in section 4.7 of the HEU Final EIS, the avoided adverse impacts from displaced uranium mining, milling, conversion, and enrichment over time increase the environmental advantage of commercial use of LEU derived from surplus HEU. Because LEU fuel feed derived from surplus HEU would displace LEU fuel feed derived from virgin uranium, the environmental impacts that normally result from the front end of the nuclear fuel cycle (mining, milling, conversion, and enrichment) would be avoided by using the HEU-derived material instead.

In actuality, those front-end environmental impacts have already been incurred for the HEU. By making beneficial use of the material rather than wasting it, the Department would derive both environmental and economic benefit from those sunk costs. The analysis in section 4.7 of the HEU Final EIS indicates that the total avoided impacts in terms of radiological exposure, nonradiological air quality impacts, and waste generation would be greater than those that are projected to result from the HEU blending program.

An unavoidable corollary to the physical environmental advantages of commercial use of surplus HEU is the potential socioeconomic disadvantage: displacing the front end of the nuclear fuel cycle could impact employment in the domestic uranium mining, conversion, and enrichment sectors. The analysis in section 4.8 of the HEU Final EIS concludes that DOE will be able to avoid causing adverse material impacts on those industry sectors, as required by provisions of the USEC Privatization Act.

D. Floodplains Impacts

1. Floodplain Assessment

As required by DOE—s regulations on protection of floodplains and wetlands (10 CFR Part 1022), the HEU Final EIS assesses whether the proposed action would impact or be impacted by the floodplains at the involved sites. The proposed action in the HEU Final EIS involves blending activities that would be accommodated within existing facilities at Y–12, SRS, B&W, and NFS. The locations of facilities at the candidate sites with respect to delineated floodplains are presented in the maps shown in Figures 3.3.4–2, 3.4.4–2, 3.5.1–2, and 3.6.4–1 of the HEU Final EIS, respectively.

Because HEU blending activities associated with the proposed action and its alternatives could be accommodated in existing facilities, no positive or negative impacts on floodplains would be expected at any of the candidate sites. Similarly, since no new construction activity is proposed at any of the candidate sites and blending facilities are not located in the vicinity of wetlands, no impacts to wetlands are anticipated.

As discussed in sections 3.3.4 and 3.5.4 of the HEU Final EIS, and shown in Figures 3.3.4–2 and 3.5.1–2, blending operations at the Y–12 Plant and B&W, respectively, would be accommodated in facilities located outside the 100- and 500-year floodplains. At SRS, the F- or H-Canyons that could be used for blending also fall outside the 100-year floodplains of the Fourmile Branch and the Upper Three Runs Creek (EIS Section 3.4.4). The 500-year floodplain limits at SRS are not currently delineated. However, the blending alternatives at SRS would not likely affect, or be affected by, the 500-year floodplain of either the Fourmile Branch or Upper Three Runs Creek because the F- and H-Canyons are located at an elevation of about 91 m (300 ft) above mean sea level and are approximately 33 m (107 ft) and 64 m (210 ft) above these streams and at distances from these streams of 0.8 km (0.5 mi) to 1.5 km (0.94 mi), respectively. The maximum flow that has occurred on the Upper Three Runs Creek was in 1990, with a flow rate of about 58 m^3/s (2,040 ft^3/s). At that time the creek reached an elevation of almost 30 m (98 ft) above mean sea level. The elevations of the buildings in F- and H-Canyons are located more than 62 m (202 ft) above the highest flow elevation of the Upper Three Runs Creek. The maximum flow that has occurred on the Fourmile Branch was in 1991 with a rate of approximately 5 m^3/s (186 ft^3/s), and an elevation of about 61 m (199 ft) above mean sea level. Elevations of the buildings in F- and H-Areas are located more than approximately 30 m (101 ft) higher than the maximum flow level that has occurred.

The NFS site is partially located on the 100- and 500- year floodplains of the Nolichucky River and Martin Creek (as determined by the Federal Emergency Management Agency (FEMA), Flood Insurance Rate Map, January 3, 1985). However, as described in section 3.6.4 of the EIS and below, mitigation measures have been and would continue to be implemented to reduce potential flooding of the site and the likelihood of adverse impacts to site operations.

2. Final Floodplain Statement Of Findings

The HEU Final EIS includes, in section 4.13.1, a Proposed Floodplain Statement of Findings. The Federal Register Notice of Availability for the Final EIS (61 FR 33719) stated that DOE would accept comments on the proposed statement of findings during a 15-day period. The Department received no comments in response to that notice. This section of the ROD constitutes the Final Floodplain Statement of Findings, as required by 10 CFR 1022.15.

Four candidate sites, two DOE (Y–12 and SRS) and two commercial (B&W and NFS), were considered in the HEU Final EIS as potential sites where the proposed action could be implemented. These candidate sites were selected for evaluation because they currently have technically viable HEU conversion and blending capabilities and could blend surplus HEU to LEU for commercial fuel or waste. In addition, the commercial sites considered are the only ones in the United States presently licensed for the processing of HEU.

As described above, all facilities except NFS that are proposed to be used for this proposed action at the candidate sites would be outside the limits of the 100-year floodplain and are at least one foot above the 100-year floodplain elevation and, therefore would conform to both State and local floodplain requirements.

The floodplains of the Nolichucky River and Martin Creek at NFS, as presented in Figure 3.6.4–1 of the HEU Final EIS, cover approximately one-third and two-thirds of the NFS site's northern portion under 100-year and 500-year floodplain conditions, respectively. Based on the Flood Insurance Rate Map and the flood profiles, both published by FEMA, floodplain elevations at the NFS site are determined to be 499.5 m (1639 ft) and 500 m (1640 ft) above mean sea level for the 100-year and 500-years floods, respectively. As stated in the Nuclear Regulatory Commission's (NRC) Environmental Assessment for Renewal of Special Nuclear Material License No. SNM–124, Nuclear Fuel Services, Inc., Erwin Plant, Erwin, Tennessee (August 1991), elevations of the building floors are between 500 m (1640 ft) and 510 m (1660 ft) above mean sea level. At the time of construction of the plant (1956), there were no local, State, or NRC requirements prohibiting construction or operation of nuclear facilities in 100- or 500-year floodplains. Presently, the State of Tennessee has no requirements pertaining to building in 100- or 500-year floodplains. Local standards require that any new construction or substantial improvement of any commercial, industrial, or non-residential structure should have the lowest floor, including basement, elevated no lower than one foot above the level of base flood (100-year flood) elevation. Because NFS was built prior to 1974, site operations are grandfathered, and this local requirement does not apply to existing facilities at NFS. NRC, which regulates the NFS site, also has no regulations against building or operating nuclear facilities in floodplains. Nevertheless, with the widening of the site's culvert, upgraded drainage system, rechanneling of the Nolichucky River, and rerouting of Martin Creek to enter the Nolichucky River farther downstream, the chance of flood levels at the site has been lowered.

In addition, warning devices and systems have been placed by the State of Tennessee along the river to warn the public and the NFS plant of the chance of possible flooding. In addition, NFS and the State of Tennessee have emergency action plans to mitigate potential flood impacts and protect the public water supply from any possible contamination.

There are two alternatives in addition to no action that could be considered to remediate potential flooding of facilities at NFS. One would be to use the facilities in the 300 Area at NFS, which is outside both the 100- and 500-year floodplain limits, for blending activities. Facilities in the 300 Area have building floor elevations of at least 500.5 m (1642 ft) above mean sea level, which would conform to the local requirement of at least one foot above the 100-year floodplain and would also fall outside of the 500-year floodplain. The second alternative is to eliminate NFS as a candidate blending site. Based on the analyses in the HEU Final EIS and on the information in the Floodplains Assessment and this Statement of Findings, DOE will, for any blending done at NFS on the Department's behalf pursuant to this ROD, specify that the work should be done in the 300 Area, and/or that measures to mitigate potential flood impacts at NFS will continue.

E. Preferred Alternative

The Preferred Alternative is identified in the HEU Final EIS as Alternative 5, Maximum Commercial Use (four sites), which is:

- To gradually blend down surplus HEU and sell as much as possible (up to 85 percent) of the resulting commercially usable LEU for use as reactor fuel over time (including 50 metric tons of HEU that are to be transferred to USEC over a 6-year period, along with 7,000 metric tons of natural uranium), using a combination of four sites (Y–12, SRS, B&W, and NFS) and two possible blending technologies (blending as UF_6 and UNH); implemented over an approximate 15- to 20-year period; with continued storage of the HEU until blend-down occurs; and
- To blend down surplus HEU that has no commercial value using a combination of four sites (Y–12, SRS, B&W, and NFS) and two blending technologies (blending as UNH and metal); to dispose of the resulting LEU as low-level radioactive waste (LLW) pursuant to the Programmatic Environmental Impact Statement for Managing, Treatment, Storage, and Disposal of Radioactive and Hazardous Waste (DOE/EIS–0200–D, draft issued in August 1995) (Waste Management PEIS) and associated RODs, and any subsequent NEPA documents tiered from or supplementing the Waste Management PEIS; implemented over an approximate 15- to 20-year period; with continued storage of the HEU until blend-down occurs.

Because some material is in difficult-to-access forms, only about 65–70% of the nominal 200 metric tons of surplus HEU could be blended and made available for commercial use over the next 10–15 years. The Department expects that 15–20 years would be needed to bring about the disposition of the entire nominal 200 metric tons of surplus HEU analyzed in the EIS.

F. Notice of Availability for HEU Final EIS / Basis for Record of Decision

On June 28, 1996, the U.S. Environmental Protection Agency published in the Federal Register (61 FR 33735) a Notice of Availability of the Disposition of Surplus Highly Enriched Uranium Final Environmental Impact Statement (DOE/EIS–0240), after DOE had disseminated approximately 750 copies of the EIS and/or the EIS Summary to government officials, states, Indian tribes, and interested groups and individuals. A separate DOE Notice of Availability, summarizing the HEU Final EIS, appeared in the Federal Register that same day (61 FR 33719).

DOE has prepared this ROD in accordance with the regulations of the Council on Environmental Quality for implementing NEPA (40 CFR Parts 1500–1508) and DOE's NEPA Implementing Procedures (10 CFR Part 1021). This ROD is based on DOE's Disposition of Surplus Highly Enriched Uranium Final Environmental Impact Statement (the HEU Final EIS). In making the decisions announced in this ROD, DOE considered environmental impacts and other factors, such as cost considerations and public comments received on the HEU Draft EIS.

IV. Cost Analysis

To assist the Department in reaching a decision on the HEU disposition program, a study comparing the expected costs of the various disposition alternatives was conducted. The Cost Comparison was completed in April 1996, and was disseminated at the beginning of May 1996 to over 200 individuals who either expressed an interest in the cost issue in comments, or attended one of the public workshops on the HEU Draft EIS, or requested the study. In addition, the availability of the Cost Comparison was noted in the June 28, 1996 Notice of Availability for the Disposition of Surplus Highly Enriched Uranium Final Environmental Impact Statement (61 FR 33719), along with notification that the Department would entertain comments on it during a 15-day period. No comments were received.

The *Cost Comparison* provides estimates of the potential costs for blending HEU by using each of the blending technologies analyzed in the HEU EIS (UNH, UF_6, and metal blending). It compares the economic impact for disposition of the surplus HEU according to the various action alternatives (Alternatives 2 through 5) defined in the EIS, which are based on different proportions of the material being blended for commercial use or for disposal as waste. The report derives the following estimated unit costs for the various blending technologies and end-products:

Metal blending to 0.9-percent LEU for disposal—$13,900/kg of HEU
UNH blending to 0.9-percent LEU for disposal—$22,900/kg of HEU
UF_6 blending to 4-percent LEU for commercial use—$3,200/kg of HEU
UNH blending to 4-percent LEU for commercial use—$5,700/kg of HEU

Unit costs for blending to waste include estimated disposal costs as well as blending costs. The report estimates that the potential sales revenue for each kilogram of HEU blended for commercial use is $11,700, which is substantially greater than the costs for blending it. The cost of ultimate disposal of spent nuclear fuel derived from down-blended HEU that is used commercially would be borne by the utility purchasers of the fuel pursuant to the Nuclear Waste Policy Act.

Based on these unit costs and revenues from commercial sales, the Cost Comparison concludes that disposition of the entire nominal 200 metric tons of surplus HEU under the waste option (Alternative 2) would cost approximately $3.4 billion. In contrast, disposition of 170 metric tons of surplus HEU for commercial use, and disposition of the remaining 30 metric tons as waste (the Preferred Alternative) would result in a net return of about $340 to $770 million. The analyses indicate that, on average, each metric ton of surplus HEU that is blended to LEU fuel and sold, rather than blended for disposal as waste, would save taxpayers $21 million to $26 million (depending on the mix of blending technologies used). The report concludes that it is economically attractive to pursue the commercial fuel option to the maximum extent possible rather than to pursue the waste option exclusively.

V. Environmentally Preferable Alternative

CEQ regulations (40 CFR 1505.2) require that a Record of Decision identify the environmentally preferred alternative(s). The analysis of alternatives presented in Chapter 4 and section 2.4 of the HEU Final EIS indicates that, even using conservative assumptions (that is, assumptions that tend to overestimate risks), all of the action alternatives (Alternatives 2 through 5) would have low radiological impacts on the human environment in or around the analyzed blending sites during accident-free operations or on workers or the populations near the potential transportation routes. However, there are differences among the estimated impacts for the various action alternatives. As discussed in section III.C. of this ROD, above, except for the No Action Alternative, the analyses in the HEU Final EIS indicate that the Preferred Alternative (Alternative 5, blend 85 percent to fuel/15 percent to waste at four sites) would generally result in the somewhat lower total environmental impacts for many resources, including radiological impacts, during accident-free operations, and that the risk of accidents would also be low. Thus, the environmentally preferable alternative is the Preferred Alternative identified in the HEU Final EIS, which, as discussed above, also best serves the economic recovery objective, and fully serves the nonproliferation objective, of the HEU disposition program.

The environmental analyses in the HEU Final EIS indicate that the radiological, air, hazardous chemical, and socioeconomic impacts on the environment during accident-free operations would be low and within regulatory standards for all blending technologies. There would be a choice of two technologies for each of the two end-products (fuel or waste). For surplus HEU that is blended to waste for disposal, either UNH blending or molten metal blending could be used. On the whole, the data in section 2.2.2 and the analyses in section 4.3 of the HEU Final EIS show that molten metal blending would be the environmentally preferable blending technology for most resources for blending surplus HEU to waste, although molten metal blending would generate more *process* LLW (as opposed to the LEU end-product waste) than would UNH blending.

For surplus HEU that is blended for commercial use as reactor fuel feed, either UNH blending or UF_6 blending could be used. The data in section 2.2.2 and the analyses in section 4.3 of the HEU Final EIS show that, on the whole, at the commercial sites, UNH blending would be the environmentally preferable blending technology for blending surplus HEU for commercial use, although UNH blending would produce greater impacts in three resource areas: liquid hazardous waste generated, solid nonhazardous waste after treatment, and transportation. In the area of potential facility accidents, in particular, UF_6 blending would result in higher accident consequences because of the possibility of a UF_6 cylinder breach accident that could release gaseous UF_6 (both radiologically and chemically toxic) into the environment. However, as discussed in section III.C, above, the probability of accidents that would release significant quantities of material into the environment is estimated to be low. DOE concludes that these differences in impacts would not dictate against the use of UF_6 blending technology for blending surplus HEU for commercial use.

The analyses in section 4.3 of the HEU Final EIS indicate that all four of the analyzed blending facilities (Y–12, SRS, B&W, and NFS) have the capacity to process surplus HEU with low impacts to workers, the public, and, for many parameters, the environment during normal operations. For the two DOE sites, the generation of waste based on an increased usage of utilities represents small increases—less than 5 percent over current operations. For the two commercial sites, the generation of waste based on an increased usage of utilities represents increases of over 20 percent, but both facilities have adequate capacities to accommodate the increases since neither site is currently operating at full capacity. Because the NFS site has not been operating recently, it would require a large increase in water usage (166 percent) and fuel requirements (933 percent) relative to the current baseline. However, because the quantity of water and fuel used in the past for similar operations is comparable to that which would be used for the proposed action, it is anticipated that the increase in these requirements can easily be accommodated at NFS. As discussed in section III.D, above, the potential for flooding at NFS is another relative disadvantage of that facility.

For postulated facility accidents, there are also differences among the sites based on different proximities and concentrations of workers and nearby populations, as well as meteorological factors. The analyses in section 4.3 of the HEU Final EIS indicate that accident impacts to the maximally exposed individual member of the public and to the population within 80 kilometers (50 miles) would be lowest at SRS, where the involved facilities are in the middle of a very large, limited-access, rural site, so the distances to members of the public are large. The greatest impacts to the public from accidents would be experienced at Y–12 and NFS, at both of which the involved facilities are relatively close to site boundaries (in the case of NFS, the site is small) and population centers. The postulated accident impacts to on-site non-involved workers would be lowest at SRS (because the workers are fairly widely dispersed) and NFS (because there are relatively few workers on the site). The non-involved worker impacts would be highest at B&W, which has a relatively large workforce in close proximity to the blending facility. However, as noted in section III.C, above, the probabilities of serious accidents at all sites are low.

The environmental justice analysis shows that the SRS site has a substantial minority and low-income population in surrounding census tracts (more than 25 percent minority and low-income in most census tracts, and more than 50 percent minority in several). However, the impacts to surrounding populations are projected to be low for all sites, and lowest for SRS, so there would be no disproportionate adverse impacts on minority populations.

In summary, the analyses in the HEU Final EIS indicate that the environmentally preferable blending facility would be SRS. However, since the impacts at all sites are expected to be low during normal operations for many parameters (including radiological impacts), well within regulatory limits, and since overall risks associated with potential accidents are low, DOE concludes that environmental differences among the sites would not serve as a basis for choosing among them. Each of the facilities would be capable of blending up to the entire inventory of surplus HEU without significant adverse environmental impacts, and use of a combination of facilities can facilitate mission accomplishment.

VI. Decisions

A. Programmatic Decisions

DOE has decided to implement a program to make surplus HEU non-weapons-usable by blending it down to LEU, as specified in the Preferred Alternative (Alternative 5, site variation c [all four sites]) in the HEU Final EIS.

As defined in section 1.4.2 of the HEU Final EIS, the Preferred Alternative is:

- To gradually blend down surplus HEU and sell over time as much as possible (up to 85 percent) of the resulting commercially usable LEU for use as reactor fuel feed, (including 50 metric tons of HEU to be transferred to USEC over a 6-year period[2]); using a combination of four sites (Y–12, SRS, B&W, and NFS), and two possible blending technologies (blending as UF_6 and UNH); over an approximate 15-to 20-year period; with continued storage of the surplus HEU until blend-down occurs; and
- To blend down surplus HEU that has no potential commercial value; using a combination of four sites (Y–12, SRS, B&W, and NFS), and two blending technologies (blending as UNH and metal); to dispose of the resulting LEU as LLW pursuant to Record(s) of Decision associated with the Waste Management PEIS and any other relevant site- or project-specific NEPA reviews[3]; over an approximate 15-to 20-year period; with continued storage of the surplus HEU until blend-down occurs.

Because a portion of the surplus HEU is in forms, such as weapons components, that would require considerable time to make available for blending, it is anticipated that no more than 70 percent of the current surplus HEU could be blended down and commercialized in the near term (over the next 10-to 15-year period).

The preferred site variation is to use all four of the analyzed sites. For purposes of analysis in the EIS, it was assumed that the blending operations would be divided evenly among the four facilities (25 percent to each) under this site variation. However, as noted in section 2.1.2 of the HEU Final EIS, the defined alternatives and site variations were not intended to represent exclusive choices among which the decisionmaker must choose, but rather were proffered to define a spectrum of reasonable alternatives. While the Department considers it likely that each of the four analyzed blending facilities will be used for part of the surplus HEU disposition program, it is highly unlikely that the work would be so evenly divided, and there is no intent to seek such a distribution. Section 4.5.6 of the HEU Final EIS explains how impacts would change over the life of the campaign if the exact fuel/waste ratio or division among sites were different. Because the HEU Final EIS analyzes the impacts of site variations for the Preferred Alternative that would involve blending 0, 25, 50, and 100 percent of the surplus HEU at each of the sites, and concludes that expected impacts would be low for many parameters (including radiological impacts) during normal operations and within regulatory limits for each site even if that site were to blend 100 percent of the inventory, the impacts at any site from any possible distribution of the blending work among the facilities would be low for many parameters (including radiological impacts) during normal operations, and would be bounded by the analyses in the EIS.

