APPENDIX D:

ENVIRONMENTAL SYNOPSIS FOR THE DEPLETED UF_6 CONVERSION PROJECT

ENVIRONMENTAL SYNOPSIS
FOR THE DEPLETED UF_6 CONVERSION PROJECT

(Solicitation No. DE-RP05-01OR22717)

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1 INTRODUCTION

The U.S. Department of Energy (DOE) issued a Request for Proposals (RFP) on October 31, 2000, to procure a contractor to design, construct, and operate two depleted uranium hexafluoride (DUF_6) conversion facilities at Portsmouth, Ohio, and Paducah, Kentucky (Solicitation No. DE-RP05-01OR22717). The Department intends to use the proposed facilities to convert its inventory of DUF_6 to a more stable chemical form suitable for beneficial use or disposal. The contractor selected will design the conversion plants using the technology it proposes; construct the plants; and operate the plants for a 5-year period, which will include maintaining depleted uranium and product inventories, transporting all uranium hexafluoride storage cylinders from Tennessee to the conversion plant at Portsmouth, Ohio, and transporting converted product that is not needed for other uses to a disposal site. The selected contractor will be expected to arrange for the disposal of such excess material at an appropriate site.

As a Federal agency, the DOE must comply with the National Environmental Policy Act of 1969 (NEPA) (42 USC 4321 et seq.) by considering potential environmental issues associated with its actions prior to undertaking the actions. The NEPA environmental review of the proposed DUF_6 conversion project will be prepared pursuant to Council on Environmental Quality (CEQ) Regulations (40 CFR Parts 1500 - 1508), and the Department's NEPA Implementing Procedures (10 CFR Part 1021), which provide directions specific to procurement actions that DOE may undertake or fund before completing the NEPA process. Per these regulations, DOE has prepared an environmental critique and an environmental synopsis to support the procurement selection process.

The environmental critique for the DUF_6 conversion services procurement process, which was completed during 2001, provided an evaluation and comparison of potential environmental impacts for each proposal received in response to the RFP and deemed to be within the competitive range. The critique was used by DOE to evaluate appreciable differences in the potential environmental impacts from the proposals in the competitive range. As delineated in 10 CFR 1021.216(g), the environmental critique focused on environmental issues pertinent to a decision among the proposals within the competitive range, and included a brief discussion of the purpose of the procurement and each offer, a discussion of the salient characteristics of each offer, and a brief comparative evaluation of the environmental impacts of the offers. The critique represents one aspect of the formal process being used to award a contract for conversion services. As such, it is a procurement-sensitive document and subject to all associated restrictions.

This document is the Environmental Synopsis, which is a publicly available document based on the environmental critique. The Environmental Synopsis documents the evaluation of potential environmental impacts associated with the proposals in the competitive range and does not contain procurement-sensitive information. The specific requirements for an environmental synopsis delineated in 10 CFR 1021.216(h) are as follows:

> *(h) DOE shall prepare a publicly available environmental synopsis, based on the environmental critique, to document the consideration given to environmental factors and to record that the relevant environmental consequences of reasonable alternatives have been evaluated in the selection process. The synopsis will not contain business, confidential, trade secret or other information that DOE otherwise would not disclose pursuant to 18 U.S.C. 1905, the confidentiality requirements of the competitive procurement process, 5 U.S.C. 552(b) and 41 U.S.C. 423. To assure compliance with this requirement, the synopsis will not contain data or other information that may in any way reveal the identity of offerors. After a selection has been made, the environmental synopsis shall be filed with EPA, shall be made publicly available, and shall be incorporated in any NEPA document prepared under paragraph (i) of this section.*

To address the above requirements, this environmental synopsis includes (1) a brief description of background information related to the DUF_6 conversion project, (2) a general description of the proposals received in response to the RFP and deemed to be within the competitive range, (3) a summary of the assessment approach used in the environmental critique to evaluate the potential environmental impacts associated with the proposals, and (4) a summary of the environmental impacts presented in the critique, focusing on potential differences among the proposals. Because of confidentiality concerns, the proposals and environmental impacts are discussed in general terms.

2 BACKGROUND

Depleted UF_6 results from the process of making uranium suitable for use as fuel in nuclear reactors or for military applications. The use of uranium in these applications requires increasing the proportion of the uranium-235 isotope found in natural uranium, which is approximately 0.7% (by weight), through an isotopic separation process. A uranium–235 "enrichment" process called gaseous diffusion has historically been used in the United States. The gaseous diffusion process uses uranium in the form of UF_6, primarily because UF_6 can conveniently be used in the gas form for processing, in the liquid form for filling or emptying containers, and in the solid form for storage. Solid UF_6 is a white, dense, crystalline material that resembles rock salt.

Over the last five decades, large quantities of uranium were enriched using gaseous diffusion. "Depleted" UF_6 (DUF_6) is a product of the process and was stored at the three uranium enrichment sites located at Paducah, Kentucky; Portsmouth, Ohio; and the East Tennessee Technology Park (ETTP—formerly known as the K–25 Site) in Oak Ridge, Tennessee. Depleted uranium is uranium that, through the enrichment process, has had a portion of the uranium-235 that it once contained removed so that it has a lower uranium-235 proportion than the 0.7 weight-percent found in nature. The uranium in most of DOE's DUF_6 has between 0.2 to 0.4 weight-percent uranium-235.

At the time the RFP was issued, DOE had management responsibility for approximately 700,000 metric tons (MT) of DUF_6 contained in about 57,700 steel cylinders at the Portsmouth, Paducah, and ETTP sites, where it has stored such material since the 1950s. On June 17, 2002, an agreement was signed by DOE and USEC to transfer up to 23,300 MT of additional DUF_6 from USEC to DOE between 2002 and 2006. The exact number of cylinders was not specified. Transfer of ownership of all the material will take place at Paducah.

The characteristics of UF_6 pose potential health and environmental risks. DUF_6 in cylinders emits low levels of gamma and neutron radiation. Also, when released to the atmosphere, DUF_6 reacts with water vapor in the air to form hydrogen fluoride (HF) and uranyl fluoride (UO_2F_2), both chemically toxic substances. In light of such characteristics, DOE stores DUF_6 in a manner designed to minimize the risk to workers, the public, and the environment.

DOE has several agreements with the states in which DUF_6 is stored. In October 1992, the Ohio Environmental Protection Agency (OEPA) issued a Notice of Violation (NOV) alleging that DUF_6 stored at the Portsmouth facility is subject to regulation under state hazardous waste laws applicable to the Portsmouth Gaseous Diffusion Plant. The NOV stated that OEPA had determined DUF_6 to be a solid waste and that DOE had violated Ohio laws and regulations by not evaluating whether such waste was hazardous. DOE disagreed with this assessment, and in February 1998, DOE and OEPA reached an agreement. This agreement sets aside the issue of whether the DUF_6 is subject to regulation as solid waste and institutes a negotiated management plan governing the storage of the Portsmouth $DUF_{6.}$ The agreement also requires DOE to continue its efforts to evaluate potential use or reuse of the material. The agreement expires in 2008. Similarly, in February 1999, DOE and the Tennessee Department of Environment and

Conservation (TDEC) entered into a consent order which included a requirement for the performance of two environmentally beneficial projects: the implementation of a negotiated management plan governing the storage of the small inventory (relative to other sites) of all UF_6 (depleted, low-enriched, and natural) cylinders stored at the ETTP site, and the removal of the DUF_6 from the ETTP site or the conversion of the material by December 31, 2009.

In 1994, DOE began work on the *Programmatic Environmental Impact Statement for Alternative Strategies for the Long-Term Management and Use of Depleted Uranium Hexafluoride* (DUF_6 PEIS; DOE 1999). The DUF_6 PEIS was completed in 1999 and identified conversion of DUF_6 to another chemical form for use or long-term storage as part of a preferred management alternative. In the corresponding *Record of Decision for the Long-Term Management and Use of Depleted Uranium Hexafluoride* (ROD) (64 FR 43358, August 10, 1999), DOE decided to promptly convert the DUF_6 inventory to depleted uranium oxide, depleted uranium metal, or a combination of both. The ROD further explained that depleted uranium oxide will be used as much as possible and the remaining depleted uranium oxide will be stored for potential future uses or disposal, as necessary. In addition, according to the ROD, conversion to depleted uranium metal will occur only if uses are available.

During the time that DOE was analyzing its long-term strategy for managing the DUF_6 inventory, several other events occurred related to DUF_6 management. In 1995, the Department began an aggressive program to better manage the DUF_6 cylinders, known as the DUF_6 Cylinder Project Management Plan. In part, this program responded to the Defense Nuclear Facilities Safety Board (DNFSB) Recommendation 95–1, Safety of Cylinders Containing Depleted Uranium. This program included more rigorous and frequent inspections, a multiyear program for painting and refurbishing of cylinders, and construction of concrete-pad cylinder yards. Implementation of the DUF_6 Cylinder Project Management Plan has been successful, and, as a result, on December 16, 1999, the DNFSB closed out Recommendation 95–1.

In July 1998, the President signed Public Law (P.L.) 105–204. This law directed the Secretary of Energy to prepare “a plan to ensure that all amounts accrued on the books” of the United States Enrichment Corporation (USEC) for the disposition of DUF_6 would be used to commence construction of, not later than January 31, 2004, and to operate, an on-site facility at each of the gaseous diffusion plants at Paducah and Portsmouth, to treat and recycle DUF_6 consistent with NEPA. DOE responded to P.L. 105–204 by issuing the *Final Plan for the Conversion of Depleted Uranium Hexafluoride* (referred to herein as the “Conversion Plan”) in July 1999. The Conversion Plan describes DOE’s intent to chemically process the DUF_6 to create products that would present both a lower long-term storage hazard and provide a material that would be suitable for use or disposal.

DOE initiated the Conversion Plan with the announced availability of a draft RFP on July 30, 1999, for a contractor to design, construct, and operate DUF_6 conversion facilities at the Paducah and Portsmouth uranium enrichment plant sites. Based on comments received on the draft RFP, DOE revisited some of the assumptions about management of the DUF_6 inventory made previously in the PEIS and ROD. For example, as documented in the Oak Ridge National Laboratory study, Assessment of Preferred Depleted Uranium Disposal Forms (Croff et al. 2000), four potential conversion forms (triuranium octoxide [U_30_8], uranium dioxide [$U0_2$], uranium tetrafluoride [UF_4], and uranium metal) were evaluated and found to be acceptable for near-surface disposal at low-level radioactive waste disposal sites such as those at DOE's Nevada Test Site (NTS) and Envirocare of Utah, Inc. Therefore, the RFP was modified to allow for a wide range of potential conversion product forms and process technologies. However, any of the proposed conversion forms must have an assured, environmentally acceptable path for final disposition.

On October 31, 2000, DOE issued the final RFP to procure a contractor to design, construct, and operate DUF_6 conversion facilities at the Paducah and Portsmouth plant sites, which is the subject of this environmental synopsis. The conversion plants that result from this procurement will convert the DUF_6 to a more stable chemical form that is suitable for either beneficial use or disposal. The selected contractor will design the conversion plants using the technology it proposes and construct the plants. The selected contractor also will operate the plants for a 5-year period, which will include maintaining depleted uranium and product inventories, transporting all uranium hexafluoride storage cylinders at ETTP to a conversion plant at Portsmouth, and transporting converted product for which there is no use to a disposal site. The selected contractor will be expected to prepare excess material for disposal at an appropriate site.

DOE received a total of five proposals in response to the RFP in March 2001. On August 6, 2001, DOE announced that three proposals were within the competitive range.