As noted in sections 1.3 and 1.4.2 of the HEU Final EIS, decisions about the timing and details of specific disposition actions (which facility or process to use) might be made in part by DOE, by other government agencies, by USEC, by a private successor to USEC, or by other private entities acting as marketing agents for DOE. In the case of the 50 metric tons of surplus HEU that is being transferred to USEC as part of this decision (see below), the choice of blending sites for that work will be made by USEC or its private, corporate successor. The quantities and other characteristics of additional specific ''batches'' of surplus HEU and the exact time and blending sites at which such batches would be subject to disposition are unknown at this time, and would depend on a number of factors, including the rate of weapons dismantlement; the timing and rate at which any additional HEU may be declared surplus; market conditions; legislative restrictions on delivery to commercial end users (see Public Law 104–134); and available throughput capacities and unrelated workloads at the blending facilities. (See section VI.B.2, below, for a discussion of a possible transfer of ''off-spec'' surplus HEU material to the Tennessee Valley Authority.) Competitive bidding procedures—including both the commercial and DOE facilities (the latter under their ''Work for Others'' programs)—as well as facility availability and other business considerations are likely to be key components of disposition actions. DOE is preparing an HEU Disposition Plan, which will be available shortly following publication of this ROD, that will provide additional information concerning specific disposition actions that are expected to commence during the next several years, as well as describe an approach to other future, specific actions. The ultimate distribution of blending work among the four facilities will be determined in multiple individual decisions by multiple decisionmakers, based largely on business and facility availability considerations, over a period of up to 15–20 years.

This programmatic decision does not include within it the choice of blending technologies for specific batches of HEU. The HEU Final EIS analyses indicate that all three of the analyzed technologies (UNH, UF_6, and metal blending) could be used. As in the case of facility selection, the choices of blending technologies are expected to be made largely on the basis of business and technical considerations, and may be made by DOE, USEC, USEC's corporate successor, or other entities.[4]

A portion of DOE's surplus HEU inventory is in various forms of irradiated HEU fuel (the total quantity of which remains classified) from the Department's nuclear weapons, naval nuclear propulsion, or nuclear energy research programs. The irradiated fuel is not directly weapons- usable, is under safeguards and security, and poses no proliferation threat. DOE is not proposing to process the irradiated fuel to separate the HEU for down-blending as part of this decision. There are no current or anticipated DOE plans to process irradiated fuel solely for the purposes of extracting HEU. However, activities associated with the irradiated fuel for purposes of stabilization, facility cleanup, treatment, waste management, safe disposal, or environment, safety, and health reasons could result in the separation of HEU in weapons-usable form that could pose a proliferation threat and thus be within the scope of this EIS. Under the Preferred Alternative

[2] The transfer of 50 metric tons of HEU and 7,000 metric tons of natural uranium from DOE stockpiles to USEC is specifically mandated by section 3112(c) of Public Law 104–134. Both of those transfers are components of the Preferred Alternative and this decision. The delivery to commercial end users of the surplus uranium transferred to USEC could not begin before 1998 pursuant to the statute. Although the transfer of 7,000 metric tons of natural uranium from DOE to USEC is not part of the HEU disposition program, it is part of the same transaction as the transfer of 50 metric tons of HEU, so the environmental impacts of that transfer are assessed in section 4.9 of the HEU Final EIS.

[3] For purposes of analysis of transportation impacts in the HEU EIS, the LLW facility at DOE's Nevada Test Site (NTS) was assessed as a representative site for disposal of LLW from the HEU disposition program. The possibility that this material may be received at the NTS facility is also reflected in the NTS Site-Wide EIS (DOE/EIS–0243, draft published January 1996).

[4] The UF_6 blending technology will not even be available unless the potential commercial blenders make the business decisions to deploy it. If UF_6 blending capability is not developed, all blending for commercial use would use the UNH process. If new blending facilities or processes are proposed in the future, additional NEPA review would be conducted, as appropriate, either by DOE or in connection with NRC licensing proceedings for a commercial facility.

and this decision, DOE would blend such recovered HEU to LEU.[5] To provide a conservative analysis presenting maximum potential impacts, the HEU Final EIS includes such HEU (currently in the form of irradiated fuel) in the material to be blended to LEU, as if such HEU had been separated from the irradiated fuel pursuant to health and safety, stabilization, or other non-defense activities. However, such HEU may actually remain in its present form (without the HEU ever being separated) and be disposed of as high level waste in a repository or alternative pursuant to the Nuclear Waste Policy Act.[6]

B. Basis for Decisions

DOE has concluded that the Preferred Alternative identified in the HEU Final EIS would best serve the purpose and need for the HEU disposition program for several reasons. In terms of the fundamental nonproliferation objective, DOE considers all of the action alternatives (2 through 5) to be roughly equivalent in terms of serving that objective. Both 4-percent LEU in the form of commercial spent nuclear fuel and 0.9-percent LEU oxide for disposal as LLW—and any allocation between them—are considered highly proliferation-resistant material forms, because both reprocessing of commercial spent fuel (to separate the roughly 1 percent of plutonium it contains), and re-enrichment of the 0.9-percent LEU to make HEU again, are technologically difficult, time-consuming, and expensive.

In terms of the economic recovery objective of the program, that objective is best served by the Maximum Commercial Use Alternative. Commercial use would reduce the amount of blending that would be required for disposition (a 14 to 1 blending ratio of blendstock to HEU as opposed to 70 to 1 for waste) and minimize Government waste disposal costs that would be incurred if all (or a greater portion of) the material were blended to waste. The sale of LEU derived from surplus HEU would yield returns on prior investments to the Federal Treasury. As noted in section IV of this ROD, the Cost Comparison for Highly Enriched Uranium Disposition Alternatives indicates that the Preferred Alternative could save as much as $4 billion compared to the blend-to-waste alternative. Under the best case, the proceeds from commercial sales of 85 percent of the inventory could actually more than pay for the entire HEU disposition program, including the blending and disposal of the 15 percent that would still need to be disposed of as waste, and yield $340 million to $770 million in net revenues. (As noted above, however, this degree of commercialization may not ultimately be achieved.)

Finally, as discussed in section III.C of this ROD, the analyses in the EIS indicate that the Preferred Alternative would have somewhat lower overall environmental impacts than the other action alternatives. The Maximum Commercial Use Alternative would generate smaller quantities of radioactive waste requiring disposal than would the No Commercial Use Alternative. Adverse environmental impacts from uranium mining, milling, conversion, and enrichment would be avoided by using this material rather than virgin uranium to produce nuclear fuel. Making beneficial use of the LEU derived from surplus HEU would derive some environmental benefit (when compared to the blend-100-percent-to-waste alternative) in return for the environmental costs that were expended in making the HEU in the first place, thus conserving non-renewable natural resources.

The Maximum Commercial Use Alternative would, as discussed in section 4.8 of the HEU Final EIS, displace some uranium mining, milling, conversion, and enrichment. However, in light of the provision in the USEC Privatization Act that requires DOE to determine that its sales of uranium would not have adverse material impacts on those industries, and the rate at which DOE expects to be able to make surplus HEU available for disposition, serious, long-lasting impacts on those industry sectors is not anticipated. Mitigation of any such impacts, as required by the USEC Privatization Act, is discussed in section VII of this ROD, below.

An indirect impact of the Preferred Alternative would be the creation of spent nuclear fuel (through the use of commercial LEU fuel derived from surplus HEU in power reactors). However, since the LEU nuclear fuel derived from surplus HEU would replace nuclear fuel that would have been created from newly mined uranium without this action, there would be no additional spent fuel that would not otherwise be generated. The domestic spent fuel would be stored, and potentially disposed of in a repository or other alternative, pursuant to the Nuclear Waste Policy Act, as amended (42 U.S.C. 10101 et seq.), with appropriate associated NEPA review.

With respect to the ultimate disposal of LLW material, certain DOE LLW is currently disposed of at commercial facilities, and other DOE LLW is stored or disposed of at DOE sites. A location where LLW derived from DOE s surplus HEU can be disposed of has not been designated. Disposal of DOE LLW would be pursuant to DOE's Programmatic Environmental Impact Statement for Managing, Treatment, Storage, and Disposal of Radioactive and Hazardous Waste (DOE/EIS–0200–D, draft issued in August 1995) (Waste Management PEIS) and associated ROD(s), any subsequent NEPA documents tiered from or supplementing the Waste Management PEIS, and any applicable project- or site-specific NEPA reviews (such as the NTS Site-Wide EIS, currently in preparation). Waste material derived from surplus HEU would be required to meet LLW acceptance criteria of DOE's Office of Environmental Management. No LLW would be transferred to any LLW facility until completion of the Waste Management PEIS (or other applicable project or site-specific NEPA documentation) and would be in accordance with decisions in the associated RODs. Additional options for disposal of LLW may be identified in other documents.

Continued storage of surplus HEU prior to blending may be required for some time. The storage, pending disposition (for up to 10 years) of surplus HEU at the Y–12 Plant (where most of the HEU is stored or destined to be stored), is analyzed in the Environmental Assessment for the Proposed Interim Storage of Enriched Uranium Above the Maximum Historical Storage Level at the Y–12 Plant, Oak Ridge, Tennessee (DOE/EA–0929, September 1994) (Y–12 EA). Impacts from storage, as analyzed in the Y–12 EA, are summarized and incorporated by reference in the HEU Final EIS (see section 4.2). Should storage of surplus HEU pending disposition be required beyond 10 years, it would be done pursuant to and

[5] For example, weapons-usable HEU is anticipated to be recovered from dissolving and stabilizing targets and spent fuel at SRS pursuant to the analysis and decisions in the Final EIS (October 1995) and RODs (December 1995 and February 1996) on the Interim Management of Nuclear Materials at SRS.

[6] If HEU currently in irradiated fuel remains in its current form, it would be managed pursuant to the analyses and decisions in the *Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Environmental Impact Statement* (April 1995) and the associated RODs (60 FR 28680, June 1, 1995, amended by 61 FR 9441, March 8, 1996), and subsequent, project-specific or site-specific NEPA documentation. Such spent fuel could be disposed of as high level waste in a repository pursuant to the Nuclear Waste Policy Act (42 U.S.C. 10101 et seq.). DOE is in the process of characterizing the Yucca Mountain Site in Nevada as a potential repository for disposal of spent fuel pursuant to that Act.

consistent with the ROD associated with the Department's Storage and Disposition of Weapons-Usable Fissile Materials Programmatic Environmental Impact Statement or tiered NEPA documents.

C. Specific Action Decisions

1. Transfer of HEU and Natural Uranium to USEC

As a first concrete disposition action pursuant to the programmatic decisions described in section VI.A of this ROD, above, DOE has decided to transfer title to 50 metric tons of surplus HEU and 7,000 metric tons of natural uranium to USEC for gradual sale and commercial use. In addition to serving the objectives of the HEU disposition program, these transfers are consistent with the Fiscal Year 1996 Federal Budget, and are specifically mandated by the USEC Privatization Act (Pub. L. 104–134, § 3112(c)(1)).

Specifics concerning the timing of deliveries and the characteristics and locations of material to be delivered to USEC (or to blending contractors that USEC selects) are to be established in a separate DOE/USEC Memorandum of Agreement pertaining to the transfers. USEC or its corporate successor will make decisions concerning where and when blending of the 50 metric tons of HEU being transferred will occur, what technologies will be used, and when and how the resultant LEU will be marketed (consistent with the USEC Privatization Act). It is anticipated that USEC will utilize one or both of the commercial blending facilities for down-blending, that the first transfers of HEU will occur before the end of 1996, and that they will continue for about six years. Under the USEC Privatization Act, USEC (or its corporate successor) may not deliver this material for commercial end use prior to 1998, and there are quantitative limits on annual deliveries to end users (Pub. L. 104–134, § 3112(c)(2)).

The transfer of 7,000 metric tons of natural uranium to USEC is not part of the HEU disposition program. However, since it is part of the transaction transferring 50 metric tons of HEU, the impacts of the transfer are assessed in section 4.9 of the HEU Final EIS. This material is in the form of UF_6, and is part of a larger quantity of UF_6 that is in storage at DOE's Portsmouth (Ohio) and Paducah (Kentucky) Gaseous Diffusion Plants, which are currently being leased to USEC for uranium enrichment operations. The most likely disposition of the 7,000 metric tons of natural uranium is eventual use as feedstock for enrichment to nuclear power plant fuel, the usual business of the enrichment plants. If it is so used, and follows the typical path of such uranium, it would probably be enriched to about 2 percent U–235 at the Paducah Plant, then transported to the Portsmouth Plant for additional enrichment to an appropriate commercial material, generally about 4 percent. From there the enriched UF_6 would be transported to a commercial fuel fabrication plant for conversion and fabrication of nuclear fuel. The analysis in section 4.9 of the HEU Final EIS indicates that the environmental impacts from enrichment and transportation of this material would be negligible. Commercialization of the 7,000 metric tons of natural uranium by USEC is regulated by the same USEC Privatization Act limits as described in the preceding paragraph for commercialization of the 50 metric tons of HEU.

2. Down-Blending of ''Off-Spec'' Materials at SRS

A significant portion of the surplus HEU inventory, including most of the approximately 22 metric tons of surplus HEU that is currently located at the SRS site, is in various forms of off-specification or ''off-spec'' material which, when blended down, would not meet standard U.S. commercial nuclear fuel specifications for content of the uranium isotopes U–234 and/or U–236.[7] As noted in section 2.1.1 of the HEU Final EIS, such off-spec material might nonetheless be commercially used as reactor fuel feed under certain circumstances, which might involve blending to somewhat higher enrichment levels, and NRC license amendments for reactors that would use the material.

DOE had previously decided, in two RODs pursuant to the *Interim Management of Nuclear Materials at Savannah River Site Final EIS* (DOE/EIS–0220, October 1995)(IMNM EIS), to use the H-Canyon and/or F-Canyon and associated facilities at SRS for down-blending, as part of its interim stabilization activities under the IMNM EIS, for UNH solutions (60 FR 65300, December 19, 1995), and Mark-16 and Mark-22 (irradiated) fuels (61 FR 6633, February 21, 1996). These materials are part of the inventory of surplus HEU. The IMNM RODs stated that these HEU materials would be blended down to LEU and then either oxidized using the FA-Line in the F-area at SRS, or stored as LEU solutions pending decisions on ultimate disposition.[8]

In addition to the materials noted above, there is also off-spec unirradiated aluminum alloy HEU reactor fuel material located at SRS and Y–12. Pursuant to this HEU ROD, DOE has decided that the unirradiated HEU reactor fuel will also be down-blended at the F-Canyon and/or H-Canyon and associated facilities at SRS, and will eventually be sold for commercial use, if possible. The ability of SRS facilities to withstand earthquakes is currently being reviewed. No surplus HEU from decisions made in this HEU ROD would be introduced into the canyons or blended in the canyon facilities until completion of the seismic review. The HEU down-blending activities at SRS pursuant to this decision will occur during a relatively limited period, subject to facility operations and availability.

The SRS canyon facilities, with their large chemical processing and separations capabilities, are capable of processing these off-spec materials. Commercial blending facilities are reluctant to handle these materials because of the resultant contamination of their facilities with undesirable uranium isotopes. The UNH blending facilities at the Y–12 Plant are also not considered likely candidates for blending of such off-spec material, as their processing capacity and chemical separation capabilities are much lower than the SRS canyon facilities, and may be needed for future defense programs activities.

The USEC Privatization Act (Pub. L. 104–134, § 3112(e)(1)) provides that DOE may transfer off-spec uranium to a Federal agency without resale or transfer to another entity. Pursuant to the Act, DOE may pursue discussions with the Tennessee Valley Authority (TVA), a Federal agency that operates several nuclear power plants, to try to reach agreement on a demonstration of the use of off-spec LEU derived from surplus HEU that would be down-blended at SRS.

[7] The quantities of the various surplus HEU material forms located at SRS remain classified.

[8] As discussed in section 2.2.3.3 of the HEU Final EIS, due to criticality issues, the FA-Line is not capable of oxidizing material at commercial enrichment levels (4–5 percent), so that facility would not be used for oxidation of the commercial material. Rather, these LEU solutions will be stored at SRS until other arrangements can be made for oxidation of commercial-enrichment material. There are several options for providing for solidification of UNH solutions at commercial enrichment levels at SRS, although none is being proposed by DOE at this time. One option being considered is construction of a private, commercial facility on land leased from DOE at SRS. Such a private facility would need to be licensed by the NRC, and would be accompanied by appropriate NEPA review.

3. Other Future Actions

DOE has no other concrete surplus HEU disposition actions under specific contemplation at this time. DOE has decided that, when additional HEU blend-down actions for either commercial use or for disposal as waste are developed in the future, they could involve the use of all four of the analyzed blending facilities. The commercial facilities (B&W and NFS) are considered to be available for such activities immediately. The SRS facilities may also be available for blending some of the HEU. The Y–12 facilities are currently not operational. Under DOE Order 425.1, *Startup and Restart of Nuclear Facilities,* DOE must successfully complete an Operational Readiness Review addressing operational health and safety issues prior to restart of the Y–12 facilities. HEU operations are expected to resume at Y–12 in 1998. Thus, all four of the facilities would potentially be available, and could be used for portions of the HEU down-blending, in the timeframes that additional disposition actions might develop.

DOE is preparing an HEU Disposition Plan, which will be available shortly after publication of this ROD, that will provide additional information concerning specific disposition actions that are expected to commence during the next several years, as well as describe an approach to other future, specific actions. The plan will be updated periodically based on industry response and program progress.

VII. Avoidance/Minimization of Environmental Harm

As discussed in section III.C. above, implementation of the decisions reached in this ROD will result in low environmental and health impacts during normal operations. However, DOE will take all reasonable steps to avoid or minimize harm, including the following:

• DOE will use current safety and health programs and practices to reduce impacts by maintaining worker radiation exposure as low as reasonably achievable.

• DOE will meet appropriate waste minimization and pollution prevention objectives consistent with the Pollution Prevention Act of 1990. As discussed in section 2.3 of the HEU Final EIS, segregation of activities that generate radioactive and hazardous wastes will be employed, where possible, to avoid the generation of mixed wastes. Treatment to separate radioactive and non-radioactive components will be employed to reduce the volume of mixed wastes. Where possible, nonhazardous materials will be substituted for those that contribute to the generation of hazardous or mixed waste. Waste streams would be treated to facilitate disposal as nonhazardous wastes, where possible. In addition to following such practices at its own facilities, DOE will seek to include comparable requirements in any contracts with commercial facilities.

• Consistent with the requirement of the USEC Privatization Act (Pub. L. 104–134, § 3112(d)(2)(B)), DOE will determine, before making sales of LEU derived from HEU for commercial use, whether such sales would have adverse material impacts on the domestic uranium mining, conversion, or enrichment industries, taking into account other DOE sales of uranium and the sales of uranium under the Russian HEU Agreement and the Suspension Agreement. Such determinations may be made on a periodic basis (for example, for all contemplated sales over a certain period), as opposed to a sale-by-sale basis. (No such determination is required under the USEC Privatization Act for the initial transfer of 50 metric tons of HEU and 7,000 metric tons of natural uranium to USEC, as provided in section VI.B. of this ROD, or to transfers to other government agencies [such as TVA] of off-spec material.)

VIII. DOE Public Reading Rooms

Copies of the HEU Final EIS, the *Cost Comparison for Highly Enriched Uranium Disposition Alternatives,* and this ROD, as well as technical data reports and other supporting documents, are available for public review at the following locations:

Department of Energy Headquarters, Freedom of Information Reading Room, Forrestal Building, 1000 Independence Ave., SW, Washington, DC 20585, Attn: Carolyn Lawson, 202–586–6020

Albuquerque Operations Office, Technical Vocational Institute, 525 Buena Vista, SE, Albuquerque, NM 87106, Attn: Russ Gladstone (contractor), 505–224–3286, Elva Barfield (DOE), 505–845–4370

Nevada Operations Office, Nevada Operations Office, U.S. Department of Energy, Public Reading Room, 2753 South Highland Dr., P.O. Box 98518, Las Vegas, NV 89193–8518, Attn: Janet Fogg, 702–295–1128

Oak Ridge Operations Office, U.S. Department of Energy, Public Reading Room, 200 Administration Road, P.O. Box 2001, Oak Ridge, TN 37831–8501, Attn: Amy Rothrock, 615–576–1216

Richland Operations Office, Washington State University, Tri-Cities Branch Campus, 300 Sprout Road, Room 130 West, Richland, WA 99352, Attn: Terri Traub, 509–376–8583

Rocky Flats Office, Front Range Community College Library, 3645 West 112th Avenue, Westminister, CO 80030, Attn: Dennis Connor, 303–469–4435

Savannah River Operations Office, Gregg-Graniteville Library, University of South Carolina-Aiken, 171 University Parkway, Aiken, SC 29801, Attn: Paul Lewis, 803–641–3320, DOE Contact: Pauline Conner, 803–725–1408

Los Alamos National Laboratory, U.S. Department of Energy, c/o Los Alamos Community Reading Room, 1450 Central, Suite 101, Los Alamos, NM 87544, Attn: LANL Outreach Manager, 505–665–2127

Chicago Operations Office, Office of Planning, Communications & EEO, U.S. Department of Energy, 9800 South Cass Avenue, Argonne, IL 60439, Attn: Gary L. Pitchford, 708–252–2013

Amarillo Area Office, U.S. Department of Energy, Amarillo College, Lynn Library/Learning Center, P.O. Box 447, Amarillo, TX 79178, Attn: Karen McIntosh, 806–371–5400

U.S. DOE Reading Room, Carson County Library, P.O. Box 339, Panhandle, TX 79068, Attn: Tom Walton (DOE), 806–477–3120, Kerry Cambell (contractor), 806–477–4381

Sandia National Laboratory/CA, Livermore Public Library, 1000 S. Livermore Avenue, Livermore, CA 94550, Attn: Julie Casamajor, 510–373–5500

IX. Conclusion

DOE has decided to implement a program to make surplus HEU non-weapons-usable by blending it down to LEU, and gradually selling as much of it as possible for commercial use over time, as specified in the Preferred Alternative in the HEU Final EIS, and including the mitigation activities identified in section VII. This programmatic decision is effective upon being made public, in accordance with DOE's regulations implementing NEPA (10 CFR § 1021.315). The goals of this program are to support the United States' nuclear weapons nonproliferation policy by reducing global stockpiles of excess fissile materials so that they may never be used in weapons again, and to recover the economic value of the material to the extent feasible. This program will demonstrate the United States' commitment to its nonproliferation goals, as specified in the President's Nonproliferation and Export Control Policy of 1993, and provide an example for other nations, where stockpiles of surplus HEU may be less secure from potential theft or diversion than those in the United States, to encourage them to take similar actions. The impacts on the environment, workers, and the public from implementing this HEU disposition program are estimated to be low for most parameters (including radiological impacts) during normal operations, and well within applicable regulatory limits.

The decision process reflected in this Notice complies with the requirements of the National Environmental Policy Act (42 U.S.C. § 4321 et seq.) and its implementing regulations at 40 CFR Parts 1500–1508 and 10 CFR Part 1021.

Issued in Washington, D.C., July 29, 1996.

Hazel R. O'Leary,

Secretary.

[FR Doc. 96–19798 Filed 8–2–96; 8:45 am]

BILLING CODE 6450–01–P

Oak Ridge Operations Office; Notice of Program Interest; Diesel Engine Technologies for Light Trucks

AGENCY: Transportation Technologies, DOE.

ACTION: Notice of program interest—diesel engine technologies for light trucks.

SUMMARY: The Department of Energy is today publishing the Notice of Program Interest for support of the cooperative development of technologies for a high efficiency, very low emission, diesel engine for light trucks, specifically pickups and sport utility vehicles. The Department of Energy has sponsored research in high efficiency diesel engines for several years. These programs have assisted industry in continuously improving the technology in diesel engines for large trucks (class 6–8) which have resulted in efficiencies approaching 45% in current production (vs 27% for gasoline engines) and 55% in advanced research designs. Current penetration of diesels has been limited to the larger pickups (over 8500 lbs GVW) due to emission regulations. The Department is proposing the application of this advanced technology to diesel engines specifically designed for the light truck market. This market segment has grown from 23% in 1984 to over 42% in 1995 representing a substantial influx of low fuel economy vehicles into the public and private fleets. This trend threatens to increase the rate of U.S. dependence on foreign petroleum beyond current projections.

DATES: This notice expires at 4:00 PM EDT on September 9, 1996, and applications may be submitted at any time prior to that time.

ADDRESSES: Submit five (5) copies of the application prior to the expiration date of this notice to: U.S. Department of Energy, Oak Ridge Operations Office, Procurement and Contracts Division, Environmental Acquisitions Branch, 200 Administration Road, P. O. Box 2001, Oak Ridge, TN 37831, Attn: Mary Lou Crow, Contract Specialist. (Telephone: 423–576–7343.)

FOR FURTHER INFORMATION CONTACT EITHER OF THE FOLLOWING: Mary Rawlins, DOE Oak Ridge Operations Office, Telephone: 423–576–4507; William L. Siegel, DOE Headquarters, Telephone: 202–586–2457.

SUPPLEMENTARY INFORMATION: The new design must meet all proposed emission regulations for vehicles under 8500 GVW, while maintaining performance levels expected of current production gasoline engines. Efficiency targets will be cited in terms of vehicle miles per gallon (equivalent BTU basis) and at least a 35% improvement is sought over comparable, current production vehicles. The criteria for selection and funding will be based on the offeror's internal technical capabilities in terms of diesel engine development and manufacturing, and a demonstration of the intent in moving the resultant technology to production targeted for light trucks. The latter can be shown by partnering with a domestic, high volume light truck manufacturer on this development effort. The following types of factors will be considered in DOE's evaluation: (1) The overall merit of the proposed project or activity. (2) The anticipated objectives to be achieved and the probability of achieving the stated objectives. (3) The facilities or techniques which the applicant proposes to make available to achieve the proposed project's objectives. (4) The qualifications of the proposed project director or key personnel who are considered to be critical to the achievement of the proposed project's objectives.

APPLICATIONS: A four (4) to five (5) year, 50% cost shared competitive program is anticipated with multiple industry teams. A financial assistance cooperative agreement award instrument will be used. Total program costs are expected to be in the range of $25 to $50 million per team. Award will be subject to the Energy Policy Act of 1992, Section 2306, which contains the following limitation: ''Section 2306. Limits on Participation by Companies—A company shall be eligible to receive financial assistance under sections XX through XXIII of this Act only if— (1) the Secretary finds that the company's participation in any program under such titles would be in the economic interest of the United States, as evidenced by investments in the United States in research, development, and manufacturing (including, for example, the manufacture of major components or subassemblies in the United States); significant contributions to employment in the United States; an agreement with respect to any technology arising from assistance provided under this section to promote the manufacture within the United States of products resulting from that technology (taking into account the goals of promoting the competitiveness of United States industry), and to procure parts and materials from competitive suppliers; and (2) either—(A) the company is a United States-owned company; or (B) the Secretary finds that the company is incorporated in the United States and has a parent company which is incorporated in a country which affords to United States-owned companies opportunities, comparable to those afforded to any other company, to participate in any joint venture similar to those authorized under this Act; affords to United States-owned companies local investment opportunities comparable to those afforded to any other company; and affords adequate and effective protection for the intellectual property rights of United States-owned companies.'' All responsible sources may submit an application. All applications will be evaluated as unsolicited applications. Applications are to be prepared in accordance with 10 CFR 600.10 and shall not exceed five (5) pages. Along with the application, applicants are required to submit (1) SF–424, Application for Federal Assistance, (2) Certifications Regarding Lobbying; Debarment, Suspension and Other Responsibility matters; and Drug-Free Workplace Requirements, (3) Assurance of Compliance Nondiscrimination in Federally Assisted Programs, and (4) DOE F 4620.1, Budget Page. These forms may be obtained from the Contract Specialist and will not be included in the five (5) page limitation

Issued in Oak Ridge, Tennessee on July 29, 1996.

Peter D. Dayton,

Director, Procurement and Contracts Division, Oak Ridge Operations Office.

[FR Doc. 96–19799 Filed 8–2–96; 8:45 am]

BILLING CODE 6450–01–P

Federal Energy Regulatory Commission

[Docket No. ER96–1933–000]

Gelber Group, Inc.; Notice of Issuance of Order

July 30, 1996.

Gelber Group, Inc. (Gelber) submitted for filing a rate schedule under which Gelber will engage in wholesale electric power and energy transactions as a

• Telephone at (202) 343–1255.

Dated: November 13, 2001.

Michael A. Anzick,

Designated Federal Officer.

[FR Doc. 01–28917 Filed 11–16–01; 8:45 am]

BILLING CODE 4191–02–P

DEPARTMENT OF STATE

[Public Notice 3828]

Advisory Committee on International Economic Policy Notice of Postponement and Rescheduling of Public Meeting

The Advisory Committee on International Economic Policy (ACIEP) public meeting described in Public Notice No. 3804 that had been scheduled from 10 a.m. to 12 p.m. on Tuesday, November 20, 2001, in Room 1107, U.S. Department of State, 2201 C Street, NW., Washington, DC 20520 has been postponed. It will now be held on December 12, from 9:00 a.m. to 12:00 p.m. in the Loy Henderson Auditorium at the State Department. The meeting will be hosted by Committee Chairman R. Michael Gadbaw and Assistant Secretary of State for Economic and Business Affairs E. Anthony Wayne.

The ACIEP serves the U.S. Government in a solely advisory capacity concerning issues and problems in international economic policy. The objective of the ACIEP is to provide expertise and insight on these issues that are not available within the U.S. Government.

Topics for the December 12 meeting will be:

• China's Accession to the WTO
• Results of the Doha WTO Ministerial
• The Campaign Against International Terrorism

The public may attend these meetings as seating capacity allows. The media is welcome but discussions are off the record. Admittance to the Department of State building is by means of a pre-arranged clearance list. In order to be placed on this list, please provide your name, title, company or other affiliation if appropriate, social security number, date of birth, and citizenship to the ACIEP Executive Secretariat by fax (202) 647–5936 (Attention: Raynell Bowling); Tel: (202) 647–0847; or e-mail: (*bowlingra@state.gov*) by December 10th. On the date of the meeting, persons who have pre-registered should come to the 23rd Street entrance. One of the following valid means of identification will be required for admittance: a U.S. driver's license with photo, a passport, or a U.S. Government ID.

For further information about the meeting, contact

Deborah Grout, ACIEP Secretariat, U.S. Department of State, Bureau of Economic and Business Affairs, Room 3526, Main State, Washington, DC 20520. Tel: 202–647–1826.

Dated: November 15, 2001.

Deborah Grout,

Executive Secretary, Department of State.

[FR Doc. 01–28969 Filed 11–16–01; 8:45 am]

BILLING CODE 4710–07–P

TENNESSEE VALLEY AUTHORITY

Blending of Surplus Highly Enriched Uranium From the Department of Energy, to Low Enriched Uranium for Subsequent use as Reactor Fuel at the Tennessee Valley Authority's Browns Ferry Nuclear Plant

AGENCY: Tennessee Valley Authority.

ACTION: Issuance of record of decision.

SUMMARY: This notice is provided in accordance with the Council on Environmental Quality's regulations (40 CFR parts 1500 to 1508) and the Tennessee Valley Authority's (TVA) procedures implementing the National Environmental Policy Act. On February 14, 2001, TVA published a notice of adoption of the Final Environmental Impact Statement (FEIS), ''Disposition of Surplus Highly Enriched Uranium,'' prepared by the U.S. Department of Energy (DOE), Office of Fissile Materials. This FEIS was released by DOE in June 1996. TVA was not a cooperating agency on that FEIS. In February 2001, TVA re-circulated the FEIS to agencies and persons who had provided comments on the original DOE FEIS. EPA's Notice of Availability for the re-circulation of the FEIS appeared in the **Federal Register** on February 16, 2001. Subsequent to TVA's adoption of the DOE FEIS and consideration of public comments received on TVA's adoption of the FEIS, TVA has decided to implement the actions related to the preferred alternative identified by DOE. The preferred alternative in DOE's FEIS, as adopted by TVA, is Alternative 5, Maximum Commercial Use.

TVA's actions related to the preferred alternative include entering into an interagency agreement with DOE to obtain approximately 33 metric tons of highly enriched uranium (HEU) for blend down and subsequently to use the low enriched uranium (LEU) in the form of nuclear reactor fuel at TVA's Browns Ferry Nuclear Plant (BFNP). Interagency agreements are a common method for federal agencies to frame roles, responsibilities, and conditions for arrangements between agencies. TVA actions related to the preferred alternative also include entering into contracts with a consortium composed of Framatome ANP of Lynchburg, Virginia and Richland, Washington and Nuclear Fuel Services of Erwin, Tennessee, to process and blend the uranium and to fabricate the fuel.

FOR FURTHER INFORMATION CONTACT: Bruce L. Yeager, Senior Specialist, National Environmental Policy Act, Environmental Policy and Planning, Tennessee Valley Authority, 400 West Summit Hill Drive, mail stop WT 8C, Knoxville, Tennessee 37902–1499; telephone (865) 632–8051 or e-mail blyeager@tva.gov.

SUPPLEMENTARY INFORMATION:

Synopsis of Decision

After analysis of the adequacy and applicability of the DOE's Final Environmental Impact Statement for Disposition of Surplus Highly Enriched Uranium, TVA's adoption of the DOE FEIS (**Federal Register**, February 14, 2001), re-circulation of the DOE FEIS, and the consideration of public comments received on TVA's adoption of the FEIS, TVA decided to implement the actions (as described below) related to the preferred alternative identified in the DOE FEIS. These actions include entering into an interagency agreement with the DOE and into contracts with a private consortium for the procurement and processing of the HEU and for the fabrication of LEU into nuclear fuel. TVA will obtain approximately 33 metric tons of HEU from the DOE for blending down and subsequently use the LEU as nuclear reactor fuel at TVA's BFNP. Framatome ANP will process and blend the uranium at the Nuclear Fuel Services facility in Erwin, Tennessee, and fabricate fuel at its facilities in Richland, Washington. The first fuel covered by the contracts is expected to be loaded during the spring of 2005 and the last reload is expected to occur in 2015.

Basis for Decision

TVA has decided to implement the actions described under the DOE preferred alternative (Maximum Commercial Use) because it would result in substantial savings to TVA ratepayers in nuclear fuel costs in the years 2005–2015, thereby aiding TVA in its mission of providing low cost, reliable power for the Tennessee Valley region without significantly impacting the environment. Implementation of

TVA's actions would also avoid the environmental impacts associated with producing an equivalent amount of LEU from 14 million pounds of natural uranium (as U3O8) that in turn would require mining of 140,000 tons of ore.

Background

In accordance with United States policies and international agreements for the non-proliferation of weapons-usable fissile material, the President declared on March 1, 1995 that approximately 200 tons of this material was surplus to United States defense needs. In the HEU Final EIS (Issued June 28, 1996), DOE considered the potential environmental impacts of alternatives for a program to reduce global nuclear proliferation risks by blending up to 200 metric tons of United States-origin surplus HEU down to LEU to make it non-weapons usable. The resulting LEU was to either be sold for commercial use as fuel feed for non-defense nuclear power plants, or disposed of as low-level radioactive waste (LLW). After consideration of the public comments received, DOE finalized the HEU EIS and decided to implement the preferred alternative (Maximum Commercial Use) of the FEIS. Implementation of the preferred alternative will involve gradually blending up to 85 percent of the surplus HEU to a U-235 enrichment level of approximately 4 percent for sale and commercial use over time as reactor fuel feed, and blending the remaining surplus HEU down to an enrichment level of about 0.9 percent for disposal as LLW. This would take place over an estimated 15-to 20-year period.

Three blending technologies (uranyl nitrate hexahydrate [UNH] liquid) blending; uranium hexafluoride (gas); or molten metal blending), and four potential blending sites (DOE's Y–12 Plant in Oak Ridge, Tennessee; DOE's Savannah River Site in Aiken, South Carolina; the Babcock and Wilcox Naval Nuclear Fuel Division Facility in Lynchburg, Virginia; and the Nuclear Fuel Services, Inc. Plant in Erwin, Tennessee) were considered in the FEIS.

DOE issued the Final Environmental Impact Statement for Disposition of Surplus Highly Enriched Uranium in June 1996, and subsequently issued a Record of Decision on July 29, 1996.

TVA published a Notice of Adoption for this FEIS in the **Federal Register** on February 14, 2001, and the Environmental Protection Agency's Notice of Availability for re-issue of the FEIS appeared in the **Federal Register** on February 16, 2001. The FEIS was re-circulated by TVA to federal and state agencies. Individuals and organizations who had provided comment on DOE's draft EIS were mailed the Notice of Adoption and a letter noting TVA's adoption of the FEIS, and its availability. Additionally, the FEIS was placed in local libraries in Aiken, South Carolina; Richland, Washington; Athens, Alabama; and Erwin, Oak Ridge, Knoxville, and Chattanooga, TN.

At their March 28, 2001, public meeting, the TVA Board of Directors approved delegation of authority to enter into the Interagency Agreement with the Department of Energy for obtaining surplus HEU and processing the HEU to LEU. The Board further approved delegation of authority for awarding separate contracts to Framatome ANP (Lynchburg, VA and Richland, WA) for processing and blending HEU to LEU, and for fabrication of fuel assemblies for use in TVA reactors. The environmental impacts of the above actions were earlier evaluated by TVA and determined to be bounded by the actions analyzed in the DOE FEIS. The FEIS was subsequently adopted by TVA.

Alternatives Considered

Because of the large number of potential combinations of end products, blending technologies and blending sites, DOE formulated several representative alternatives that bounded potential effects. The Final HEU EIS adopted by TVA considered and analyzed the No Action Alternative and four reasonable alternatives for blending of a nominal 200 metric tons of surplus HEU down to LEU to make it non-weapons-usable. In addition to the No Action Alternative (continued storage of surplus HEU), DOE considered four alternatives that represent reasonable choices within the matrix of possible combinations for blending of different proportions of the surplus HEU for commercial use or for disposal as waste, with variations on numbers and locations of blending sites. The analyses of potential effects from the types and amounts of materials, transfer of materials, and sites in the range of alternatives considered by DOE bound those implemented in TVA's actions. The FEIS considered:

- Alternative 1—No Action (continued storage)
- Alternative 2 (No Commercial Use)—Blend 100 percent to waste (at all four sites)
- Alternative 3 (Limited Commercial Use)—Blend 75 percent to waste (at all four sites), 25 percent to fuel (at 2 commercial sites)
- Alternative 4 (Substantial Commercial Use)—Blend 35 percent to waste, 65 percent to fuel (at any 1 site, the 2 commercial sites, the 2 DOE sites, or at all 4 sites)
- Alternative 5 (Maximum Commercial Use)—Blend 15 percent to waste, 85 percent to fuel (at any 1 site, the 2 commercial sites, the 2 DOE sites, or at all 4 sites).

As described in the DOE FEIS, each alternative involving commercial use of LEU derived from surplus HEU (Alternatives 3, 4, and 5) included transfer of 50 metric tons of surplus HEU and 7,000 metric tons of natural uranium from DOE stockpiles to the United States Enrichment Corporation (USEC) for eventual sale and commercial use.

Environmentally Preferred Alternative

Council on Environmental Quality (CEQ) regulations require that a Record of Decision identify the environmentally preferred alternative(s). The analyses in DOE's HEU final EIS indicated that the environmentally preferred site for the blending facility would be the Savannah River site (SRS). However, since the impacts at all proposed blending sites are expected to be low during normal operations (including radiological impacts) and well within regulatory limits, and since the overall risks associated with potential accidents are low, TVA concludes that the minor environmental differences between sites would not serve as a basis for choosing among them. Each of the facilities identified in the FEIS would be capable of blending up to the entire inventory of surplus HEU without significant adverse environmental impacts. Further, location of the oxide conversion facility at NFS in Erwin, Tennessee, where conversion of UNH liquid to uranium dioxide powder will occur with subsequent shipment of the oxide powder to the Framatome ANP-Richland nuclear fuel fabricating facility, has less potential for environmental impacts than shipment of UNH liquid or crystals to the fabricating facility.

Environmental Consequences

The environmental analyses in DOE's FEIS estimated that the incremental radiological and other impacts of disposition of HEU during normal accident-free operations would be low for workers, the public and the environment, and well within regulatory requirements for all alternatives. Blending activities that would be conducted for the proposed TVA actions would be substantively the same as activities that have been analyzed in DOE's FEIS. The incremental impacts from TVA's actions would be low and well within the bounds of impacts described in the DOE FEIS. There would be some increases in water usage, fuel needs, and waste generation from use of the NFS site. However, these increases can be accommodated at the NFS site. The only additional construction required would be that for an oxide conversion facility and a uranyl nitrate storage facility at the NFS site. As discussed in response to comments below (Impact of Converting Low Enriched Uranyl Nitrate Solution to UO2 (Provision 7), the potential effects of performing the conversion to oxide at NFS is not a substantial change relevant to environmental concerns in the FEIS. Further, the impact of these minor changes is within the bounds of impacts analyzed. Conversion of the material at NFS would result in fewer and safer shipments of a less soluble form of uranium.