In August 2002, Congress passed P.L. 107-206, which stipulates in part that, within 30 days of the law's enactment, DOE must award a contract for the scope of work described in the RFP, including design, construction, and operation of a DUF_6 conversion plant at each of the Department's Paducah, Kentucky, and Portsmouth, Ohio, sites. Accordingly, on August 29, 2002, DOE announced selection of Uranium Disposition Services, LLC (UDS) as the conversion contractor after a full and open competition. Consistent with the RFP, UDS will also be responsible for maintaining the depleted uranium and product inventories and for transporting depleted uranium from Oak Ridge, Tennessee, to the Portsmouth, Ohio, site. UDS was formed by Framatome ANP Inc., Duratek Federal Services Inc., and Burns and Roe Enterprises Inc., specifically to bid on the DUF_6 conversion contract.

3 DESCRIPTION OF PROPOSALS

A total of five proposals were received on March 1, 2001, with three proposals identified within the competitive range in August 2001. The three proposals within the competitive range were evaluated for the environmental critique and synopsis. The proposals contain confidential information and therefore are not available for review by the public and cannot be fully described in this synopsis. General characteristics of the proposals are described below.

In general, each proposal considered conversion of depleted UF_6 to either U_3O_8 or UF_4 at two stand-alone industrial plants dedicated to the conversion process and located at the DOE facilities in Portsmouth, Ohio, and Paducah, Kentucky. All of the proposals would involve the handling and processing of approximately 700,000 MT of DUF_6 in about 57,700 cylinders stored at the Paducah, Portsmouth, and ETTP sites. Each proposed facility would occupy only a fraction of the candidate site location at the Portsmouth or Paducah facility specified in the RFP. Cylinders at the ETTP would be transported to the conversion facility at Portsmouth, in accordance with U.S. Department of Transportation (DOT) regulations. The conversion plants would typically be capable of receiving depleted UF_6 cylinders on trucks or railcars, temporarily storing a small inventory of full cylinders, processing the depleted UF_6 to another chemical form, and temporarily storing the converted uranium product and any other products until shipment off site.

All proposals are based on previously demonstrated technologies, although some would require scale-up to meet the RFP requirements. All proposers identified a disposal pathway for the depleted uranium product in the event the material cannot be used. Two candidate disposal facilities were identified: DOE's NTS and Envirocare of Utah. Each proposal presented information to demonstrate that the proposed conversion product form would be suitable for disposal at one or both of these facilities. In addition, all proposers indicated that the HF product would be sold for reuse and shipped off site, either as anhydrous HF (AHF) or aqueous HF.

All proposals in the competitive range indicated that emptied cylinders would be sold for reuse in the uranium enrichment industry as much as possible. In addition, two of the three proposals in the competitive range indicated that unsold, emptied DUF_6 cylinders would be modified for use as disposal containers for the depleted uranium conversion product. The remaining proposal indicated that the depleted uranium conversion product would be disposed of in large bulk bags, with the cylinders being crushed and disposed of separately as low-level waste (LLW).

4 ASSESSMENT APPROACH USED IN THE ENVIRONMENTAL CRITIQUE

In the RFP, the offerors were required to provide data for DOE's use in preparing appropriate preliminary NEPA documentation per 10 CFR 1021.216. The data request appeared as Attachment L.3 in the RFP and is repeated in Table 4.1. The NEPA data submitted in the proposals in March 2001 and subsequently revised in October 2001 formed the basis of the evaluation of impacts in the critique and this synopsis.

For the critique, potential environmental consequences were evaluated in the areas of human health and safety (normal operations and accidents), air quality and noise, water and soil, socioeconomics, wetlands and ecology, waste management, resource requirements, land use, and cultural resources. These assessment areas are shown in Figure 4.1. In addition, a total of 49 federal, state (Kentucky and Ohio), and local permit, license, or approval requirements (referred to collectively as "consents") were identified and listed in the critique as potentially applicable to activities that are covered by the RFP to design, construct, and operate two depleted UF_6 conversion facilities, and to manage storage and transport of depleted UF_6 cylinders.

As described in the critique, potential environmental impacts from conversion facilities could occur (1) during construction of a conversion facility; (2) during operations of the facility under both normal conditions and during postulated accidents; (3) during transportation of cylinders, depleted uranium, and HF products; (4) during decontamination and decommissioning (D&D) of the facilities; and (5) during disposal of the conversion products. The potential impacts associated with facility construction would result from typical land-clearing and construction activities. Potential impacts during operations and D&D would occur primarily to workers during handling operations and to the public as a result of routine releases of small amounts of contaminants through exhaust stacks and treated liquid effluent discharges. Potential impacts to workers and the public from processing or storage also might occur as a result of accidents that release hazardous materials, during both facility operations and transportation. Potential impacts from disposal could occur primarily from the intrusion of water into the disposal facility and movement of contaminants into the groundwater.

The potential environmental impacts presented in the critique were based primarily on the environmental data and information provided by the offerors and the detailed evaluations conducted for and presented in the DUF_6 PEIS and PEIS supporting documentation. The PEIS analyses included an evaluation of the impacts associated with several conversion technologies, including conversion to uranium oxide and uranium metal (conversion to UF_4 was an intermediate step in the conversion to metal process considered in the PEIS).

In the PEIS, potential impacts were evaluated for a single plant sized to process an inventory of about 740,000 MT over a 26-year period using the Portsmouth, Paducah, and ETTP sites as representative locations (the inventory of DUF_6 considered in the PEIS was an upper bound estimate meant to address uncertainties related to the transfer of cylinders from USEC to DOE that was occurring at the time the PEIS was prepared). The inventory specified in the RFP was about 700,000 MT, with the DOE inventory increasing to about 723,000 MT in June 2002.