Response To Public Comments Received on TVA's Adoption Of DOE's FEIS

During the public review period, four agencies (US Environmental Protection Agency {EPA}, Nuclear Regulatory Commission {NRC}, Alabama Department of Environmental Management {ADEM} and Tennessee Department of Environment and Conservation {TDEC}); two organizations (Local Oversight Committee—Oak Ridge Reservation {LOC} and the Citizens for National Security {CNS}); and three individuals responded with comments on TVA's notice of adoption of the DOE FEIS for highly enriched uranium (HEU) disposition. On March 16, 2001, the EPA published their Availability of Comments on Environmental Impact Statements in the **Federal Register** in which the EPA expressed lack of objections with TVA's adoption of, and no concerns with, DOE's FEIS provided TVA follows the actions described in the FEIS. On March 8, 2001, the Alabama Department of Environmental Management (ADEM) responded that the agency had no comments concerning the disposition of highly enriched uranium into nuclear fuel assemblies for the TVA BFNP in Athens, Alabama.

General comments from individuals included concerns regarding: (1) Threat of nuclear materials to humans and the environment (1 individual); (2) comments of support regarding the nuclear power industry and/or the TVA action (2 individuals); (3) the appropriateness of using an Interagency Agreement between TVA and DOE (LOC); and 4) desire for a public meeting or additional time for comment (LOC and 1 individual). The first two comments were noted. With regard to the third comment the proposed use of an Interagency Agreement between TVA and DOE to document each parties obligations is an appropriate contractual instrument to specify the role of two federal agencies implementing a project. A considerable number of opportunities were provided to the public to comment on the original DOE FEIS. The 33-day period provided for submitting comments on TVA's adoption of DOE's FEIS (after re-circulation of the FEIS), constituted additional opportunity for review of TVA's proposed actions and their relationship to DOE's actions. All comments received were considered in TVA's deliberations.

Other comments from the public, organizations, and agencies were in the following areas of specific concern:

- General comments about need to maintain consistency with the DOE FEIS (EPA, TDEC, LOC, CNS);
- Source of blendstock, inclusion of off-specification materials in the DOE FEIS, the processes used for blending and types of products involved (LOC, NRC, 1 individual);
- Desired identification of specific transport routes, methods and types of materials (CNS, LOC, 1 individual) as it relates to the DOE FEIS;
- Scaling down of potential impacts to the lesser quantities involved in the TVA action (1 individual);
- NEPA analysis related to the NFS facility and the environmental assessment to be performed by NRC for a license amendment for the NFS facility (NRC, 1 individual);
- Age of the DOE FEIS and identification of areas the commenter believed needed updated, additional review or further disclosure of analyses, e.g. socioeconomic, transportation, safeguards and accident scenarios (CNS);
- Assurance that regulation and licensing would be consistent with NRC procedures for other commercial fuel cycle facilities in the United States and previous Records of Decision issued by DOE regarding disposition of Low Level Waste (TDEC).

TVA initiated review on the use of surplus HEU as a source of low enriched uranium in March, 1994 in response to a Commerce Business Daily inquiry and **Federal Register** notice from DOE for proposed disposition options for uranyl nitrate (UN) solutions at its Savannah River Site (SRS). TVA performed feasibility studies specifically aimed at utilization of ''off-spec'' HEU as a source of enriched uranium for TVA reactors and began discussions with commercial fuel vendors to identify potential interest in providing fuel fabrication services using such uranium. Based on these studies, TVA provided input for DOE's consideration in evaluating the alternatives for HEU disposition in the FEIS. Following NEPA review for potential environmental effects, TVA conducted a limited successful demonstration (from Spring 1999 through Fall 2000) at its Sequoyah Nuclear plant using 4 fuel assemblies derived from off-specification highly enriched uranium. Results of the test indicated that the HEU-derived fuel performed normally, caused no changes in plant operational parameters, characteristics or safety, and resulted in no new or additional wastes beyond those occurring with typical operations.

In 1997, TVA and DOE signed a Memorandum of Understanding to fully investigate the commercial and technical viability of using up to 33 metric tons of ''off-spec'' HEU. TVA requested formal proposals from all domestic commercial fuel vendors in 1998 to provide services including HEU purification, downblending, conversion to uranium dioxide powder, and fabrication into fuel assemblies. A consortium composed of Framatome-Cogema Fuels in Lynchburg, Virginia, Siemens Power Corporation in Richland, Washington, and Nuclear Fuel Services in Erwin, Tennessee, provided the best proposal. Subsequent to the original proposal, Framatome-Cogema Fuels and Siemens Power Corporation merged into Framatome ANP. TVA then initiated joint negotiations with DOE and the consortium to determine the most cost-effective approach to complete the HEU disposition consistent with the FEIS assumptions. These negotiations have culminated in the TVA decision to enter into agreements with DOE and the commercial consortium. These agreements have the following major provisions:

1. DOE shall provide natural uranium in the form of UF6 to TVA as blendstock.
2. TVA shall provide natural uranium oxide for downblending 33 metric tons of HEU.
3. TVA's contractor shall convert 225 metric tons of natural uranium powder into UN solution and ship the solution to SRS for downblending HEU.
4. DOE shall downblend approximately 16 metric tons of HEU at SRS into low-enriched UN solution containing 233 metric tons of uranium.
5. TVA's contractor shall ship the low-enriched UN solutions from SRS to the NFS site.
6. DOE shall ship approximately 17 metric tons of HEU to NFS for

downblending into low-enriched UN solution containing 228 metric tons of uranium.

7. TVA's contractor shall convert all of the low-enriched UN solutions to UO2 powder containing 461 metric tons of uranium at the NFS site.

8. TVA's contractor shall ship the UO2 powder to Richland, WA for fuel pellet and fuel assembly fabrication.

The environmental impacts of the above actions have been evaluated by TVA and determined to be bounded by the actions analyzed in the FEIS. The following discussion provides the basis for this determination, and also attempts to address comments received from the public, organizations and agencies.

Impact of Blendstock Selection (Provisions 1 and 2)

DOE evaluated a number of different options for providing uranium blendstock to blend the HEU (FEIS pages 2–4 & 2–14). These included depleted uranium and natural uranium both in the form of UF6 and uranium oxide powder. The natural or depleted UF6 to be provided to TVA already exists in DOE inventory at the USEC. Transfer to TVA would be accomplished at the USEC site by a ''book transfer'' to the TVA inventory already in storage at USEC. Therefore, no environmental impact would result from this transfer action. Since a UNH blending process will be utilized both at SRS and NFS, UF6 must be converted into uranium oxide powder for dissolution into UN solution. TVA evaluated the alternative of converting the UF6 to uranium oxide at one of its commercial fuel fabricators versus procuring uranium oxide powder directly on the commercial uranium market. The total cost of shipping the UF6 (either natural or depleted uranium), conversion to uranium oxide powder, and shipping the powder to NFS for dissolution was greater than procuring the powder directly. Furthermore, the environmental impact of the UF6 conversion to powder would be greater. Approximately 50–70 shipments of depleted or natural UF6 from the USEC facilities in Paducah, Kentucky, or 50 shipments of depleted UF6 from Oak Ridge, Tennessee, would be required. The FEIS evaluated shipping UF6 to the GE (now Global Nuclear Fuel—GNF) plant in Wilmington, North Carolina, from Paducah (a distance of 1,278 km) or from Oak Ridge (a distance of 791 km) for conversion to uranium oxide powder. Once converted the uranium oxide powder would have to be shipped from the GNF plant to NFS (a distance of 860 Km) in approximately 40 shipments. To complete these actions, a minimum of 90 total shipments resulting in 73,950 shipment-km of transportation would be required. TVA proposed procuring uranium oxide powder directly from a commercial supplier such as Cameco in Ontario, Canada. Approximately 40 shipments of uranium powder from the Cameco facility in Blind River, Ontario, Canada (a distance of 1,700 Km from NFS) would be required, resulting in 68,000-km of transportation. Although, the route from Cameco to NFS was not specifically analyzed in the FEIS, the expected environmental impact from this transportation is estimated to be less than the UF6 alternative primarily due to the elimination of the UF6 shipments. (Note that UF6 is a more volatile chemical form than uranium oxide). Shipment of uranium oxide powder from other commercial suppliers in the United States would have less impact than shipments from Cameco. The FEIS did evaluate the impact of shipping natural uranium powder from the Hanford site in Richland, Washington, to SRS (a distance of 4,442 km) to bound the maximum intersite transportation effects (FEIS page 2–14 and Appendix G) for all intermediate routes. The FEIS analyses of this route does bound the impact of the TVA proposed action. TVA also evaluated use of surplus depleted uranium solutions at SRS and surplus low-enriched uranium powder at DOE's Fernald site as blendstock.

Both of these alternatives were unacceptable because the chemical contaminants in this material made it unusable as blendstock.

Finally, the incremental effect of TVA's adopted action is less than the TVA alternative action of refueling its reactors using uranium procured in the commercial market. If TVA did not use the surplus HEU as a source of uranium, it would have to procure natural UF6 from its commercial vendors. Only two vendors exist in North America, ConverDyne in Illinois and Cameco in Canada. TVA normally procures 50 percent of its requirements annually from each of these suppliers. If the HEU-derived uranium is not used, TVA would procure approximately 2,500,000 kg of uranium as UF6 from Cameco. This would require over 300 shipments of natural UF6 from Cameco to USEC enrichment facilities at Paducah, Kentucky, (a distance of 1450 km) resulting in 435,000 shipment-km. Therefore, the proposed action, procuring natural uranium oxide powder from Cameco as blendstock has much less significant environmental impacts in regard to transportation than the alternative of not using the HEU-derived uranium.

Impact of Blendstock Dissolution (Provision 3)

The natural uranium oxide powder delivered to NFS will be converted into a uranyl nitrate solution for blending HEU using the UNH blending process (FEIS page 2–20). Approximately, 562,500 liters of uranyl nitrate solution containing 225,000 kg of uranium will be shipped from the NFS site in Erwin, Tennessee, to the SRS in Aiken, South Carolina, (a distance of 620 km). The shipments will be made in DOT certified cargo tank trailers approved for shipping uranyl nitrate solution. Approximately 50 shipments total will be required with a maximum of 15 shipments in a year. The route to be taken will primarily be interstate highways from Johnston City, Tennessee, to Asheville, North Carolina, via I–81 and I–40, Asheville, North Carolina, to Columbia, South Carolina, via I–26, and Columbia, South Carolina, to Aiken, South Carolina, via I-20. The FEIS does not specifically evaluate these shipments in Appendix G. However, the FEIS does evaluate shipment of 4 percent uranyl nitrate solution from SRS to the Westinghouse commercial fuel fabrication plant in Columbia, South Carolina, (FEIS page 4–95) and the shipment of 4 percent uranyl nitrate hexahydrate from NFS to Westinghouse in Columbia, South Carolina, (FEIS page G–7) over the same route. The results of the FEIS transportation analyses bound the expected impacts of the planned natural uranyl nitrate solution shipments from Erwin, TN to Aiken, SC because the total number of shipments evaluated in the FEIS over the same route is greater than 500 shipments and the FEIS analyses were done for 4 percent enriched uranium instead of natural uranium. The total health impact of shipping the natural uranyl nitrate solution (estimated at <6E–03 fatalities total) is significantly less than the total heath impact from the FEIS analyses (5.5E–02 fatalities total). Furthermore, the FEIS bounding analyses for shipping natural uranium blendstock (FEIS page 2–14) is from the Hanford site in Richland, Washington, to SRS (a distance of 4,442 km). For 50 shipments of natural uranium blendstock over this route a total health impact of 3.7E–02 fatalities can be calculated from Table G.1–6 of the FEIS.

Impact of Blending 17 Metric Tons of HEU at SRS (Provision 4)

The FEIS specifically evaluates blending up to 200 metric tons of HEU to a combination of 4 percent UNH and

0.9 percent UNH at SRS (FEIS pages 2–64 to 2–77).

Impact of Shipping Enriched Uranyl Nitrate Solution from SRS to NFS (Provision 5)

TVA's contractor will ship 233 metric tons of low enriched uranium as uranyl nitrate solution from SRS to NFS in Erwin, Tennessee. The route to be used is the same route discussed previously in regard to natural uranium solution shipping. The shipments will be made in 230 gallon Type B shipping containers licensed by the NRC. Each commercial truck shipment will carry 9 shipping containers for a total of 2070 gallons containing 800 kg of uranium. Type B shipping containers are required by federal regulations for these shipments because of the U–234 concentration expected in the uranyl nitrate solution. Type B containers are designed and tested to meet stringent requirements (FEIS page G–14) to ensure that the contents are not released even under hypothetical accident conditions. TVA contracted with Columbiana Boiler to design, test, and license a bulk liquid transport package suitable for shipping low-enriched uranyl nitrate solution.

The uranyl nitrate solution shipping campaign will occur over the period of 2003–2007 and will require approximately 300 shipments. The maximum number of shipments expected per year is 70. The FEIS evaluated shipment of 4 percent uranyl nitrate solution from SRS to the Westinghouse commercial fuel fabrication plant in Columbia, South Carolina, (FEIS page 4–95) using Type A cargo tankers and the shipment of 4 percent uranyl nitrate hexahydrate crystal from NFS to Westinghouse in Columbia, South Carolina (FEIS page G–7) using Type A containers.

These shipments are over the same route proposed for the low enriched uranyl nitrate solution. The results of the FEIS transportation analyses cited bound the expected impacts of the planned low enriched uranyl nitrate solution shipments because the total number of shipments evaluated in the FEIS over the same route is greater than 500 shipments as compared to the 300 shipments necessitated by the TVA action. Additionally, the FEIS assumes the shipments are made in Type A containers (FEIS page 4–102) with a 100 percent content release rate during maximum accident conditions (FEIS page G–2). The low enriched uranyl nitrate solution shipments will be made in Type B containers with zero content release expected during accident conditions. The total health impact of shipping the low enriched uranyl nitrate solution is estimated to be less than 5.8E–02 fatalities using the conservative assumptions of the FEIS. The smaller number of shipments and the use of Type B containers would result in lesser health impacts from TVA actions. Furthermore, the FEIS bounding analyses for shipping low enriched uranium is from SRS to Siemens in Richland, Washington, (a distance of 4,442 km). For 300 shipments of low enriched uranium over this route a total health impact of 2.1E–01 fatalities can be calculated from Table G.1–7.

Impact of Blending 16 Metric Tons of HEU at NFS (Provision 6)

The FEIS specifically evaluates blending up to 200 metric tons of HEU to a combination of 4 percent UNH and 0.9 percent UNH at NFS (FEIS pages 2–64 to 2–77).

Impact of Converting Low Enriched Uranyl Nitrate Solution to UO2 (Provision 7)

Processing and downblending up to 200 metric tons of HEU at the NFS site is specifically evaluated in the FEIS. The FEIS assumes that the product of the downblending operation would be UNH crystals. The process is illustrated in the FEIS on page 2–21. Further, the FEIS assumes that the UNH crystals will be shipped to commercial fuel fabricators for dissolution to UN liquid, denitration to U3O8 powder, and reduction to UO2 powder.

Under TVA's adopted action, the denitration and reduction processes to produce low enriched UO2 powder would be undertaken at the NFS site. The FEIS evaluated the impacts of downblending 25 percent of the surplus HEU (50 metric tons) to 0.9 percent enriched uranyl nitrate solution (3750 metric tons) and conversion to U3O8 powder at the NFS site (FEIS pages 2–20 to 2–22 and 2–41 to 2–44). Thermal denitration of uranyl nitrate solution to U3O8 will produce essentially equivalent gaseous and liquid effluents as the ammonium diuranate(ADU) process used to produce UO2. In the thermal denitration process, nitrates are recovered from the offgas in a liquid process. In the ADU process, the nitrates are also recovered as liquid and the ammonium hydroxide is recycled. Both processes require offgas treatment including filtration for uranium solids by HEPA filtration. Since the effluent from the ADU process will be concentrated and solidified, the impact to the environment will be minimized. Therefore, the FEIS analyses for conversion of 3750 metric tons uranium as uranyl nitrate solution to U3O8 powder bound the expected impacts of the proposed conversion of 461 metric tons uranium as low enriched uranyl nitrate solution to UO2 powder at the NFS site. Addition of these processes and the storage tank facility at the NFS site for uranyl nitrate, would require a license amendment from the NRC. The NRC will independently evaluate the potential environmental impacts of a proposed license amendment by NFS.

Impact of Shipping 461 Metric Tons of UO2 Powder to Framatome ANP-Richland (Provision 8)

After the low enriched uranyl nitrate solution is converted into UO2 powder at NFS, it will be shipped to the Framatome ANP fuel fabrication facility in Richland, Washington. The shipping campaign will occur over the period of 2004–2008. A total of 154 shipments will be required to transport 461 metric tons of uranium as UO2 powder. The maximum number of shipments expected in any one year is 40. The UO2 will be packaged in Type B shipping containers meeting DOT requirements and licensed by the NRC. The FEIS evaluates shipping low enriched uranium as UNH crystals from NFS to Siemens (now Framatome ANP) in Richland, WA. UNH crystals require more volume than UO2 powder, therefore, 215 shipments would be needed to ship the 461 metric tons of uranium as crystals. Furthermore, UNH crystals are much more soluble than UO2 powder and accidental releases of UNH crystals would likely have a more significant impact than releases of UO2 powder. From the FEIS Table G.1–7, the total health impact for these shipments is calculated as 1.44E–01 fatalities. The FEIS analyses bound the expected impacts of shipping the low enriched uranium as UO2.

Use of Off-Specification HEU

TVA is planning to use the off-specification material described in the FEIS that can be economically recovered. The FEIS does cover the impact of blending this off-specification uranium to 4 percent enrichment for commercial reactor use in Alternative 5 : Maximum Commercial Use Alternatives (Pages 2–9). This alternative evaluated an 85 percent fuel/15 percent waste ratio for 200 metric tons of surplus HEU. The 85 percent commercial fuel usage included off-specification uranium that could be economically recovered (approximately 33 metric tons). The 15 percent waste included HEU material that cannot be economically recovered. The results are summarized in Table 2.4–1 (page 2–64) and discussed in Chapter 4 of the FEIS.

Socioeconomics

TVA's staff economist reviewed the DOE FEIS and concluded that the FEIS adequately covers the socioeconomic and environmental justice considerations for TVA's proposed actions. One activity was evaluated in greater detail for socioeconomic effects to corroborate that effects were minimal and did not create additional substantive issues or potential for impacts. Construction of additional facilities at NFS is not explicitly addressed in the DOE FEIS. Construction would require about 4 years, with a maximum employment of about 105 workers. This activity would have a positive socioeconomic impact on the area. At maximum employment, the number of jobs in Unicoi County, where the facility is located, would increase about 1.6 percent. However, the Labor Market Area within which most construction workers would live, also includes Carter, Sullivan and Washington Counties. This Labor Market Area (LMA) has a combined employment level of over 189,000 workers. Therefore the maximum LMA employment increase during construction would be less than one-tenth of one percent and would constitute a minor, insignificant addition to employment in the LMA.

Other Considerations

As discussed, the DOE FEIS bounds the expected environmental impacts from the proposed TVA actions. Furthermore, the alternative of obtaining low enriched uranium through conventional mining, milling, conversion, and enrichment has far greater environmental impacts than the proposed action. To produce an equivalent amount of LEU for fuel rod assemblies would require 14 million pounds of U3O8 which would conservatively require mining about 140,000 tons of ore. Finally, the following should be considered. The Department of Transportation estimates that 3.6 billion tons of regulated hazardous materials are transported each year in the United States with approximately 500,000 shipments of hazardous materials occurring each day (FEIS page 4–101). There are approximately 2 million annual shipments of radioactive materials representing about 2 percent of the annual hazardous material shipments. As discussed, TVA's proposed actions will replace some of those shipments with other shipments in the form of natural uranium and low enriched uranium. All of the shipments anticipated resulting from the TVA actions would represent less than a 0.01 percent increase in the number of expected radioactive material shipments over the same time period, and constitute an insignificant addition to the amount of such material shipped.

Avoidance and Minimization of Environmental Harm

As discussed, implementation of the decisions in this ROD will result in low environmental and health impacts during normal operations. These impacts were adequately addressed in the DOE FEIS. However, DOE, TVA, and its contractors will take all reasonable steps to avoid or minimize harm, including the following:

- DOE and TVA will use current safety and health programs and practices to reduce impacts by maintaining worker radiation exposure as low as reasonably achievable.
- DOE, TVA and its contractors will meet appropriate waste minimization and pollution prevention objectives consistent with the Pollution Prevention Act of 1990. As discussed in the HEU FEIS, segregation of activities that generate radioactive and hazardous wastes will be employed, where possible to avoid the generation of mixed wastes. Treatment to separate radioactive and non-radioactive components will be employed to reduce the volume of mixed wastes. Where possible, non-hazardous materials will be substituted for those that contribute to the generation of hazardous or mixed waste. Waste streams would be treated to facilitate disposal as nonhazardous wastes, where possible. In addition to following such practices at its own federal facilities, TVA and DOE will seek to include comparable requirements in contracts with commercial facilities.

Dated: November 4, 2001.

John Scalice,

Chief Nuclear Officer and Executive Vice President.

[FR Doc. 01–28844 Filed 11–16–01; 8:45 am]

BILLING CODE 8120–08–P

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

Notice of Approval of the Record of Decision for the Proposed Chicago Terminal Airspace Project

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Notice of approval of the Record of Decision (ROD).

SUMMARY: The FAA is announcing the approval of the Record of Decision (ROD) for the Final Environmental Impact Statement for the Chicago Terminal Airspace Project (CTAP). The ROD provides final agency determinations and approvals for air traffic actions.

FOR FURTHER INFORMATION CONTACT: Ms. Annette Davis, Environmental Specialist, AGL–520.E, 2300 East Devon Avenue, Des Plaines, Illinois 60018, Telephone (847) 294–8091.

SUPPLEMENTARY INFORMATION: The ROD describes and approves the implementation of FAA actions associated with high-altitude airspace and procedural changes for flights to/from the Chicago region. The project would not provide for any airport related development nor would it cause significant adverse environmental impacts. The FAA's actions, which include only air traffic actions, are described tin detail in the CTAP Final Environmental Impact Statement (FEIS), which was approved on August 23, 2001.

In reaching the decisions, the FAA has given careful consideration to: (a) The aviation safety and operational objectives of the project in light of the various aeronautical factors and judgments presented; (b) the need to enhance efficiency of the national air transportation system; and (c) the anticipated environmental impacts of the project.

The FAA's determinations on CTAP are discussed in the ROD, which was approved on November 2, 2001.

ADDRESSES: The ROD is available for review at: Federal Aviation Administration; Airspace Branch; AGL–520, 2300 East Devon Avenue, Des Plaines, Illinois, 60018. Individuals who would like to review the ROD must contact Ms. Annette Davis at (847) 294–8091 to make prior arrangements. The ROD will also be posted at the following Web site: *http://www.faa.gov/ctap.html*

Issued in Des Plaines, Illinois on November 9, 2001.

Nancy B. Shelton,

Manager, Air Traffic Division.

[FR Doc. 01–28869 Filed 11–16–01; 8:45 am]

BILLING CODE 4910–13–M

DEPARTMENT OF TRANSPORTATION

Federal Railroad Administration

Petition for Waiver of Compliance

In accordance with part 211 of Title 49 Code of Federal Regulations (CFR), notice is hereby given that the Federal

DOE/EIS-0240-SA1

SUPPLEMENT ANALYSIS

DISPOSITION OF SURPLUS HIGHLY ENRICHED URANIUM

October 2007

U.S. Department of Energy
National Nuclear Security Administration
Office of Fissile Materials Disposition

Washington, D.C.

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Acronyms

BWXT	BWXT Nuclear Operations Division
CEQ	Council on Environmental Quality
CFR	*Code of Federal Regulations*
DOE/NNSA	U.S. Department of Energy/National Nuclear Security Administration
DOT	U.S. Department of Transportation
EIS	environmental impact statement
FRR SNF EIS	*Final Environmental Impact Statement on a Proposed Nuclear Weapons Nonproliferation Policy Concerning Foreign Research Reactor Spent Nuclear Fuel*
HEU	highly enriched uranium
HEU EIS	*Disposition of Surplus Highly Enriched Uranium Final Environmental Impact Statement*
INL	Idaho National Laboratory
ISO	International Organization for Standardization
LCF	latent cancer fatalities
LEU	low-enriched uranium
LLW	low-level radioactive waste
MEI	maximally exposed individual
MEOI	maximally exposed offsite individual
NEPA	National Environmental Policy Act
NFS	Nuclear Fuel Services, Inc.
NRC	U.S. Nuclear Regulatory Commission
NTS	Nevada Test Site
ORNL	Oak Ridge National Laboratory
ORR	Oak Ridge Reservation
ROD	Record of Decision
SA	supplement analysis
SRS	Savannah River Site
SST	DOE safe, secure transport
SST/SGT	SST/SafeGuards Transport
TRAGIS	Transportation Routing Analysis Geographic Information System
UF_6	uranium hexafluoride
UN	uranyl nitrate
UO_3	uranium trioxide
U_3O_8	triuranic octaoxide
UNH	uranyl nitrate hexahydrate
U-235	uranium-235
WSRC	Westinghouse Savannah River Company/Washington Savannah River Company
Y–12	Y–12 National Security Complex

SUPPLEMENT ANALYSIS

DISPOSITION OF SURPLUS HIGHLY ENRICHED URANIUM

1.0 INTRODUCTION AND PURPOSE

The U.S. Department of Energy/National Nuclear Security Administration (DOE/NNSA) maintains an ongoing program for disposition of surplus U.S.-origin highly enriched uranium (HEU). The purposes of this program are to support U.S. nuclear weapons nonproliferation policy by reducing global stockpiles of excess weapons-usable fissile materials and to recover the economic value of the materials to the extent feasible. Activities supporting disposition of this HEU have been underway for more than a decade in accordance with the *Disposition of Surplus Highly Enriched Uranium Final Environmental Impact Statement* (*HEU EIS*) (DOE 1996a) and the associated Record of Decision (ROD) (61 FR 40619; August 5, 1996).

This supplement analysis (SA) summarizes the status of HEU disposition activities conducted to date and evaluates the potential impacts of continued program implementation. In addition, this SA considers the potential environmental impacts of proposed new DOE/NNSA initiatives to support the surplus HEU disposition program. Specifically, DOE/NNSA is proposing new end-users for existing program material, new disposal pathways for existing program HEU discard material, and down-blending additional quantities of HEU.

Council on Environmental Quality (CEQ) regulations under Title 40, Section 1502.9(c) of the *Code of Federal Regulations* (CFR) (40 CFR 1502.9(c)) require Federal agencies to prepare a supplement to an environmental impact statement (EIS) when an agency makes substantial changes to a proposed action that are relevant to environmental concerns, or when there are significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts. CEQ also recommends careful re-examination of EISs that are more than 5 years old and concern ongoing programs to determine whether a supplement to the EIS is required. DOE regulations under 10 CFR 1021.314(c) further direct that, when it is unclear whether a supplement to an EIS is required, an SA should be prepared to assist in that determination.

This SA evaluates the potential environmental impacts of both the current ongoing program and proposed new initiatives in accordance with these requirements to determine whether the existing *HEU EIS* should be supplemented, a new EIS should be prepared, or no further National Environmental Policy Act (NEPA) analysis is necessary.

2.0 BACKGROUND

Surplus U.S.-origin HEU is primarily stored at the Y–12 National Security Complex (Y–12) on the Oak Ridge Reservation (ORR) in Tennessee in accordance with the RODs for the *Storage and Disposition of Weapons-Usable Fissile Materials Final Programmatic Environmental Impact Statement* (DOE 1996b; ROD: 62 FR 3014; January, 21, 1997) and the *Final Site-Wide Environmental Impact Statement for the Y–12 National Security Complex* (DOE 2001; ROD: 67 FR 11296; March 13, 2002). Disposition of this material is conducted in accordance with the *HEU EIS* ROD, which specifically analyzes down-blending and subsequent management of a nominal 200 metric tons of surplus HEU.

Uranium enriched in the isotope uranium-235 (U-235) to 20 percent or above is considered highly enriched and is suitable for use in nuclear weapons. Down-blending HEU involves diluting this material to lower enrichment levels by blending it with other uranium materials (blendstock) to produce low-enriched uranium (LEU), which is considered unsuitable for use in weapons. Blendstock materials used in this process may include LEU, natural uranium, or depleted uranium.

2.1 Scope of the *HEU EIS*

The *HEU EIS* evaluates down-blending HEU to LEU at U-235 enrichment levels that would be suitable for either fabrication into commercial nuclear fuel (typically 3 to 5 percent U-235 enrichment) or disposal as low-level radioactive waste (LLW) (0.9 percent U-235 enrichment) using one or more of three blending technologies: uranyl nitrate (UN); molten metal; and uranium hexafluoride (UF_6).[1] In addition, the *HEU EIS* evaluates conducting this down-blending at up to four existing U.S. facilities: Y–12; the Savannah River Site (SRS) in South Carolina; Babcock and Wilcox (now BWXT Nuclear Operations Division [BWXT]) in Lynchburg, Virginia; and Nuclear Fuel Services, Inc., (NFS) in Erwin, Tennessee. These sites were considered because they have technically viable HEU conversion and blending capabilities and could blend surplus HEU to LEU for use as commercial fuel or disposal as waste. BWXT and NFS are the only commercial enterprises in the United States licensed by the U.S. Nuclear Regulatory Commission (NRC) to process HEU.

Because of the many possible permutations of end products, blending technologies, and blending sites, DOE analyzed several options that encompassed the range of reasonable alternatives. In the associated ROD, DOE announced selection of its preferred alternative: to blend down up to 85 percent (approximately 170 metric tons) of the surplus HEU to LEU for use in fabricating commercial fuel for nuclear power plants; and to blend down the remaining 15 percent (approximately 30 metric tons) for disposal as waste. In addition, DOE announced a programmatic decision to distribute down-blending services among the four facilities considered in the *HEU EIS* over a period of 15 to 20 years.

2.2 Status of Surplus HEU Disposition Activities

The *HEU EIS* explained that approximately 175 of the nominal 200 metric tons of HEU analyzed had already been declared surplus. DOE/NNSA subsequently defined disposition pathways for specific batches of the material. As of March 2007, approximately 100 of the 175 metric tons initially declared surplus has been down-blended using a combination of the four blending sites considered in the *HEU EIS*. Disposition of another approximately 10 metric tons of the material is in progress under ongoing campaigns.

DOE/NNSA has identified the characteristics of the balance of the 200 metric tons of HEU analyzed in the *HEU EIS*. Disposition of these batches of HEU is proposed or anticipated to occur as part of future down-blending campaigns or other initiatives:

- Approximately 17.4 metric tons of HEU were recently proposed for down-blending to support the Reliable Fuel Supply Initiative (described in **Section 3.1** of this SA).

- Approximately 28 metric tons of HEU are presently unallocated material that DOE/NNSA expects to dispose of in future down-blending campaigns similar to those completed or in progress (anticipated between 2008 and 2030).

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[1] In the *Disposition of Surplus Highly Enriched Uranium Final Environmental Impact Statement*, the uranyl nitrate and uranium hexafluoride blending technologies are evaluated for down-blending surplus highly enriched uranium to 4 percent uranium-235 enrichment for commercial use; the uranyl nitrate and molten metal technologies are evaluated for down-blending to 0.9 percent uranium-235 enrichment for disposal as waste.

- Approximately 18 metric tons of HEU are currently considered unsuitable for beneficial reuse and are expected to be disposed of as waste in either a geologic repository for spent nuclear fuel or a LLW facility. Most of this material is in the form of spent nuclear fuel. No timeframe for this activity has been established.

- Approximately 25 metric tons of HEU would come from future declarations of surplus material that would be disposed of consistent with the *HEU EIS* ROD.

Some aspects of the proposed action to complete future disposition of specific quantities of HEU differ from or extend beyond the activities considered in the *HEU EIS*. These aspects are the subject of this SA.

3.0 PROPOSED ACTION

Since the mid-1990s, DOE/NNSA has maintained an ongoing program for disposition of surplus U.S.-origin HEU. In addition to continuing these activities, DOE/NNSA proposes to implement new initiatives and modify certain elements of the existing surplus HEU disposition program, including:

- Supplying potential new end-users with LEU from surplus HEU (approximately 17.4 metric tons) in support of the Reliable Fuel Supply Initiative;

- Establishing new disposition pathways for HEU discard material (approximately 18 metric tons);

- Down-blending additional quantities of HEU (approximately 20 metric tons).

3.1 New End-Users of Existing Program Material

The Reliable Fuel Supply Initiative is a series of mechanisms to be instituted by the United States to ensure that foreign countries with good nonproliferation credentials that refrain from developing and deploying uranium enrichment and reprocessing technologies continue to have access to the nuclear fuel market and the benefits of nuclear power. As one component of this initiative, DOE plans to down-blend and hold a supply of LEU to serve as backup in case other market mechanisms fail. Specifically, DOE/NNSA has procured commercial services to down-blend 17.4 metric tons of surplus U.S.-origin HEU to LEU, and maintain this supply of LEU until needed. The primary components of this proposed action consist of:

- Processing and packaging the material for offsite shipment at Y–12 in Tennessee.

- Shipping 17.4 metric tons of HEU from Y–12 to a commercial blending site.

- Down-blending the HEU to LEU using the liquid UN process.

- Transporting the resulting LEU (approximately 290 metric tons) as uranyl nitrate hexahydrate (UNH) or oxide from the blending site to a U.S. commercial fuel fabrication facility. The fabricator would be required to maintain 40 metric tons of LEU in storage, and would be able to use the majority of the remaining LEU for working inventory, subject to contractual conditions for providing LEU when requested by DOE/NNSA. LEU storage would be accommodated within the facility's existing capacity and operating license, and would not require additional construction.

- Shipping quantities of LEU, in the form of UF_6, to participating foreign countries as directed by DOE/NNSA and in accordance with procedures and requirements governing the sale of this material.

DOE/NNSA awarded a contract for this down-blending work on June 29, 2007.[2] Shipments of HEU to the blending contractor began in August 2007, and down-blending is scheduled to be completed in approximately 4 years. Most of the activities necessary to support disposition of the 17.4 metric tons of surplus HEU allocated to the Reliable Fuel Supply have already been evaluated in the *HEU EIS*, including transport of the HEU from storage at Y–12 to the blending site; down-blending the HEU to LEU; and transporting the LEU from the blending site to a domestic commercial fuel fabricator. As such, potential impacts associated with these activities are not revisited in this SA. However, the proposed action in this SA also includes transporting LEU fuel to participating foreign countries, which would constitute potential new end-users of HEU disposition program material. Because transport of this material to these new end-users is not within the scope of the *HEU EIS*, this SA evaluates the potential impacts of its transportation from the commercial fuel fabricator to a U.S. ocean port and across the global commons. Overland and ocean shipments under this initiative are expected to be similar to routine commercial transport of LEU.

No decisions have been made regarding the potential sale and transport of Reliable Fuel Supply LEU to specific foreign countries. If DOE/NNSA ultimately decides not to implement the international component of this proposed action, the HEU could still be down-blended for commercial use within the United States consistent with the ongoing surplus HEU disposition program.

3.2 New Disposition Pathways for HEU Discard Material

This SA also evaluates the proposed direct disposition of HEU discards in the form of spent nuclear fuel and low equity materials.[3] The *HEU EIS* analyzed the potential down-blending of surplus HEU that could be separated from spent nuclear fuel—pursuant to health and safety, stabilization, or other nondefense activities—to LEU. The *HEU EIS* also evaluated down-blending a minimum of 30 metric tons of HEU to an enrichment level of 0.9 percent U-235 for disposition as waste, and assumes this waste would then be disposed of at a LLW facility. This disposition approach is analyzed in the *HEU EIS* partly to address "off-specification materials," which at the time had no economically viable pathway for fabrication to commercial reactor fuel.[4] Subsequent changes in HEU market conditions and establishment of the Tennessee Valley Authority Off-Specification Fuel Program in 2001 have provided an economical means of using such material as fuel. However, approximately 18 of the 175 metric tons of HEU initially declared surplus are still considered unsuitable for use in fuel. DOE/NNSA is no longer considering down-blending this material for disposition as waste, but intends to directly dispose of it in either a geologic repository or a LLW facility:

- Approximately 15 metric tons of HEU discard material in the form of spent nuclear fuel stored at Idaho National Laboratory (INL) are proposed for direct disposal in a geologic repository.
- Approximately 3 metric tons of HEU (not in the form of spent nuclear fuel) considered low-equity materials are proposed for direct disposal in a LLW facility.

The impacts of transporting this spent nuclear fuel from INL for disposal at the proposed Yucca Mountain geologic repository are addressed in the *Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (DOE 2002a). The impacts of transporting HEU material suitable for disposal as low-level waste at the Nevada Test Site (NTS) are addressed in the *HEU EIS*.

[2] DOE/NNSA awarded the Reliable Fuel Supply contract to a team consisting of Wesdyne International (a subsidiary of Westinghouse Electric Company) and NFS. Under the terms of the contract, NFS will down-blend the 17.4 metric tons of surplus HEU to LEU at its facility in Erwin, Tennessee, and Wesdyne International will store the LEU at the Westinghouse fuel fabrication facility in Columbia, South Carolina (DOE 2007).

[3] Low-equity items include materials with varying enrichments no longer needed for programmatic needs, have no further defined use, and are commonly considered uneconomical for recovery due to low concentration of HEU or impurities.

[4] "Off-specification" highly enriched uranium refers to material possessing characteristics undesirable for use in commercial nuclear fuel.

Because the *HEU EIS* analyses already account for the potential impacts that would have been associated with down-blending surplus HEU for disposal as waste, the proposed direct disposal of this material would add approximately 18 metric tons to the blending margin available under the existing *HEU EIS* analyses, as described further in Section 3.3.

3.3 Down-Blending of Additional HEU

Lastly, this SA addresses the proposed future down-blending of additional quantities of HEU that were not associated with the surplus HEU disposition program at the time the *HEU EIS* was prepared. These additional quantities primarily derive from two sources: new material recently declared excess to weapons needs, and HEU returned to DOE from domestic and foreign research reactor programs. DOE/NNSA proposes to down-blend these additional quantities of HEU to LEU for use in fabricating commercial fuel for nuclear power plants.

HEU recently declared excess. In the fall of 2005, an additional 200 metric tons of HEU were declared excess to weapons needs. The U.S. Naval Reactors Program will use much of this material as fuel. However, DOE/NNSA anticipates that approximately 30 metric tons of this HEU will be unsuitable for use as naval reactor fuel and proposes to down-blend it to LEU. Another 20 metric tons of this material are already designated for down-blending. Disposition of these combined 50 metric tons of HEU is proposed to begin in 2008 and be incorporated into down-blending campaigns over the next several decades.

Domestic and foreign research reactor returns. DOE/NNSA is also considering down-blending approximately 10 metric tons of HEU from domestic and foreign research reactor returns.[5] The vast majority of these 10 metric tons of HEU would be processed and down-blended at SRS. The impacts of transporting spent nuclear fuel to SRS are evaluated in the *Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement* (DOE 1995) and the *Final Environmental Impact Statement on a Proposed Nuclear Weapons Nonproliferation Policy Concerning Foreign Research Reactor Spent Nuclear Fuel (FRR SNF EIS)* (DOE 1996c). In 2004, DOE/NNSA extended the schedule for receipt of foreign research reactor spent nuclear fuel through 2019 (69 FR 69901; December 1, 2004).

Associated recovery operations are evaluated in the *Savannah River Site Spent Nuclear Fuel Management Final Environmental Impact Statement (SRS SNF EIS)* (DOE 2000). DOE/NNSA may recover some or all of this spent nuclear fuel in H-Canyon consistent with the RODs for the *FRR SNF EIS* (61 FR 25092; May 17, 1996) and *SRS SNF EIS* (65 FR 48224; August 7, 2000). In addition, DOE is currently preparing the *Highly Enriched Uranium and Spent Nuclear Fuel Management SA* to address management activities for spent nuclear fuel stored at INL and SRS, including the use of H-Canyon for separation and recovery of HEU embedded in research reactor returns and certain other spent nuclear fuel.

While there are no current or anticipated DOE/NNSA plans to process spent nuclear fuel solely for the purposes of extracting HEU, activities associated with the fuel for the purposes of stabilization, facility cleanup, treatment, waste management, safe disposal, or other environment, safety, and health reasons could result in the separation of HEU in weapons-usable form that could pose a proliferation threat. Therefore, if HEU is recovered from spent HEU fuel, it would be available for down-blending consistent with the ROD for the *HEU EIS* and addressed within the scope of this SA.