TABLE 4.1 NEPA Information Requested in the RFP (RFP Attachment L.3)

Category	Requirements
Facility Descriptions	Provide physical and functional descriptions of all proposed facilities and structures, including their dimensions, materials of construction, and intended use. State if the facilities will be constructed new or will be modifications of existing facilities.
Process Descriptions and Material Flows	Describe the proposed chemical and physical processes from receipt of the depleted UF_6 cylinders through the preparation for final shipment off site or for long-term disposition on site of all the products, by-products, and wastes generated. Provide materials flow diagrams that identify all processes and unit operations; all the products, by-products, and wastes; and potential emissions/effluents to the environment. Provide the physical/chemical state of the materials and the input/output rates per metric ton of depleted UF_6 processed. Provide the concentrations of hazardous substances, including radionuclides in each output stream. Specify the quantity of DUF_6 to be processed on an annual basis.
Anticipated Waste Generation	For each type of hazardous, mixed, radioactive, and nonhazardous waste to be shipped off site or disposed of on site, provide the following: annual generation rate by volume and mass following any on-site treatment, physical and chemical characteristics, estimated concentrations of hazardous constituents, polychlorinated biphenyls (PCBs), asbestos, or radionuclides, as applicable, and a description of final packaging, if any.
Anticipated Air Emissions	Estimated emissions of criteria air pollutants from construction activities during peak construction year. Estimated annual emissions of criteria air pollutants and hazardous air pollutants, including radionuclides during operations.
Anticipated Liquid Effluents	Annual amounts of liquid effluents (including storm water runoff), description of effluents, and expected concentrations of toxic and conventional pollutants and radionuclides in the effluents. Specify how the effluents will be discharged.
Waste Minimization and Pollution Prevention	Describe the waste minimization and pollution prevention activities planned for the proposed facilities.
Anticipated Water Usage	Annual use expected during operations and the peak construction year.
Anticipated Energy Consumption	Quantity of electricity and fuel (e.g., natural gas, diesel fuel) to be used during the peak construction year and annually during operations.
Anticipated Materials Usage	Amounts of materials to be used for construction (e.g., concrete, steel) and annually during operations (e.g., process chemicals). An indication of the availability of the required materials.

TABLE 4.1 (Cont.)

Category	Requirements
Anticipated Toxic or Hazardous Chemical Storage	Total amount of each extremely hazardous substance (See 40 CFR 355, Appendix A) expected to be present at any one time at the facility at concentrations greater than one percent by weight, regardless of location, number of containers, or method of storage, and a description of the storage container(s) or vessel(s).
Wastes Generated During Facility Disposition and Disposal	For each type of waste (mixed, hazardous, or radioactive) provide the quantity anticipated by volume.
Floodplain and Wetland Information	If the proposed facilities are located in a floodplain or wetland, provide the proposed mitigation measures and any practicable alternatives to locating in a floodplain or wetland.
Noise	Describe the expected noise levels by source during construction and operation, proximity of the workers and the public to sources of noise, and proposed mitigation measures.
Land Use	Describe the location and amount of land needed for buildings, parking lots, utilities, etc., during construction and operation.
Employment Needs	Expected numbers of employees during construction and operation of the proposed facilities broken down by job category (e.g., managers, professionals, laborers.)
Anticipated Transportation Needs	Annual quantities and the number of shipments to and from the site of the materials used or produced in the proposed facilities on site. Identify the expected mode of transportation (e.g., by truck, train, barge) and describe the packaging to be used, if any.
Safety Analysis Data	Using the available technology specific-information or data based on similar technologies, provide descriptions and expected frequencies for and environmental releases from potential accidents during facility operations. If possible, provide the above data for one or more accidents in each of the following four frequency ranges: greater than 0.01 per year, between 0.01 and 0.0001 per year, between 0.0001 and 0.000001 per year, and less than 0.000001 per year. If this information is not yet available, provide a discussion of the expected safety issues based on current technology concepts or similar technologies.

TABLE 4.1 (Cont.)

Category	Requirements
Safety Analysis Data (Cont.)	Describe the approach to be taken to protect worker safety and health. If the project presents a potential safety hazard beyond project boundaries, provide emergency response plans. Discuss hazards and mitigation measures related to construction activities and facility operations.
Biological Resources	To the extent information is readily available in the public domain, briefly describe the types of plants and animals, as well as their habitat, that you believe may be affected by the construction and operation of the conversion facilities. Species of concern, state and federally listed threatened and endangered species, and their critical habitats affected or likely to be affected should be identified.

Thus, the PEIS considered an inventory slightly greater than the inventory for which DOE currently has management responsibility.

The results were presented in the PEIS as ranges encompassing the results calculated for all three sites. Following the publication of the PEIS, the site-specific data and analyses from the PEIS were segregated and compiled in separate reports for each of the three current storage sites (Hartmann 1999a,b,c). Consequently, the PEIS conversion analyses and the data presented in the PEIS and the three data compilation reports formed a framework that closely represented the environmental analyses required for the critique. The environmental impacts in the critique were estimated by comparing the environmental and engineering data provided in the proposals with the data used to support the PEIS, and then scaling the PEIS results as appropriate. Supplemental analyses were conducted as necessary. In instances where the proposals did not provide complete or adequate data to evaluate environmental impacts, the specific data gaps were noted.

The environmental critique did not include a detailed evaluation of impacts from D&D activities or from disposal. The impacts from D&D activities would be expected to be similar to those discussed for conversion facility construction and would not be expected to differ significantly among the proposals. For disposal, the critique explains that the results of the PEIS and subsequent studies indicated that disposal of depleted uranium either as an oxide or UF_4 should be permissible at a dry location. The disposal facility could be a DOE facility (e.g., NTS) or a site licensed by the U.S. Nuclear Regulatory Commission or an Agreement State (e.g., the Envirocare facility). Either kind of facility would have its own environmental documentation and a set of criteria for acceptance of the waste. Any depleted uranium waste forms would have to meet the applicable site-specific waste acceptance criteria before being allowed to be disposed of. As a result, environmental impacts of disposal were not analyzed as part of the critique.