This SA assumes the surplus HEU proposed for disposition would be located at either Y–12 or SRS. The blending sites, processes, and annual throughputs associated with disposition of these additional

[5] These approximately 10 metric tons may include other miscellaneous HEU materials, and are not a subset of the 200 metric tons of highly enriched uranium declared excess in the fall of 2005.

quantities of HEU (approximately 60 metric tons) are expected to be identical or similar to those evaluated in the *HEU EIS*. Because down-blending of approximately 25 metric tons of HEU presently remains available within the scope of analysis originally considered in the *HEU EIS* and the proposed direct disposal of HEU discard material (addressed in **Section 3.2** of this SA) would also increase the available blending margin another 18 metric tons, disposition of all but approximately 20 metric tons of these additional quantities of HEU would occur within the scope of the *HEU EIS*. However, because the total additional quantity of HEU involved and the timing of the actions would still exceed those evaluated in the *HEU EIS*, these aspects are addressed in this SA.

4.0 IMPACTS

This section evaluates the potential environmental impacts of continuing surplus HEU disposition activities at each of the blending sites evaluated in the *HEU EIS* (Y-12, BWXT, NFS, and SRS) and identifies where current key data or assumptions differ from those considered in the *HEU EIS* analyses. It also evaluates the potential environmental impacts of proposed disposition program initiatives for DOE/NNSA surplus HEU: specifically, new end-users for existing program material, new disposal pathways for existing HEU discard materials, and down-blending additional quantities of HEU. A discussion of potential impacts resulting from intentional destructive acts (i.e., acts of sabotage or terrorism) is also presented.

4.1 Overview of Impacts Analysis

The following discussions provide an overview of the analyses and results originally presented in the *HEU EIS*, address key parameters or assumptions that have since changed, and describe the DOE/NNSA approach to determining impacts associated with the SA proposed action.

4.1.1 Key Assumptions and Impacts Presented in the *HEU EIS*

A number of key assumptions form the basis for the analyses presented in the *HEU EIS*:

- The analyses evaluated disposition of a nominal 200 metric tons of surplus HEU, resulting in two possible end products: (1) LEU that can be used as commercial nuclear reactor fuel feed (at a U-235 enrichment level of approximately 4 percent) and (2) LEU that can be disposed of as LLW (at a U-235 enrichment level of approximately 0.9 percent).

- To assess potential environmental impacts, the down-blending analyses assume that surplus HEU is enriched to 50 percent U-235 based on a weighted average of the surplus HEU in inventory at that time.

- Impacts are based on an annual HEU throughput of 10 metric tons at each of the sites when down-blending for use as commercial fuel and an annual HEU throughput of 2.1 to 3.1 metric tons when down-blending to waste. Construction of new facilities would not be required.

- For transportation analyses purposes, most of the surplus HEU would originate from Y–12. The transportation analyses also conservatively assume that the longest route (Hanford to all potential blending sites) would be representative for shipping the blendstock material necessary to support down-blending activities. The NTS is used as a representative site to evaluate the impacts of transportation from the blending sites to an LLW disposal site.

As discussed in **Section 2.1**, DOE developed and analyzed several alternatives to represent reasonable choices within the range of possible end products, blending technologies, and blending sites. In the *HEU EIS*, the results of Alternative 2, No Commercial Use, and Alternative 5, Maximum Commercial Use (the preferred alternative), generally envelope the range of potential impacts associated with the proposed action. Alternative 2, No Commercial Use, assumes that all 200 metric tons of surplus HEU would be down-blended to LLW using a combination of all four blending sites (Y–12, BWXT, NFS, and SRS). Conversely, Alternative 5 assumes gradually down-blending up to 170 metric tons of surplus HEU using a combination of the four sites, selling the resulting commercially usable LEU for use as reactor fuel, and down-blending the remaining surplus HEU that has no commercial value (up to 30 metric tons) to LEU for disposition as LLW. The other two action alternatives presented in the *HEU EIS* (Alternative 3, Limited Commercial Use, and Alternative 4, Substantial Commercial Use) represent additional fuel/waste blending ratios and points of reference along the continuum bounded by *HEU EIS* Alternatives 2 and 5.

Because no new construction would be required and the down-blending activities conducted to support the proposed action would be either identical or very similar to operations that have occurred at the analyzed facilities in the past, DOE concluded that the potential incremental impacts from the *HEU EIS* proposed action at the blending sites would be low. However, DOE acknowledged that impacts could change over the life of the campaign if the exact fuel/waste ratio or division among sites were different than evaluated. Accordingly, the *HEU EIS* analyzes the impacts of site variations for the preferred alternative that would involve down-blending 0, 25, 50, and 100 percent of the surplus HEU at each of the sites. Based on these analyses, DOE concluded that the expected impacts would be low for many parameters (including radiological impacts) during normal operations and would be within the regulatory limits for each site even if that site were to down-blend 100 percent of the inventory. Therefore, the impacts at any site from any possible distribution of the down-blending work among the facilities would similarly be low and would be bounded by the analyses in the *HEU EIS*.

4.1.2 Key Changes in the Past 10 Years

In preparing this SA, DOE/NNSA has compared the assumptions and down-blending operations evaluated in the *HEU EIS* against actual operational experience over the past 10 years and determined that the following core assumptions have not changed:

- Surplus HEU blending sites and processes are the same as those evaluated in the *HEU EIS*.
- Annual down-blending throughputs vary, but are within the parameters considered in the *HEU EIS*.
- Surplus HEU material forms are consistent with those evaluated in the *HEU EIS*.
- Average nonradiological emissions would be the same as those presented in the *HEU EIS*.
- No new accident scenarios or source terms associated with surplus HEU disposition activities have been identified.

However, changes in the following parameters have occurred since the *HEU EIS* impact analyses were conducted:

- The SA analyses assume that the remaining HEU feedstock is enriched to 80 percent U-235 to better reflect the actual weighted average of the HEU materials now proposed for down-blending. The *HEU EIS* assumed an average U-235 enrichment of 50 percent.
- The chemical form of the uranium oxide blendstock considered for down-blending as UN now includes the potential use of either triuranic octaoxide (U_3O_8) (as addressed in the *HEU EIS*) or uranium trioxide (UO_3).
- Total site worker populations have changed at the blending sites.

- The 80-kilometer (50-mile) radius population dose evaluated in the *HEU EIS* for each of the blending sites was based on 1990 census data extrapolated to 2010; updated population values are now available based on the 2000 census data extrapolated to 2020.

- The standard dose-to-latent-cancer-fatalities-risk (dose-to-LCF-risk) conversion factors used by DOE/NNSA to estimate radiological risk to workers and offsite populations have been revised.

4.1.3 Approach to *HEU SA* Analyses

Because surplus HEU disposition activities have generally continued as analyzed in the *HEU EIS*, the analysis presented in this SA employs a sliding-scale approach that focuses on those areas most likely to be affected by implementation of new surplus HEU disposition program initiatives, as well as by key parameters and assumptions known to have changed since preparation of the *HEU EIS*.

DOE/NNSA conducted an initial screening of all resource areas addressed in the *HEU EIS* to determine which would potentially be affected by the proposed actions, or by known changes to related site activities or environmental conditions. Each blending site's operational experience was reviewed to identify potential concerns relative to facility resource requirements, throughputs, and emissions. Based on this screening, DOE/NNSA determined the following resource areas would not likely be affected by the proposed action:

- Land resources (no new construction or land requirements)

- Site infrastructure (same annual facility water, electrical, and fuel requirements)

- Air quality and noise (same down-blending processes and annual non-radiological emissions)

- Water resources (same down-blending processes and annual discharges)

- Geology and soils (no new construction or land disturbance)

- Biotic resources (no new construction or land disturbance)

- Cultural resources (no new construction or land disturbance)

- Socioeconomics (same number of workers supporting down-blending operations)

Therefore, the impact analyses presented in the *HEU EIS* for these resources are still considered applicable and are not evaluated further in this SA. The resource areas likely to be impacted, and therefore evaluated in greater detail in this SA, include human health risk, facility accidents, transportation risk, and waste management. In addition, this SA addresses environmental justice concerns and potential impacts occurring as a result of sabotage or terrorism.

Because of the uncertainty as to when some materials would be received and made available to the disposition program over the next several decades, this SA does not identify an end date for implementation of the proposed action. Rather, impact estimates presented in this SA are annualized or tied to specific events (e.g., postulated accidents) based on an assumed down-blending throughput of approximately 10 metric tons per year. This material throughput is conservatively high, and would allow for disposition of all surplus HEU addressed under the proposed action by 2020. Should disposition activities extend beyond 2020 as anticipated, total campaign impacts would essentially remain the same. However, because these total impacts would be projected over a longer timeframe, associated annual impacts would be similar but proportionately lower. An exception to this correlation is the impact resulting from use of the H-Canyon at SRS, which is not expected to continue operating after completing the planned processing of the inventory of currently identified materials, including certain HEU materials. DOE projects completion of this processing by 2019.

4.2 Human Health and Facility Accidents

The analysis of human health and facility accidents includes evaluation of public and worker health data and assessment of changes that would affect the consequences and risks of accidents associated with the proposed action. Public health, worker health, and facility accidents are described for the four sites in the following sections, and relevant data are presented to update information developed since the *HEU EIS* was issued. **Table 4.2–1** compares the key radiological impact parameters cited in the *HEU EIS* with those used in this SA. Of particular note is the use of updated dose-to-risk conversion factors in the SA analyses. The *HEU EIS* used a factor of 0.0004 LCF per rem for workers and 0.0005 LCF per rem for the public, but current DOE guidance stipulates the use of 0.0006 LCF per rem for both workers and the public. This change results in a 50-percent increase in risk to workers and a 20-percent increase in risk to the public from the same radiological exposures reported in the *HEU EIS*.

4.2.1 Human Health

Normal Operations. A comparison of radiological consequences and risks evaluated in the *HEU EIS* and this SA from normal operations at each of the four blending sites is presented in **Table 4.2–2**. The *HEU EIS* normal operations analyses present doses resulting from potential offsite exposure to U-235 and U-238. These values have been adjusted to account for additional radionuclides (U-232, U-234, and U-236) consistent with the facility accident and transportation analyses presented in the *HEU EIS*, and provide a more comparable basis for assessing potential impacts associated with the proposed action.

Annual doses to the involved workforce at each site are expected to remain unchanged because the number of involved workers and their average exposure levels have not changed. Involved workers are not expected to be affected by the higher U-235 enrichment of the HEU feedstock because their exposure is limited by facility design features, operational procedures, and health physics monitoring programs. These factors enable the blending sites to adjust levels of shielding, the distances of involved workers from radioactive source terms, and the duration of their exposures. In contrast, increases in the maximally exposed offsite individual (MEOI) dose would occur due to the higher assumed U-235 enrichment of the HEU feedstock. Increases in the offsite population dose would also occur due to the higher assumed U-235 enrichment as well as the updated population values presented in Table 4.2–1. All risks resulting from normal operations would also increase because of the larger dose-to-LCF-risk factor used in this SA for both workers and the public. However, all annual radiation doses would remain a small fraction of applicable regulatory limits (detailed below) and normal background radiation exposure (0.36 rem per year).

The measured annual dose to the MEOI from all radiological emissions at each of the blending sites from 2002 to 2005 is presented in **Table 4.2–3**. All annual doses are less than 0.001 rem, or less than 1 percent of the DOE annual public dose limit of 0.1 rem (DOE 1993), and represent an increase in lifetime fatal cancer risk of less than 1 in 2 million. These MEOI doses are due to radiological emissions from all activities at each site; the actual MEOI dose (and LCF risk) attributable solely to surplus HEU disposition activities would therefore be lower than the values presented.

Table 4.2–1. Comparison of Key Blending Site Radiological Impact Parameters

Parameter	*HEU EIS* [a]	Supplement Analysis [b]
Y–12		
Stack height	10 meters (33 feet)	20 meters (66 feet)[e]
MEOI distance	619 meters (2,031 feet)	Same
Noninvolved worker distance	644 meters (2,113 feet)	Same
Total onsite workforce	17,000 at ORR; 6,400 at Y–12	17,000 at ORR; 5,000 at Y–12
80-kilometer (50-mile) population	1,040,000[c]	1,523,573[d]
BWXT		
Stack height	11 meters (36 feet)	24 meters (79 feet)[e]
MEOI distance	540 meters (1,772 feet)	Same
Noninvolved worker distance	230 meters (755 feet)	Same
Total onsite workforce	2,200	2,300
80-kilometer (50-mile) population	730,000[c]	789,917[d]
NFS		
Stack height	33 meters (108 feet)	Same
MEOI distance	250 meters (820 feet)	Same
Noninvolved worker distance	250 meters (820 feet)	Same
Total onsite workforce	325	850
80-kilometer (50-mile) population	1,260,000[c]	1,287,973[d]
SRS		
Stack height	10 meters (33 feet)	Same
MEOI distance	11,750 meters (38,550 feet)	Same
Noninvolved worker distance	644 meters (2,113 feet)	Same
Total onsite workforce	12,000	8,900
80-kilometer (50-mile) population	710,000[c]	889,341[d]
All Sites		
Involved workforce	125	Same
Average HEU feedstock U-235 enrichment	50 weight percent	80 weight percent
Worker dose-to-LCF-risk factor	0.0004 per rem	0.0006 per rem
Public dose-to-LCF-risk factor	0.0005 per rem	0.0006 per rem

[a] DOE 1996a.
[b] BWXT 2007a, 2007b; NFS 2007a; NRC 2003a; WSRC 2007.
[c] Projected 2010 population extrapolated from 1990 census data.
[d] Projected 2020 population extrapolated from 2000 census data.
[e] The larger stack height would result in lower radiation doses; therefore this parameter is bounded by the lower stack height evaluated in the *HEU EIS*.

Key: BWXT=BWXT Nuclear Operations Division; DOE=U.S. Department of Energy; *HEU EIS=Disposition of Surplus Highly Enriched Uranium Final Environmental Impact Statement*; LCF=latent cancer fatalities; MEOI=maximally exposed offsite individual; NFS=Nuclear Fuel Services, Inc.; ORR=Oak Ridge Reservation; and SRS=Savannah River Site; and Y–12=Y–12 National Security Complex.

Table 4.2–2. Comparison of *HEU EIS* and Supplement Analysis Normal Operations Radiological Doses and Risks

Impact Parameter	Involved Workforce		MEOI		Offsite Population	
	HEU EIS	**SA**	***HEU EIS*** [a]	**SA**	***HEU EIS*** [a]	**SA**
Y-12						
Annual Dose (person-rem)	11.3	11.3	7.0×10^{-4} (rem)[b]	7.8×10^{-4} (rem)[b]	2.9	4.7
Risk (LCF per year)	4.5×10^{-3}	6.8×10^{-3}	3.5×10^{-7}	4.7×10^{-7}	1.5×10^{-3}	2.9×10^{-3} [c]
BWXT						
Annual Dose (person-rem)	11.3	11.3	3.4×10^{-5} (rem)[b]	3.8×10^{-5} (rem)[b]	0.30	0.37
Risk (LCF per year)	4.5×10^{-3}	6.8×10^{-3}	1.7×10^{-8}	2.3×10^{-8}	1.5×10^{-4}	2.3×10^{-4} [c]
NFS						
Annual Dose (person-rem)	11.3	11.3	2.5×10^{-3} (rem)[b]	2.8×10^{-3} (rem)[b]	21	25
Risk (LCF per year)	4.5×10^{-3}	6.8×10^{-3}	1.3×10^{-6}	1.7×10^{-6}	1.1×10^{-2}	1.5×10^{-2} [c]
SRS						
Annual Dose (person-rem)	11.3	11.3	4.5×10^{-5} (rem)[b]	5.0×10^{-5} (rem)[b]	2.9	4.0
Risk (LCF per year)	4.5×10^{-3}	6.8×10^{-3}	2.3×10^{-8}	3.0×10^{-8}	1.5×10^{-3}	2.4×10^{-3} [c]

[a] Adjusted to include uranium-232, uranium-234, and uranium-236.
[b] Unit for MEOI dose is rem because the receptor is a single individual.
[c] This SA's calculated offsite population risk is equivalent to the following increased annual risk of an LCF occurring in the total offsite population: 1 chance in 357 for Y-12; 1 chance in 4,545 for BWXT; 1 chance in 71 for NFS; and 1 chance in 416 for SRS.

Key: BWXT=BWXT Nuclear Operations Division; DOE=U.S. Department of Energy; *HEU EIS=Disposition of Surplus Highly Enriched Uranium Final Environmental Impact Statement*; LCF=latent cancer fatalities; MEOI=maximally exposed offsite individual; NFS=Nuclear Fuel Services, Inc; SA=supplement analysis; SRS=Savannah River Site; and Y–12=Y–12 National Security Complex.
Source: Derived from DOE 1996a.

Table 4.2–3. Public Maximally Exposed Offsite Individual Radiation Doses (rem) from Annual Radionuclide Releases from All Site Activities

Site	2002	2003	2004	2005
Y–12	3.0×10^{-4}	2.0×10^{-4}	4.0×10^{-4}	8.0×10^{-4}
BWXT	3.7×10^{-4}	5.1×10^{-4}	3.9×10^{-4}	1.4×10^{-4}
NFS	5.0×10^{-5}	3.0×10^{-5}	2.0×10^{-5}	2.0×10^{-5}
SRS	1.8×10^{-4}	1.9×10^{-4}	1.5×10^{-4}	1.3×10^{-4}

Key: BWXT=BWXT Nuclear Operations Division; NFS=Nuclear Fuel Services, Inc.; ORNL=Oak Ridge National Laboratory; SRS=Savannah River Site; and Y–12=Y–12 National Security Complex.
Source: BWXT 2007c; NFS 2007b; ORNL 2003–2006; WSRC 2003–2006.

Whereas Table 4.2–2 presents analytically derived conservative estimates of MEOI dose due to down-blending activities, Table 4.2–3 presents recent measured dose information for the MEOI at each blending site. The conservative assumptions inherent in the calculated values in Table 4.2–2 include a high atmospheric release of radioisotopes and low air filter particle removal efficiency, as compared to actual measured releases and filter efficiencies that have occurred at each site. The largest calculated MEOI dose from down-blending activities would be 2.8×10^{-3} and would occur at NFS primarily due to the much closer proximity of the MEOI. In contrast, actual measured MEOI doses at all four sites from all activities during these years are much lower and range between 2.0×10^{-5} and 8.0×10^{-4} rem. Because actual MEOI doses attributable solely to down-blending operations are not measured, a direct correlation cannot be made between the data presented in Tables 4.2–2 and 4.2–3. However, both estimated project and measured total site MEOI doses are presented in this SA to illustrate that they are all well below the DOE public annual dose limit of 0.1 rem.

The proposed use of higher U-235-enriched HEU feedstock or UO_3 as alternate blendstock material would not measurably affect non-radiological facility emissions. As such, annual quantities of chemicals that would be released at each of the blending sites during normal operations under the proposed action are expected to be approximately the same as those presented in the *HEU EIS*. In addition, no new chemicals other than those presented in the *HEU EIS* are expected to be used for the proposed action (BWXT 2007a, 2007b; NFS 2007a; WSRC 2007). Therefore, environmental impacts to the public from chemical releases during normal operations would be unchanged from those presented in the *HEU EIS*.

Worker Health. Reported total site worker radiation doses for the years 2002 through 2005 are presented in **Table 4.2–4**. Year-to-year variations in the number of workers with a measurable dose and the total workforce dose at each site are a function of specific radiological activities conducted at the site for that year. All average worker doses continue to be a small fraction of both the DOE occupational annual dose limit of 5 rem (DOE 1993) and normal annual background radiation exposure.

Table 4.2–4. Historical Total Site Worker Radiation Doses from 2002 to 2005 from All Site Activities[a]

Parameter	2002	2003	2004	2005
Y–12[b]				
Workers with measurable dose	2,304	2,389	2,132	1,988
Total worker dose (person-rem)	107.8	116.0	115.5	101.4
Average worker dose (rem)	0.047	0.049	0.054	0.051
BWXT[c]				
Workers with measurable dose	238	246	252	277
Total worker dose (person-rem)	32	29.2	24.6	26.9
Average worker dose (rem)	0.14	0.12	0.10	0.10
NFS				
Workers with measurable dose	783	763	725	617
Total worker dose (person-rem)	96.8	56.3	13.2	11.2
Average worker dose (rem)	0.12	0.07	0.018	0.018
SRS				
Workers with measurable dose	3,217	3,446	2,996	2,360
Total worker dose (person-rem)	199.1	258.6	201.2	121.3
Average worker dose (rem)	0.062	0.075	0.067	0.051

[a] All reported site worker doses are based on both external dose measurements and calculations of estimated internal dose from facility air radioisotope concentrations.
[b] Values represent contributions from all Oak Ridge Reservation facilities, including Y–12.
[c] BWXT reported average worker doses are higher than Y–12, NFS, and SRS because BWXT uses a more conservative method to estimate internal dose to workers.