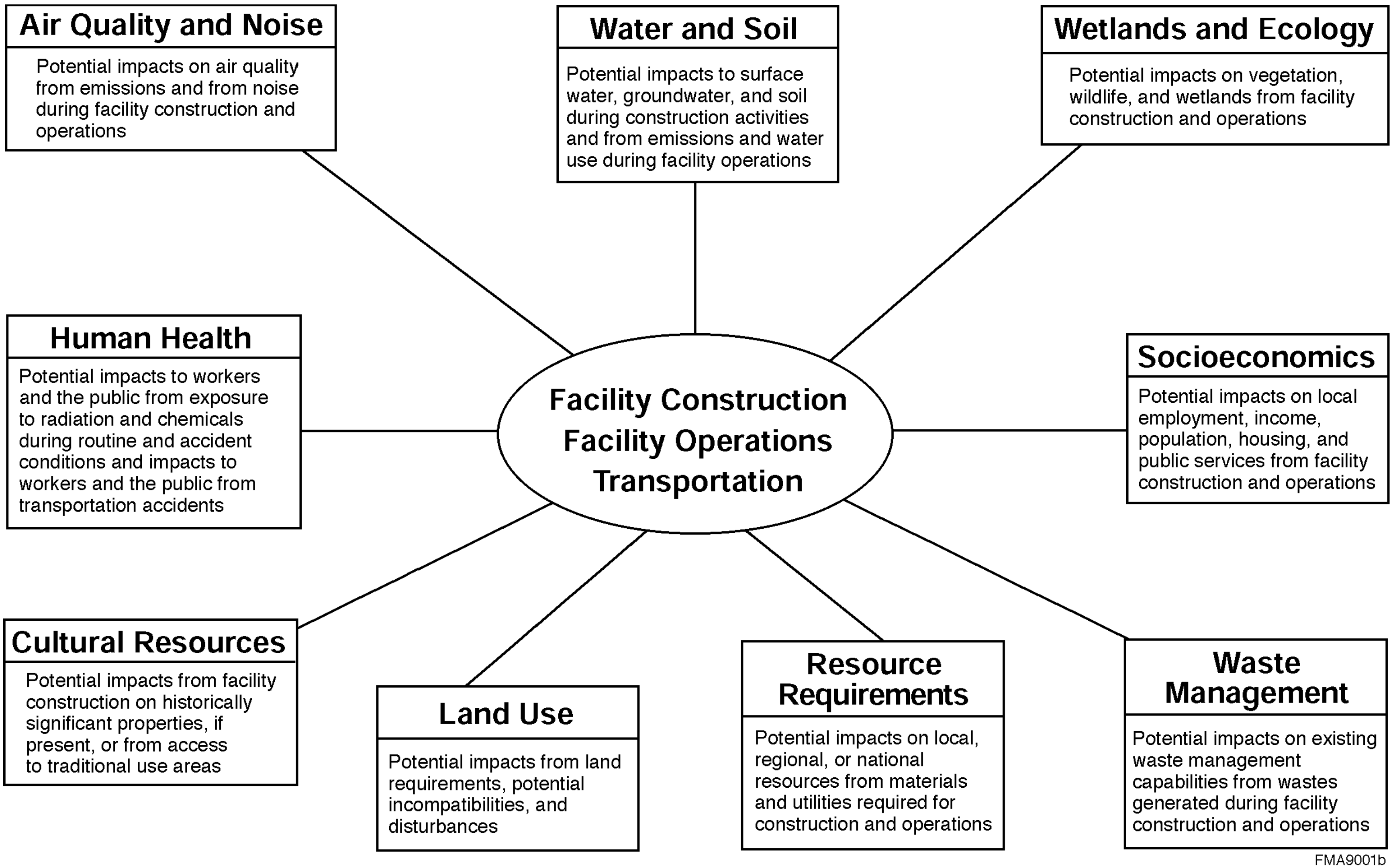

FIGURE 4.1 Areas of Impact Evaluated in the Environmental Critique

5 SUMMARY OF POTENTIAL ENVIRONMENTAL IMPACTS

In the critique, for each of the three proposals in the competitive range, potential environmental consequences at the Paducah and Portsmouth sites were evaluated in the areas of human health and safety (normal operations and accidents), air quality and noise, water and soil, socioeconomics, wetlands and ecology, waste management, resource requirements, land use, and cultural resources. Impacts were evaluated for conversion facilities to be located at the Paducah and Portsmouth sites and for cylinder transport from the ETTP site to the Portsmouth site. In general, potential environmental impacts could occur (1) during construction of a conversion facility; (2) during operations of the facility under normal conditions and during postulated accidents; and (3) during transportation of cylinders, depleted uranium, and HF products.

The potential environmental impacts presented in the critique were based on the offerors' data and detailed evaluations conducted for and presented in the DUF_6 PEIS and PEIS supporting documentation. It should be noted that the estimation of potential environmental impacts for any proposal is subject to a great deal of uncertainty at this point. In many cases, the data provided by the offerors for the NEPA evaluation were based on data from a facility with similar, but not identical, design as the proposed facility and with different throughput. In addition, the data provided by the offerors were of varying levels of detail and, in some cases, incomplete (e.g., detailed accident data will not be available until the preparation of safety analysis reports after the contract award, and some proposals did not include estimates of air releases or waste generated during construction).

The uncertainties in input parameters and varying levels of detail in the data were off-set to a degree by several factors. First, the PEIS analysis provided a detailed and thorough evaluation of fundamentally similar technologies located at the same sites at which the conversion facilities would be constructed. The PEIS analysis provided a unique baseline of the type and magnitude of environmental impacts associated with the construction and operation of conversion facilities. Consequently, by comparing the proposals to the PEIS, it was possible to provide general estimates of potential impacts even in cases where the data provided by the bidders were incomplete (such as accident scenarios).

Second, with regard to comparisons among the proposals, several factors tend to minimize the potential for major differences in the anticipated environmental impacts: (1) all of the proposals would involve the handling and processing of the same amount of DUF_6, approximately 700,000 MT; (2) all of the proposals would require the shipment of the same number of cylinders from ETTP to Portsmouth, which must be made in accordance with DOT regulations, regardless of the particular method proposed; (3) all of the proposals would generate a relatively insoluble uranium product for disposal at a western disposal site and a fluorine product, either aqueous or anhydrous HF, for reuse; (4) all of the proposals would be required to meet the same regulations pertaining to human health and safety and effluent emissions; (5) all of the proposals utilize existing processes and technologies that have been previously demonstrated on an industrial- or pilot-scale; and (6) all of the proposed facilities would be built in essentially the same locations on the Paducah and Portsmouth sites. These factors, coupled with the preliminary nature (and associated uncertainties) of the proposed designs, contribute to the similarities in estimated impacts discussed below.