Key: BWXT=BWXT Nuclear Operations Division; DOE=U.S. Department of Energy; NFS=Nuclear Fuel Services Inc; NRC=U.S. Nuclear Regulatory Commission; SA=supplement analysis; SRS=Savannah River Site; and Y–12=Y–12 National Security Complex.

Source: DOE 2004a, 2005; NRC 2003b, 2004–2006.

Whereas Table 4.2-2 presents analytically derived estimates of doses from workers involved only in down-blending activities, Table 4.2-4 presents available measured dose information for the total workforce at each site. The involved workforce doses presented in Table 4.2-2 are the same as those presented in the *HEU EIS*, and were calculated with the conservative analytical assumptions that 125 workers would be involved in HEU down-blending operations and that each involved worker would receive an annual dose of 0.09 rem, resulting in a total annual involved workforce dose of 11.3 person rem. Each blending site has confirmed the continued validity of these worker dose estimates with respect to the proposed actions considered in this SA (BWXT 2007a, 2007b; NFS 2007a; WSRC 2007). The actual measured average worker doses presented in Table 4.2–4 range between 0.018 and 0.14 rem, and account for all workers exposed to radiation at each site. Because each site is involved in numerous other radiological activities, the total number of workers with a measurable dose is larger than the 125 assumed for down-blending operations. Because actual worker doses attributable solely to down-blending operations are not available, a direct correlation cannot be made between the data presented in Tables 4.2–2 and 4.2–4. However, both estimated project and measured total site worker doses are presented in this SA to illustrate that they are all well below the DOE occupational annual dose limit of 5 rem.

4.2.2 Facility Accidents

Potential impacts to workers and the public from facility accidents are evaluated in this SA by identifying applicable *HEU EIS* accident scenarios and calculating revised consequences and risks based on the updated key parameters presented in Table 4.2–1.

Unlike the *HEU EIS*, the proposed action in this SA involves only down-blending HEU to LEU in the chemical form of UN (4 percent U-235 UN). Whereas four accident scenarios are analyzed for down-blending as UN in the *HEU EIS* at all four sites, only three of these accident scenarios are analyzed in this SA because DOE/NNSA is no longer proposing down-blending to 0.9 percent U-235 UN. **Tables 4.2–5** and **4.2–6** compare the doses and risks to the public and workers expected from the SA proposed action under the applicable accident scenarios analyzed in the *HEU EIS*.

Accident consequences and risks have increased due to the changes in five radiological impact parameters in Table 4.2–1: total onsite workforce, offsite population, worker and public dose-to-LCF-risk factors, and average HEU feedstock U-235 enrichment. Noninvolved worker and offsite population consequences have changed in direct proportion to their respective updated site-specific numerical values. Because the higher average HEU U-235 enrichment results in larger uranium source terms for the filter fire and earthquake accidents (the criticality accident releases fission products and not uranium isotopes), the consequences of these two accidents also increase for all three dose receptors: the noninvolved worker, MEOI, and offsite population. Finally, risks for all three accident scenarios and all three dose receptors increase due to the larger dose-to-LCF-risk factors used in this SA for workers and the public.

Approximately 125 involved workers directly support down-blending operations at each of the sites. In the event of an accident, nearby involved workers could receive relatively higher doses and be at risk of serious injury or death. Potential impacts to these workers are addressed qualitatively for each accident scenario because no adequate method exists for calculating meaningful consequences at or near the location where the accident could occur:

- *Filter Fire Accident*—Involved workers could inhale some radioactive particles before evacuating the area, but the relative location of filters and the short exposure time is not expected to result in fatalities from radiological consequences.

- *Criticality Accident*—Involved workers could receive substantial or potentially fatal doses from the initial pulse of neutron and gamma radiation. After this initial pulse, workers would evacuate the area on the initiation of criticality monitoring alarms.

- *Earthquake*—Involved workers could receive lethal injuries from structural damage associated with an earthquake, but no fatalities are expected from radiological consequences.

Table 4.2–5. Comparison of *HEU EIS* and Supplement Analysis of Radiological Accident Doses

Evaluation Basis Accident Scenario	Noninvolved Worker Dose (person-rem)		MEOI Dose (rem)		Population Dose (person-rem)	
	HEU EIS	**SA**	***HEU EIS***	**SA**	***HEU EIS***	**SA**
Y–12						
Filter fire accident	11	22	0.01	0.02	1.5	4.4
Criticality accident	38	38	0.051	0.051	3	4.4
Earthquake	320	576	0.31	0.56	44	64
BWXT						
Filter fire accident	24	50.4	0.012	0.024	0.9	1.94
Criticality accident	80	84	0.056	0.056	1.9	2.1
Earthquake	760	1,436	0.36	0.65	26	50
NFS						
Filter fire accident	1.6	8.4	0.002	0.004	1.3	2.6
Criticality accident	8.7	22.8	0.014	0.014	2.2	2.2
Earthquake	67	317	0.078	0.140	38	709
SRS						
Filter fire accident	2.3	3.4	6.6×10^{-5}	1.3×10^{-4}	0.37	0.92
Criticality accident	8.5	6.3	3.0×10^{-4}	3.0×10^{-4}	0.33	0.41
Earthquake	70	94	0.0019	0.0034	11	25

Key: BWXT=BWXT Nuclear Operations Division; *HEU EIS=Disposition of Surplus Highly Enriched Uranium Final Environmental Impact Statement;* MEOI=maximally exposed offsite individual; NFS=Nuclear Fuel Services, Inc.; SA=supplement analysis; SRS=Savannah River Site; and Y–12=Y–12 National Security Complex.
Source: Derived from DOE 1996a.

As discussed in **Section 4.2.1**, the quantities of chemicals that would be used for the proposed action and the processes involving these chemicals would be essentially identical to those evaluated in the *HEU EIS* accident analyses. As such, postulated chemical accidents and associated impacts are expected to be the same as those analyzed in the *HEU EIS*.

4.3 Transportation

Two types of transportation activities are addressed in this SA: (1) transport activities similar to those evaluated in the *HEU EIS*, and (2) transport of LEU to foreign countries as part of the Reliable Fuel Supply Initiative. The methods and data used to evaluate transportation impacts in the *HEU EIS* were analyzed and used as the basis for estimating impacts of similar transportation activities in this SA. This analysis is summarized in **Section 4.3.1**. Transport of LEU to a fuel fabricator in a foreign country was not considered in the *HEU EIS*; therefore, a more detailed analysis of this activity is provided in **Section 4.3.2**.

Table 4.2–6. Comparison of *HEU EIS* and Supplement Analysis of Radiological Accident Risks (LCF per year)

Evaluation Basis Accident Scenario	Noninvolved Worker Risk		MEOI Risk		Population Risk	
	HEU EIS	**SA**	***HEU EIS***	**SA**	***HEU EIS***	**SA**
Y–12						
Filter fire accident	4.4×10^{-6}	1.3×10^{-5}	5.0×10^{-9}	1.2×10^{-8}	7.5×10^{-7}	2.6×10^{-6}
Criticality accident	1.5×10^{-6}	2.3×10^{-6}	2.6×10^{-9}	3.1×10^{-9}	1.5×10^{-7}	2.6×10^{-7}
Earthquake	1.3×10^{-5}	3.6×10^{-5}	1.6×10^{-8}	3.4×10^{-8}	2.2×10^{-6}	6.8×10^{-6}
BWXT						
Filter fire accident	9.6×10^{-6}	3.0×10^{-5}	6.0×10^{-9}	1.4×10^{-8}	1.9×10^{-7}	5.6×10^{-7}
Criticality accident	3.2×10^{-6}	5.0×10^{-6}	2.8×10^{-9}	3.4×10^{-9}	9.5×10^{-8}	1.3×10^{-7}
Earthquake	3.0×10^{-5}	8.6×10^{-5}	1.8×10^{-8}	4.0×10^{-8}	1.3×10^{-6}	3.1×10^{-7}
NFS						
Filter fire accident	6.4×10^{-7}	5.0×10^{-6}	1.0×10^{-9}	2.4×10^{-9}	6.5×10^{-7}	1.6×10^{-6}
Criticality accident	3.5×10^{-7}	1.4×10^{-6}	7.0×10^{-10}	8.4×10^{-10}	1.1×10^{-7}	1.3×10^{-7}
Earthquake	2.7×10^{-6}	2.0×10^{-5}	3.9×10^{-9}	8.5×10^{-9}	1.9×10^{-6}	4.1×10^{-6}
SRS						
Filter fire accident	9.2×10^{-7}	2.0×10^{-6}	3.3×10^{-11}	8.0×10^{-11}	1.9×10^{-7}	5.6×10^{-7}
Criticality accident	3.4×10^{-7}	3.8×10^{-7}	1.5×10^{-11}	1.8×10^{-11}	1.7×10^{-8}	2.5×10^{-7}
Earthquake	2.8×10^{-6}	5.6×10^{-6}	9.5×10^{-11}	2.0×10^{-10}	5.5×10^{-7}	1.5×10^{-6}

Note: *HEU EIS* risks are based on the dose-to-LCF-risk factor of 0.0004 per rem for workers (i.e., noninvolved workers) and 0.0005 per rem for public (i.e., MEOI and population); SA risks are based on the dose-to-LCF-risk factor of 0.0006 per rem for both workers and public. Filter fire accident annual frequency=0.001 per year. All other accident annual frequencies=0.0001 per year. All accident annual frequencies are from the *HEU EIS* and are identical for this SA.

Key: BWXT=BWXT Nuclear Operations Division; *HEU EIS=Disposition of Surplus Highly Enriched Uranium Final Environmental Impact Statement*; LCF=latent cancer fatalities; MEOI=maximally exposed offsite individual; NFS=Nuclear Fuel Services, Inc.; SA=supplement analysis; SRS=Savannah River Site; and Y–12=Y–12 National Security Complex.

Source: Derived from DOE 1996a.

4.3.1 Transport Activities Similar to those Evaluated in the *HEU EIS*

Transport activities similar to those evaluated in the *HEU EIS* include transport of surplus HEU and blendstock to blending sites, transport of LEU to fuel fabricators, and transport of associated wastes. The various materials are and would continue to be transported in DOE-, NRC- and U.S. Department of Transportation (DOT)-certified packaging, as appropriate.

The *HEU EIS* analyses assume that DOE safe, secure transports (SSTs) would be used to ship HEU to the blending sites, and commercial trucks would be used for all other overland transport activities. Transportation impacts in the *HEU EIS* are conservatively estimated using the RADTRAN 4 computer program and default RADTRAN input parameters (Neuhauser and Kanipe 1992). For example, the *HEU EI*S assumes that there would be frequent stops (1 hour every 91 kilometers of travel) and that these stops could occur anywhere along the route in either rural, suburban, or urban areas. The analyses also assume constant population densities of 6; 719; and 3,861 people per square kilometer, respectively, for rural, suburban, and urban areas irrespective of the routes and locations. At the time the *HEU EIS* was prepared, these estimates were considered conservative and appropriate when analyzing aggregate route characteristics, which only consider the total distance between the origin and destination for each transport and the fractions of travel in the rural, suburban, and urban areas.

Current population density estimates are based on route-specific characteristics using the Transportation Routing Analysis Geographic Information System (TRAGIS) computer code (DOE 2003b), which generates population densities using 2000 census statistics. Comparisons of population data for transport between locations similar to those used in the *HEU EIS* indicate that today, population densities for highway routes in rural areas are higher, and population densities in the suburban and urban areas are much lower. DOE has also developed additional transportation risk assessment guidelines since the *HEU EIS* was prepared (DOE 2002b).

To determine the degree to which the updated analytical methods and data would affect the results, one transportation segment (transporting a shipment of HEU from Y–12 to a representative blending site [BWXT]) was analyzed using the new methodology, and the results were compared to the *HEU EIS* analysis. Comparison of the doses and risks indicates that the dose estimates in the *HEU EIS* remain valid and would envelope the impacts from similar activities under this SA (SAIC 2007). However, independent of the transportation analyses, application of revised dose-to-LCF-risk conversion factors (discussed in **Section 4.2**) increases the risk to exposed workers by 50 percent and to the exposed population by 20 percent over those presented in the *HEU EIS*. Updating the *HEU EIS* analyses with these revised conversion factors, the combined annual impacts of transporting surplus HEU and blendstock to each of the blending sites, and then transporting the resulting LEU to a fuel fabrication facility, are summarized in **Table 4.3–1** and discussed in the paragraphs that follow. These results indicate that the proposed activities would be similar to those analyzed in the *HEU EIS*, and the associated transportation impacts would continue to be low. Consistent with the impacts presented in the *HEU EIS*, the largest contributor to overall transportation risks would be nonradiological impacts from traffic accidents.

Table 4.3–1. Annual Transportation Risks from Surplus Highly Enriched Uranium Disposition Activities[a]

Blending Sites	Incident-free Risks[b]		Accident Population Risks[c]	
	Crew[c]	Population	Radiological	Traffic
Y–12	9.3×10^{-3}	1.3×10^{-2}	4.8×10^{-4}	3.4×10^{-2}
BWXT	1.0×10^{-2}	1.4×10^{-2}	5.7×10^{-4}	3.7×10^{-2}
NFS	1.0×10^{-2}	1.4×10^{-2}	5.1×10^{-4}	3.6×10^{-2}
SRS	1.0×10^{-2}	1.4×10^{-2}	5.5×10^{-4}	3.7×10^{-2}

[a] Total annual health effects from transport of surplus HEU from Y–12 to blending sites, transport of blendstock materials from Hanford to blending sites, and transport of resulting LEU to fuel fabricator site.
[b] Incident-free risks are in terms of LCF.
[c] Radiological risks are in terms of LCF. Traffic risks are in terms of nonoccupational traffic fatalities.
Note: The values in this table include adjustments for the worker and population risk factors to 0.0006 LCF per person-rem of exposure.
Key: BWXT=BWXT Nuclear Operations Division; DOE=U.S. Department of Energy; LCF=latent cancer fatalities; NFS=Nuclear Fuel Services, Inc.; SRS=Savannah River Site; and Y–12=Y–12 National Security Complex.
Source: Derived from DOE 1996a.

Transport of Surplus HEU to Blending Sites. Surplus HEU materials are assumed to originate at Y–12 and to be shipped to the blending sites as either metal, oxides, or alloys. Annually, about 10 metric tons of HEU would be transported from Y–12 to the blending sites. Transport characteristics and packaging are expected to be similar to those evaluated in the *HEU EIS*.

Accident risks for radiological accidents are identified in terms of increased LCFs in the exposed population, while traffic risks are in terms of potential nonoccupational (public) fatalities resulting from traffic accidents. The values presented assume the accident rates used in the *HEU EIS* are still valid. Because the HEU materials are transported in SSTs, the expected accident rates for these transports are much smaller than those associated with commercial trucks.

Transport of Blendstock Materials to Blending Sites. The *HEU EIS* evaluates the impacts of transporting various blendstocks to each of the blending sites. For analysis purposes in this SA, the blendstock is assumed to be natural uranium in the form of U_3O_8 or UO_3. This material could be provided from several Government or commercial sources and transported directly to the blending site. Consistent with the *HEU EIS*, this SA analyzes the DOE Hanford Site as a representative source for the blendstock material because its location is farthest from the blending sites. Because of the distance and material form, this assumption would envelope the impacts of transporting other blendstock materials from other locations. The required amount of blendstock is a function of initial enrichment (U-235) in the HEU feed and the desired final enrichment of the resulting LEU. This SA assumes the same final product enrichment as in the *HEU EIS*. However, this SA assumes a higher initial HEU feedstock enrichment (80 percent) to better reflect the actual average assay of HEU now proposed for down-blending, which corresponds to an annual blendstock requirement of about 280 metric tons of natural uranium (as UO_3). Assuming packaging and shipping characteristics similar to those used in the *HEU EIS*, this would result in about 26 shipments annually, or approximately 11 more per year than originally estimated in the *HEU EIS*.

Transport of LEU to Fuel Fabricators. Following down-blending, the resulting LEU would be transported in certified packaging to a domestic fuel fabricator. The *HEU EIS* evaluates such transport to a number of fuel fabrication sites, with distances ranging from 0 kilometers (where the fuel fabricator is at the blending site) to more than 4,400 kilometers (a fuel fabrication site in Richland, Washington). For this SA, the LEU feed stock is assumed to be UNH and the fuel fabricator is assumed to be in Washington State. These assumptions lead to higher transportation risk estimates, a larger number of shipments (about 70 shipments per year), and longer travel distances than are expected based on DOE/NNSA having selected a fuel fabricator in South Carolina.

Transport of LLW. As described in **Section 3.2**, the amount of surplus HEU that would be suitable for disposal as LLW at NTS has been reduced to approximately 3 metric tons, or approximately 10 percent of the amount analyzed in the *HEU EIS*. The method of transportation and nature of impacts are expected to be the same. Therefore, the risks evaluated in the *HEU EIS* for transporting HEU down-blended to LLW are higher than the potential impacts associated with the current proposed action.

4.3.2 Transport of LEU to Support the Reliable Fuel Supply Initiative

This SA evaluates the potential impacts of transporting about 220 metric tons of LEU UF_6 feedstock from a domestic fuel fabricator to a foreign country in support of the Reliable Fuel Supply Initiative. These materials would be transported in packaging that is specially designed and certified for fissile material transports. The DOT-certified packaging currently used consists of four 30-B UF_6 cylinders configured on a specially designed structure for transport within a standard 6.1-meter International Organization for Standardization (ISO) container. Each cylinder would contain 2,277 kilograms of UF_6, so each ISO container would transport about 9.1 metric tons of LEU UF_6 feedstock. This quantity of UF_6 is consistent with the amount assumed in the *HEU EIS* for transport of similar materials within the United States.

For analysis purposes in this SA, it is conservatively assumed that the LEU feedstock would be transported across the United States from a fuel fabricator on the West Coast to a port on the East Coast, and placed on a commercial vessel for marine transport to a fuel fabricator in a foreign country.[6] Each potential shipment is assumed to comprise approximately 40 metric tons of LEU, the quantity sufficient for one standard refueling cycle of a pressurized water nuclear reactor. Therefore, approximately six or seven shipments would be required to transport all 220 metric tons of LEU UF_6. In addition, each LEU shipment is assumed to require four ISO containers that would be transported as a convoy of commercial truck trailers, consistent with current practices in civilian commerce.

[6] Under the Reliable Fuel Supply contract, the Westinghouse fuel fabrication facility in Columbia, South Carolina, will serve as the actual LEU storage location and point of origin for subsequent transport to a marine terminal. Any decision to select a specific West or East Coast port would be predicated upon the geographic location of the participating foreign country. Therefore, the transportation analysis presented in this SA conservatively assumes maximum shipping distances (a West Coast fuel fabricator and an East Coast marine terminal) in order to bound all potential domestic LEU transportation impacts (including the possible use of an East Coast fuel fabricator and a West Coast marine terminal).

A number of East Coast ports regularly transport fissile materials between the United States and foreign countries. DOE/NNSA evaluated the impacts of transporting spent nuclear fuel and mixed oxide fuel through multiple U.S. East Coast ports in the *Final Environmental Impact Statement on a Proposed Nuclear Weapons Nonproliferation Policy Concerning Foreign Research Reactor Spent Nuclear Fuel* (DOE 1996c); the *Storage and Disposition of Weapons-Usable Fissile Materials Final Programmatic Environmental Impact Statement,* (DOE 1996b); and the *Supplement Analysis for the Fabrication of Mixed Oxide Fuel Lead Assemblies in Europe* (DOE 2003a). Previous NEPA analyses have demonstrated that ocean transport is safe and would involve minimal environmental impacts. These NEPA analyses considered commercial ports such as Newport News, Norfolk International, and Portsmouth Marine Terminals in Virginia, as well as military ports such as the Military Ocean Terminal at Sunny Point, North Carolina; Charleston Naval Weapons Station in South Carolina; and Yorktown Naval Weapons Station in Virginia. Norfolk International is the assumed port of departure used in this SA to evaluate the distance traveled and the impacts from port activities during container loading. The following activities are evaluated in association with transporting Reliable Fuel Supply Initiative LEU:

- Overland transport of UF_6 from a fuel fabricator to Norfolk International Terminal, in Norfolk, Virginia.

- Port transfer of the UF_6 ISO containers from trucks to an ocean container ship.

- Ocean transport of UF_6 across the global commons.

Overland Transport of UF_6. Table 4.3–2 summarizes the impacts from transporting LEU UF_6 feed materials, assuming transport characteristics and packaging similar to those used in the *HEU EIS*. It is conservatively assumed that the materials would be transported from a West Coast fuel fabricator (in Richland, Washington), to the Norfolk International Terminal. The one-way distance between these two locations is 4,530 kilometers, with fractions of travel in rural, suburban, and urban areas essentially unchanged from those evaluated in the *HEU EIS.*

Table 4.3–2. Impacts of Overland Transport of Uranium Hexafluoride Low-Enriched Uranium (per shipment)

Transport	Incident-free Risks[a]		Accident Population Risks[b]	
	Crew	Population	Radiological	Traffic
UF_6 to the port	4.0×10^{-4}	6.1×10^{-4}	2.7×10^{-5}	1.6×10^{-3}

[a] The risks are in terms of LCF.
[b] Radiological risks are in terms of LCF. Traffic risks are in terms of nonoccupational traffic fatalities.
Note: The values in this table include adjustments for the workers and population risk factors to 0.0006 LCF per person-rem of exposure.
Key: DOE=U.S. Department of Energy; LCF=latent cancer fatalities; UF_6=uranium hexafluoride.
Source: Derived from DOE 1996a.

Port Activities. These activities include loading of the ISO containers onto a commercial vessel, container-handling activities while on board, and subsequent movement of the vessel from the port out to the open sea. Assuming incident-free transfer of the ISO containers to the vessel, the only radiation exposures anticipated would be those to persons directly involved in the transfer (inspectors, port handlers, guards, etc.). Members of the public would be too distant to receive measurable radiation exposures. The dose to an exposed worker would be a function of the exposure time and the distance from the ISO container. Port activity impacts were evaluated in Appendix D of the *FRR SNF EIS*. Assuming for this analysis that the activities involved in loading the ISO containers at ports would be similar to those analyzed in the *FRR SNF EIS* and the external dose rate of the containers would be similar to those considered in the *HEU EIS*, the potential impacts to port workers from loading four containers of UF_6 are provided in **Table 4.3–3**.

Table 4.3–3. Human Health Effects from Incident-Free Port Operations (per shipment)

Exposed Personnel	MEI Dose (rem)	MEI Risk (LCF)	Collective Dose[a] (person-rem)	Collective Risk[a] (LCF)
Longshoremen	1.8×10^{-4}	1.1×10^{-7}	6.1×10^{-4}	3.6×10^{-7}
Crane Operators	3.4×10^{-5}	2.0×10^{-8}	4.5×10^{-5}	2.7×10^{-8}
Inspectors	5.2×10^{-4}	3.1×10^{-7}	2.2×10^{-3}	1.3×10^{-6}
Observers	3.2×10^{-5}	1.9×10^{-8}	1.6×10^{-3}	9.6×10^{-7}

[a] Collective dose and risk represent the total dose and risk to all potentially exposed personnel in each category (i.e., longshoremen, crane operators, inspectors, and observers).

Key: DOE=U.S. Department of Energy; LCF=latent cancer fatalities; and MEI=maximally exposed individual.

Source: Derived from DOE 1996c.

A handling accident at the port would not be expected to result in cask failure leading to any release of radioactive material. Only an accident involving a ship collision and ensuing fire has a potential to damage the cask. The *FRR SNF EIS* evaluated such a scenario; the analysis was very site-specific in terms of population distributions, land use, meteorology, and other factors. Given security provisions, port proximity, and awareness of the shipment, the potential severity of a ship collision is limited, and the consequences of accidents are enveloped by those in Appendix D of the *FRR SNF EIS.* The consequences of similar accidents at the port would be much lower than those described in the *FRR SNF EIS* due to the substantially lower total radioactivity content.

Global Commons. Transporting the Reliable Fuel Supply Initiative LEU reserves to participating foreign countries by ship is expected to add up to seven ocean trips to the thousands of commercial and military vessel trips crossing the oceans of the world each year. Therefore, a few ships transporting this LEU over the course of the program would not have a noticeable impact on the global commons.[7]

Impacts of an accident during transport of enriched uranium over the global commons would be similar to those discussed in the *Environmental Assessment for the Proposed Interim Storage at the Y-12 Plant Oak Ridge, Tennessee of Highly Enriched Uranium Acquired from Kazakhstan by the United States* (DOE/EA 1006) (DOE 1994) and the *Environmental Assessment for the Transportation of Highly Enriched Uranium from the Russian Federation to the Y-12 National Security Complex and Finding of No Significant Impact* (DOE/EA-1271) (DOE 2004b). These analyses conclude that in the case of an accident there could be some loss of marine life to organisms directly exposed to the uranium. However, as a result of the large volumes of water, the mixing mechanisms within it, the existing background uranium concentrations, and the radiation-resistance of aquatic organisms, the radiological impact of an accident would be localized and of minor impact.

It is also possible that a ship containing LEU could pass through an area known to be routinely inhabited by the right whale, an endangered species. There are two identified habitats for this species: one located mainly off the coast of Massachusetts and one off the coasts of Florida and Georgia (66 FR 58066; November 20, 2001). Before a ship enters such an area, it is required to contact the Mandatory Ship Reporting System operated by the U.S. Coast Guard and endorsed by the International Maritime Organization to report its name, call sign, location, course, speed, destination, and route. This system reduces the likelihood of a ship striking a right whale by providing ships in the area with contact information for data on the most recent whale sightings and avoidance procedures that could prevent a collision (DOE 2006).

[7] The actual number of annual commercial LEU shipments is considered sensitive information. However, the seven additional LEU shipments that could result under the proposed action would represent only a small fraction of the total LEU commercially transported overseas each year.

4.4 Waste Management

Down-blending surplus HEU to LEU generates LLW, mixed LLW, hazardous waste, and nonhazardous waste. The *HEU EIS* analyses identified that generation of such wastes would not greatly impact the waste management infrastructure at any of the blending sites. Similarly, the proposed use of higher U-235-enriched HEU feedstock or UO_3 as alternate blendstock would not measurably affect waste generation. Because the overall down-blending processes have not changed and the down-blending rates remain within the parameters evaluated in the *HEU EIS*, the amounts of wastes generated annually at each of the blending sites as a result of the SA proposed action would be similar to those previously analyzed. Accordingly, the offsite transportation of down-blending process wastes are also expected to be similar to those analyzed in the *HEU EIS*.

The *HEU EIS* proposed action considers down-blending at least 30 metric tons of surplus HEU to 0.9 percent-enrichment LEU for disposal as LLW. Establishing a new disposal pathway for surplus HEU discard material through direct disposal would reduce the volume of waste to be disposed of, compared to first down-blending the surplus HEU to 0.9 percent-enrichment LEU and then disposing of it as LLW as evaluated in the *HEU EIS*. It would also reduce the total campaign impacts presented in the *HEU EIS* that are associated with transporting substantial quantities of resulting LLW to a DOE or commercial LLW management facility. On a per unit basis, down-blending HEU to LEU for commercial use would reduce LLW and nonhazardous waste, although the total quantities of mixed LLW and hazardous waste would increase due to the addition of a purification process required to meet fuel specifications.

Considering the additional down-blending increment afforded under the *HEU EIS* analyses by not down-blending surplus HEU discard materials to waste, the proposed disposition of new quantities of HEU would exceed the envelope analyzed in the *HEU EIS* by approximately only 20 metric tons, corresponding to an approximate 10 percent increase in waste management impacts. However, the timeframe for disposition of all the additional HEU would likely extend for several decades. Because the incremental impacts associated with disposition of this additional material would be incurred over this extended timeframe, no discernable increase in annual impacts is expected.

4.5 Environmental Justice

As described in **Sections 4.2** and **4.3**, potential health impacts to surrounding populations resulting from associated normal operations, facility accidents, and transportation activities would continue to be low. Therefore, it is unlikely that disproportionate adverse impacts to minority and low-income populations would result from the proposed action considered in this SA.

4.6 Sabotage or Terrorist Attack

In the aftermath of September 11, 2001, DOE/NNSA and NRC have implemented measures to minimize the risk and consequences of potential terrorist attacks on DOE and NRC-licensed facilities. The safeguards applied to protecting Y–12, BWXT, NFS, and SRS involve a dynamic process of enhancement to meet threats; these safeguards will evolve over time. It is not possible to predict whether intentional attacks would occur at the sites addressed in this SA, or the nature or types of such attacks. Nevertheless, DOE/NNSA and NRC, as appropriate, have re-evaluated security scenarios involving malevolent, terrorist, or intentionally destructive acts at Y–12, BWXT, NFS, and SRS to assess potential vulnerabilities and identify improvements to security procedures and response measures (Brooks 2004; NRC 2002, 2003c). Security at these facilities is a critical priority for both DOE/NNSA and NRC, which continue to identify and implement measures to defend and deter attacks against them. DOE/NNSA and NRC maintain a system of regulations, orders, programs, guidance, and training that form the basis for maintaining, updating, and testing site security to preclude and mitigate any postulated terrorist actions (Brooks 2004; NRC 2007a–c). The conservative assumptions inherent in the accidents analyzed in **Section 4.2.2** for Y–12, BWXT, NFS, and SRS assume initiation by natural events, equipment failure, or inadvertent worker actions. These same events could be caused by intentional malevolent acts by one or more saboteurs or terrorists. For example, a criticality could be purposefully created, or high explosives could be used to damage buildings in the same way as an earthquake. However, the resulting radiological release and consequences to workers and the public would be similar, regardless of the nature of the initiating event.

The site physical security protection strategy is based on a graded and layered approach supported by an armed guard force that is trained to detect, deter, and neutralize adversary activities and is backed up by local, state, and Federal law enforcement agencies. The sites use both staffed and automated access-control systems to limit entry into areas and/or facilities to authorized individuals. Automated access-control systems use controlled booths, turnstiles, doors, and gates. Escorting requirements provide access controls for visitors. Barriers, electronic surveillance systems, and intrusion detection systems form a comprehensive site-wide network of monitored alarms. Various types of barriers would delay, channel personnel, or deny access to classified matter, HEU, LEU, and vital areas. Barriers direct the flow of vehicles and deter and/or prevent penetration by motorized vehicles where they could significantly increase the likelihood of a successful malevolent act. Some barriers are passive and would require the use of special tools and high explosives to penetrate them. Other barriers have an active component designed to dispense an obscuration agent, viscous barrier, or sensory irritant. Tamper-protected surveillance, intrusion detection, and alarm systems designed to detect an adversary action or anomalous behavior inside and outside the facilities are paired with assessment systems that evaluate the nature of the adversary action. Random patrols and visual observation are also used to deter and detect intrusions. Penetration-resistant, alarmed vaults and vault-type rooms are used to protect classified materials.

There is also a potential for attempted sabotage or terrorist attacks during transport. As such, transportation activities would incorporate existing physical safeguards aimed at protecting the public from harm, including SST/SafeGuards Transport (SST/SGT) for inter-site transport of HEU and enhanced monitoring and coordination of commercial transport of LEU to minimize the possibility of sabotage and facilitate recovery of shipments that could come under control of unauthorized persons. The safety features of the transportation casks that provide containment, shielding, and thermal protection also protect against sabotage. Although it is not possible to predict the occurrence of sabotage or terrorism or the exact nature of such events if they were to occur, DOE/NNSA has previously examined several transportation accident scenarios that would have the types of consequences that could result from such acts in the *FRR SNF EIS* (DOE 1996c). However, because the materials being considered for transport under this SA would have substantially less total radioactivity than those analyzed in the *FRR SNF EIS*, the corresponding impacts resulting from such events would be much lower.

5.0 CONCLUSION

In accordance with CEQ regulations 40 CFR 1502.9(c) and DOE regulations 10 CFR 1021.314(c), this SA evaluates ongoing and proposed surplus HEU disposition program activities to determine whether the *HEU EIS* should be supplemented, a new EIS should be prepared, or no further NEPA documentation is necessary.

Based on the analyses in this SA, continued implementation of ongoing disposition activities and the addition of new disposition initiatives described herein would not substantially change the environmental impacts from those described in the *HEU EIS*. Although some relatively large percentage increases to certain impacts presented in the *HEU EIS* have been identified, they represent only small changes to these impacts in absolute terms. Therefore, the activities evaluated in this SA do not represent substantial changes in any proposed actions or result in any new circumstances relevant to environmental concerns.

Proposed down-blending processes and rates would remain within the parameters evaluated in the *HEU EIS*; therefore, similar annual non-radiological emissions, waste generation, and transportation activities associated with ongoing surplus HEU disposition activities are expected. Projected radiological risks from normal operations and facility accidents to both workers and the public would increase from those presented in the *HEU EIS* as a result of incorporating the higher average U-235 enrichment of the HEU now proposed for down-blending, updated population statistics, and larger dose-to-LCF-risk factors. However, operation of surplus HEU disposition facilities continues to pose no more than a small risk to human health, and no new or different bounding accident scenarios have been identified. Transportation activities supporting the Reliable Fuel Supply Initiative would add small additional impacts associated with transfer activities at the port of departure, and impacts of associated additional overseas shipments on the global commons would be negligible. Although proposed down-blending of additional HEU would increase total campaign impacts by approximately 10 percent, these additional impacts would be distributed over an expanded timeframe and continue to be well within applicable DOE limits and each site's capacity to manage.

6.0 DETERMINATION

The analyses in this SA indicate that the activities and potential environmental impacts associated with ongoing activities and proposed new initiatives supporting the DOE/NNSA disposition program for surplus HEU do not constitute substantial changes in the proposed action that are relevant to environmental concerns. Similarly, no significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts have been identified. Therefore, pursuant to 10 CFR 1021.314(c), no additional NEPA analyses are required.

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Table S.3 Uranium fuel-cycle environmental data[a]

[Normalized to model light-water reactor (LWR) annual fuel requirement (WASH-1248) or reference reactor year (NUREG-0116)]

Environmental considerations	Total	Maximum effect per annual fuel requirement or reference reactor year of model 1000-MW(e) LWR
Natural resource use		
Land		
Temporarily committed, acres[b]	100	
Undisturbed area	79	
Disturbed area	22	Equivalent to a 110-MW(e) coal-fired power plant.
Permanently committed, acres	13	
Overburden moved, millions of MT	2.8	Equivalent to a 95-MW(e) coal-fired power plant.
Water (millions of gallons)		
Discharged to air	160	= 2% of model 1000-MW(e) LWR with cooling tower.
Discharged to water bodies	11,090	
Discharged to ground	127	
Total	11,377	< 4% of model 1000 MW(e) LWR with once-through cooling.
Fossil fuel		
Electrical energy, thousands of MWh	323	< 5% of model 1000-MW(e) LWR output.
Equivalent coal, thousands of MT	118	Equivalent to the consumption of a 45-MW(e) coal-fired power plant.
Natural gas, millions of scf	135	< 0.4% of model 1000 MW(e) energy output.
Effluents--chemical (MT)		
Gases (including entrainment)[c]		
SO_x	4,400	
NO_x[d]	1,190	Equivalent to emissions from 45-MW(e) coal-fired plant for a year.
Hydrocarbons	14	
CO	29.6	
Particulates	1,154	
Other gases		
F	0.67	Principally from UF_6 production, enrichment, and reprocessing. Concentration within range of state standards--below level that has effects on human health.
HCl	0.014	
Liquids		
SO	9.9	From enrichment, fuel fabrication, and reprocessing steps. Components that constitute a potential for adverse environmental effect are present in dilute concentrations and receive additional dilution by receiving bodies of water to levels below permissible standards. The constituents that require dilution and the flow of dilution water are NH_2--600 ft^3/sec, NO_x--20 ft^3/sec, Fluoride--70 ft^3/sec.
NO	25.8	
Fluoride	12.9	
Ca	5.4	
C1	8.5	
Na	12.1	
NH	10.0	
Fe	0.4	
Tailings solutions	240,000	From mills only--no significant effluents to environment.
Solids	91,000	Principally from mills--no significant effluents to environment.
Effluents Radiological (curies)		
Gases (including entrainment)		
Rn-222		Currently under reconsideration by the Commission.
Ra-226	0.02	
Th-230	0.02	
Uranium	0.034	
Tritium	18,100	
C-14	24	
Kr-85	400,000	
Ru-106	0.14	
I-129	1.3	Principally from fuel reprocessing plants.
I-131	0.83	
Tc-99		Currently under consideration by the Commission.
Fission products and transuranics	0.203	
Liquids		
Uranium and daughters	2.1	Principally from milling--included tailings liquor and returned to ground--no effluents; therefore, no effect on environment.
Ra-226	0.0034	From UF_6 production.
Th-230	0.0015	
Th-234	0.01	From fuel fabrication plants--concentration 10% of 10 CFR 20 for total processing 26 annual fuel requirements for model LWR.
Fission and activation products	5.9×10^{-a}	
Solids (buried on site)		
Other than high level (shallow)	11,300	9100 Ci comes from low-level reactor wastes and 1500 Ci comes from reactor decontamination and decommissioning-- buried at land burial facilities. 600 Ci comes from mills--included in tailings returned to ground. Approximately 60 Ci comes from conversion and spent-fuel storage. No significant effluent to the environment.
TRU and HLW (deep)	1.1×10^6	Buried at federal repository.
Effluents--thermal, billions of British thermal units	4,063	< 5% of model 1000-MW(e) LWR.
Transportation, man-rem		
Exposure of workers and general public	2.5	
Occupational exposure	22.6	From reprocessing and waste management.

[a]In some cases where no entry appears, it is clear from the background documents that the matter was addressed and that, in effect, the table should be read as if a specific zero entry had been made. However, other areas are not addressed at all in the table. Table 10.5-3 does not include health effects from the effluents described in the table, estimates of releases of radon-222 from the uranium fuel cycle, or estimates of technetium-99 released from waste management or reprocessing activities. These issues may be the subject of litigation in the individual licensing proceedings.

Data supporting this table are given in WASH-1248; NUREG-0116; NUREG-0216; and in the record of the Docket RM-50-3. The contributions from reprocessing, waste management, and transportation of wastes are maximized for either of the two fuel cycles (uranium only and no recycle). The contribution from transportation excludes transportation of cold fuel to a reactor and of irradiated fuel and radioactive wastes from a reactor, which are considered in Table S-4 of § 5.20(g). The contributions from the other steps of the fuel cycle are given in columns A through E of Table S-3A of WASH-1248.

[b]The contributions to temporarily committed land from reprocessing are not prorated over 30 years, because the complete temporary impact accrues regardless of whether the plant services 1 reactor for 1 year or 57 reactors for 30 years.

[c]Estimated effluents based upon combustion of equivalent coal for power generation.

[d]1.2% from natural gas use and process.

Source: 10 CFR 51.51.

Table S.4 Environmental impact of transportation of fuel and waste to and from one light-water-cooled nuclear power reactor,[a] normal conditions of transport

		Environmental impact	
Heat (per irradiated fuel cask in transit)		250,000 Btu/hr	
Weight (governed by Federal or State restrictions)		73,000 lb per truck; 100 tons per cask per rail car	
Traffic density			
Truck		Less than 1 per day	
Rail		Less than 3 per month	
Exposed population	Estimated number of persons exposed	Range of doses to exposed individuals[b] (per reactor year)	Cumulative dose to exposed population (per reactor year)[c]
Transportation workers	200	0.01 to 300 mrem	4 man-rem
General public			
Onlookers	1,100	0.003 to 1.3 mrem	3 man-rem
Along route	600,000	0.0001 to 0.06 mrem	
Accidents in transport			
		Environmental risk	
Radiological effects		Small[d]	
Common (nonradiological) causes		1 fatal injury in 100 reactor years, 1 nonfatal injury in 10 reactor years, $475 property damage per reactor year	

[a]Data supporting this table are given in the Commission's *Environmental Survey of Transportation of Radioactive Materials to and from Nuclear Power Plants*, WASH-1238, December 1972, and Supp. 1 NUREG-75/038, April 1975. Both documents are available for inspection and copying at the Commission's Public Document Room, 2120 L Street N.W., Washington, D.C., and may be obtained from National Technical Information Service, Springfield, VA 22161. WASH-1238 is available from NTIS at a cost of $5.45 (microfiche, $2.25) and NUREG-75/038 is available at a cost of $3.25 (microfiche, $2.25).

[b]The Federal Radiation Council has recommended that the radiation doses from all sources of radiation other than natural background and medical exposures should be limited to 5000 mrem per year for individuals as a result of occupational exposure and should be limited to 500 mrem per year for individuals in the general population. The dose to individuals due to average natural background radiation is about 130 mrem per year.

[c]Man-rem is an expression for the summation of whole body doses to individuals in a group. Thus, if each member of a population group of 1000 people were to receive a dose of 0.0001 rem (1 mrem), or if 2 people were to receive a dose of 0.5 rem (500 mrem) each, the total man-rem dose in each case would be 1 man-rem.

[d]Although the environmental risk of radiological effects stemming from transportation accidents is currently incapable of being numerically quantified, the risk remains small regardless of whether it is being applied to a single reactor or a multireactor site.

Source: 10 CFR 51.52.