5.1 ENVIRONMENTAL IMPACTS LIKELY TO BE NEGLIGIBLE TO LOW, OR WELL-WITHIN REGULATORY LIMITS

The following environmental disciplines were found to most likely have negligible to low impacts, or impacts well-within regulatory limits for all proposals:

- ***Human Health and Safety – Normal Conditions.*** All of the proposals would result in some risk to workers during normal operations, primarily from exposure to external radiation emitted from depleted uranium materials and associated decay products. Although throughputs differ among the proposals and also with the PEIS, all the proposals would require the handling of the same amount of uranium material over the life of the project. Moreover, the types of handling activities required would generally be similar for any conversion facility. Based on the PEIS analyses, estimated population doses to workers over the facility lifetimes could range from about 800 to 1,300 person-rem, below levels expected to cause cancer fatalities among the workers. Impacts to involved and noninvolved workers from ingestion or inhalation of uranium and/or hazardous chemicals during routine conditions would not be expected. Similarly, doses to the off-site members of the public would be expected to be very small, well below regulatory standards.

- ***Noise***. All the bidder's reported construction noise levels were typical for construction activities (bidder's levels ranged from about 75 to 100 dB(A) at the source). Some intermittent indoor noise levels during operations would be higher (up to 134 dB[A]); these higher levels could require auditory protection devices to protect workers. In general, none of the continuous operations noise levels reported for the facilities would result in adverse impacts from noise at the site boundaries.

- ***Water and Soil.*** Construction and operation of a conversion plant would disturb land, use water, and produce liquid wastes. In the PEIS, it was estimated that the impacts on the surface water, groundwater, and soil at Paducah and Portsmouth would be nonexistent or negligibly small from a conversion facility – no appreciable impacts to surface water, groundwater, or soils were identified; contaminant concentrations in water discharges would be below EPA guidelines and no changes in groundwater quality would be expected. With the exception of water consumption during operations for one proposal, all the water and soil parameters given in the proposals are similar to or less than those used in the PEIS. Therefore, it is expected that the potential impacts to water and soil from any of the proposed facilities at either site would also be nonexistent or negligibly small. Construction activities have the potential to result in surface water, groundwater, or soil contamination through spills of construction chemicals. By following good engineering practices, concentrations in soil and wastewater (and therefore surface water and groundwater) could be kept well within applicable standards or guidelines.

One exception noted was for the water consumption during operations for one proposal, which, although within the water usage capacity at both sites, was orders of magnitude larger than the other proposals and the PEIS (up to 835 million gallons per year at Paducah, compared with a maximum of 55 million gallons per year estimated in the PEIS and a maximum among the other proposals of 13 million gallons per year). However, the revised proposal indicated that the majority of this water is in a closed-loop chilled water system and would not be required to be supplied each year.

- ***Socioeconomics.*** For all of the bidders, direct employment estimates for construction and operations were comparable to or lower than PEIS estimates. The maximum number of direct jobs created during operations among the proposals was estimated to be approximately 400, compared with a maximum of 500 in the PEIS. Although indirect impacts (e.g., indirect jobs created, income generated, population in-migration, changes in housing demand and public finances) for the regions surrounding the Paducah and Portsmouth sites cannot be estimated with the available data, based on PEIS analyses, such impacts appear unlikely. The PEIS concluded that the conversion options would be likely to have a small impact on socioeconomic conditions in the regions surrounding the sites, because a major proportion of the expenditures associated with procurement for the construction and operation of the facility would flow outside the regions to other locations in the United States, reducing the concentration of local economic effects.

- ***Land Use***. Although differences exist in the land required for the proposed facilities (ranging from about 10 to 20 acres), all proposed facilities represent very small fractions of the land available at the Paducah and Portsmouth sites. The proposed facilities would require only a fraction of the candidate sites identified within the Paducah and Portsmouth site boundaries in the RFP. Consequently, land use impacts for all the proposals would likely be negligible.

- ***Resource Requirements.*** In general, the utility requirements for all proposals are not expected to be significant. Based on comparison with the appropriate values from the DUF_6 PEIS, it would be expected that the current utility capacities at the two sites (Paducah and Portsmouth) would be adequate to accommodate the proposed service requirements without any major modifications or constructing new service facilities, therefore significant adverse environmental effects would not be incurred.

The total quantities of commonly used construction materials are not expected to be significant and would be comparable to construction of a multistory building or industrial plant. Small quantities of specialty materials (e.g., Monel and Hastelloy) were identified in one proposal, although these materials are not in short supply. These specialty materials may also be necessary for construction of the various reactors to convert depleted UF_6 into another form. The amount of operations materials is not great and is comparable to a small-scale petroleum refinery or similar chemical processing plant. No specialty chemicals were identified in the proposals that are not currently available in the chemical industry.

- ***Cultural Resources.*** Archaeological and architectural surveys have not been completed or finalized for either site as a whole or for the candidate locations. If archaeological resources are encountered, or historical or traditional cultural properties identified, a mitigation plan would be required. At Portsmouth, the proposed facilities may impact the existing lithium warehouses; prior to demolition, it would need to be determined if these buildings warrant consideration for the *National Register of Historic Places*, and, if so, a mitigation plan, including avoidance or data recovery, would be required. Because all of the proposals would essentially use the same proposed sites and the land areas are roughly the same sizes (<20 acres), it is unlikely that there would be differences in potential impacts to cultural resources among the proposals.

- ***Transportation.*** All of the proposals would involve the shipment of cylinders from ETTP to Portsmouth, depleted uranium product from Portsmouth and Paducah to a western disposal site, and HF from Portsmouth and Paducah to a commercial user. In addition, operation-related wastes and raw materials would also require shipment, although such shipments would be expected to have negligible impacts. Differences in the transportation impacts among the proposals cannot be determined until detailed transportation plans are developed. However, because all proposals would require shipment of roughly the same amounts of outgoing products and all would have to comply with DOT requirements, it is expected that all proposals would result in roughly the same impacts from transportation operations. Overall, the largest impact from transportation activities would be associated with the potential for injuries and fatalities from typical traffic accidents. Low-probability accidents involving releases of DUF_6 or HF are discussed further below.

5.2 ENVIRONMENTAL IMPACTS POTENTIALLY REQUIRING MITIGATION OR OF UNCERTAIN MAGNITUDE

The following environmental disciplines were found to potentially require mitigative actions to stay within regulatory limits, or the data submitted in the proposal were insufficient to make an accurate determination of the anticipated impacts:

- ***Air Quality – Construction.*** Except for one proposal, none of the bidders provided complete information on emissions of criteria pollutants during construction. However, based on comparison of the structure sizes and types between the proposals and the PEIS, construction air emissions would be expected to be lower than or similar to those estimated in the PEIS. The only criteria pollutant of some concern during construction for each of the proposed facilities is likely to be particulate matter (PM_{10}). PM_{10} construction emissions are related to the site land area disturbed; all the proposed facilities would be comparable to or smaller in size than those analyzed in the PEIS. The PEIS estimated that the 24-hour average PM_{10} level could be as high as 90% of the standard during construction. However, with appropriate mitigation measures (such as spraying the excavation area with water and covering excavated soil), PM_{10} levels could be kept in compliance with standards.

- ***Air Quality – Operations.*** Reporting on criteria pollutant emissions during operations was incomplete for two bidders. Where emissions were reported for the third bidder, levels were much higher than levels reported for operations in the PEIS. In this case, the bidder reported that the emissions estimates were expected to be conservative because all the pollutant sources considered were assumed to be operating concurrently, which is unlikely. Although the levels of criteria pollutant emissions during operations will need to be more thoroughly addressed by whichever bidder is chosen, it is expected that the emissions could be controlled to stay within standard levels.

- ***Wetlands.*** It appears from examination of the siting information provided that the potential exists for all proposals to impact wetlands at Paducah and possibly Portsmouth. At this time it is not possible to determine the extent of such impacts because the locations of vehicle entrance roads, pipelines, and utilities have not been clearly identified. Any wetland impacts would be evaluated in the wetlands assessment required by 10 CFR 1022.12, and if unavoidable, would require permitting from the U.S. Army Corps of Engineers. The permit may require compensatory mitigation. Compensatory mitigation is designed to reduce or mitigate the impacts to a wetland by the construction of a new wetland area. The new wetland is designed to provide specific wetland functions as compensation for the loss of wetland functions at the impacted wetland. The wetlands potentially impacted do not seem to be high-quality wetlands that would be difficult to compensate for or require special protection based on rarity or uniqueness.

- ***Waste Management.*** Overall, the waste resulting from normal operations would be expected to have a low to moderate impact on waste management.

  It should be noted that not all of the proposals provided information on nonhazardous liquid effluents such as cooling tower blowdown, industrial wastewater, and process water expected to be generated during normal operations. In addition, a more exhaustive investigation of the waste stream characteristics for the various proposals is necessary to ensure proper waste classification, as indicated by comparison of the waste volumes of the proposals with those estimated in the DUF_6 PEIS. It should also be noted that a number of waste streams identified in one proposal were not present in another proposal with a similar process.

  The total LLW disposal volumes from disposal of depleted uranium were compared with the total estimated disposal volume for LLW for all DOE waste management activities. Disposal volumes were compared as total volume (m^3) because disposal facilities would typically have no throughput limitations but rather would be limited by the total volume of waste that could be accepted. Overall, disposal of the final uranium product would generate appreciable amounts of waste for disposal in either DOE or commercial facilities. Within the context of the total amount of LLW undergoing disposal in DOE facilities, these wastes would be expected to have a low impact on DOE’s total waste management disposal capabilities.

  In the event that the HF could not be sold commercially for unrestricted use, the concentrated HF may be converted to calcium fluoride (CaF_2) for disposal. Based upon the PEIS, the total volume of CaF_2 may range from 190,000 to 570,000 m^3. It is unknown whether the CaF_2 produced would be disposed of as nonhazardous solid waste or as LLW. If the CaF_2 is classified as LLW, it would be expected to have a moderate impact on DOE's total waste management disposal capabilities.

5.3 ENVIRONMENTAL IMPACTS WITH POTENTIALLY HIGH CONSEQUENCES, BUT LOW PROBABILITY

For all proposals, there is a potential for low probability events having high consequences, due to the hazardous nature of the materials handled. Although the chance of such events occurring is impossible to eliminate, existing regulations and standard engineering practices and controls will be used to minimize the probability of these events. High-consequence/low-probability events are discussed below.

- ***Human Health and Safety – Facility Accidents.*** The designs of the buildings presented in the proposals differed significantly from those evaluated in the PEIS. In many cases, the designs in the proposals do not appear to include areas to accommodate hazard categories of chemically high hazard (HH) for buildings containing DUF_6 and HF and radiologically moderate hazard (HC2) for buildings containing depleted uranium (the hazard categories are designations used by DOE to specify the types of building designs required based on the hazards posed by the materials to be used within the buildings). This difference would affect the frequency at which external events such as natural phenomena (tornadoes, earthquakes) can negatively affect building containment that could result in significant releases. The difference in building design between the proposals and the PEIS would also affect the source terms of the various accident scenarios. This may result in different bounding accidents within the four frequency categories considered in the PEIS with resulting differences in consequences. A detailed safety analysis and risk assessment that would take into account the performance categories of the various structures in the proposals was not possible at this time and will be conducted by the successful bidder after contract award. Nevertheless, the PEIS results were used to provide a rough estimate of the types of consequences that might be associated with the conversion facilities.

Based on the PEIS results, it would be expected that the radiological health impacts from facility accidents considered in the proposals would be small.

Limited information on chemical accidents was supplied in the proposals. All proposals, however, provided the amount of hazardous materials expected to be in storage at a given time. These amounts were compared with the storage volumes of the same chemicals in the PEIS. The most hazardous chemical to be stored is HF. The range in the volume of HF stored between the proposals was not great (from 63,400 to 114,000 gal) and all were less than those in the PEIS. The chemical-related health impacts estimated in the PEIS may therefore be expected to bound those for all proposals.

Hydrogen is necessary for conversion of depleted UF_6 to either UF_4 or U_3O_8. The PEIS did not directly consider the potential risks associated with storage of hydrogen in either gaseous or liquid form. It is not possible at this time to evaluate the potential hazard of hydrogen storage for the proposals. However, a preliminary literature review indicates that the potential risks associated with hydrogen storage are likely low. Because hydrogen is needed for depleted UF_6 conversion, it would not be expected to be a discriminator among the proposals.

For all of the management strategies considered in the PEIS, low-probability accidents involving chemicals (primarily HF) at a conversion facility were estimated to have the largest potential consequences to noninvolved workers and members of the public. Such accidents could be caused by a large earthquake and are expected to occur with a frequency of less than once in 1 million per year of operations. For the most severe accidents in each frequency category, it was estimated that there could be a large number (up to tens of thousands) of noninvolved workers and the general public suffering from adverse effects (e.g., minor irritation to the eye, coughing). The number of irreversible adverse health effects (e.g., lung damage) could also be large (a few hundred). However, the risk (defined as consequence multiplied by probability) for these accidents would be zero fatalities and zero irreversible adverse health effects expected for noninvolved workers and the members of the public combined.

Impacts to involved workers under accident conditions would likely be dominated by physical forces from the accident itself, so that quantitative dose/effect estimates would not be meaningful. For this reason, the impacts to involved workers during accidents were not quantified in the PEIS or critique. However, it is recognized that injuries and fatalities among involved workers would be possible for all proposals if an accident did occur.

It should be noted that there may be differences in the accident impacts between releases of AHF and aqueous HF, and that these differences were not fully evaluated in the critique. One proposal stated that AHF would be produced, whereas two would produce aqueous HF. Anhydrous HF has a much higher volatility than aqueous HF, and therefore would result in a larger amount of material being dispersed to the environment if equal amounts were spilled. At this time, it is not clear if production of aqueous HF would result in a significant reduction in accident risk.

- ***Human Health and Safety – Transportation Accidents.*** Similar to the assessment of facility accidents discussed above, in general, there was not sufficiently detailed information provided in the proposals to perform a comprehensive transportation impact assessment. The results of the PEIS and supporting studies were used to estimate potential impacts of transportation, as discussed below.

  For shipment of UF_6 cylinders, among all the accidents analyzed in the PEIS, a severe rail accident involving four DUF_6 cylinders was estimated to have the highest potential consequences (note that the consequences for a truck accident, which would likely carry only 1 or 2 cylinders, would be less than the bounding rail accident discussed here). The consequences of such an accident were estimated on the basis of the assumption that the accident occurred in an urban area (with a population density of 1,600 people/km^2) under stable weather conditions (such as at nighttime). The total probability of an urban rail accident involving a release (not taking into account the frequency of weather conditions) was estimated to be very low (on the order of about 1 chance in 100,000). In the unlikely event that such an accident were to occur, it was estimated that approximately four persons might experience irreversible adverse effects (such as lung damage or kidney damage) from chemical exposure to HF and uranyl fluoride generated from released UF_6, with zero fatalities expected. Over the long term, radiation effects would also be possible from exposure to the uranium released. It was estimated that approximately 60 latent cancer fatalities could occur in the urban population from such an accident in addition to the approximately 700,000 that would occur from all other causes (approximately 3 million persons were assumed to be exposed to low levels of uranium from the accident as the uranium dispersed in the air). The radiological risk (consequence multiplied by probability) for this accident would be essentially zero.

If a large HF release from a railcar occurred in an urban area under stable weather conditions, persons within a 7 mi^2 (18 km^2) area downwind of the accident site could potentially experience irreversible adverse effects from chemical exposure to HF, with up to 300 fatalities possible. However, the probability of such an accident occurring would be expected to be quite low. Anhydrous HF is routinely shipped commercially in the United States for industrial applications. To provide perspective, since 1971, the period covered by DOT records, there have been no fatal or serious injuries to the public or to transportation or emergency response personnel as a result of AHF releases during transportation.

As noted above, shipment of aqueous HF may have different risks than shipment of AHF.

5.4 DIFFERENCES IN POTENTIAL ENVIRONMENTAL IMPACTS AMONG THE PROPOSALS

Based upon the assessment of potential environmental impacts presented in the critique, no proposal was found to be clearly environmentally preferable. Although differences in a number of impact areas were identified, none of the differences were considered to result in one proposal being preferable over the others. Nevertheless, the following differences are of note:

- The annual raw water usage during operations for one proposal, which is reported to be approximately 835 million gallons per year, is more than an order of magnitude greater than any other proposal. The bulk of the usage comes from the chilled water use. However, the revised proposal indicates that the majority of this water flows in a closed-loop chilled water system and thus would not be required to be supplied each year.

- Relative to potential storage and transportation accidents, production of aqueous HF, identified in two proposals, may result in a reduction in accident risk compared with AHF, identified in one proposal, although it is not clear if this difference is significant.

- For one proposal, emissions during construction and operations were reported to be much higher than the estimates provided in the PEIS. The primary source of the estimated high levels of criteria pollutant emissions was heavy equipment operation (e.g., from cylinder haulers, semi-tractor trailers, forklifts, cranes, and locomotive engineers). The PEIS and the other bidder's did not give estimates for this source. The bidder's documentation states that the estimates given are conservatively high because all emissions were assumed to occur concurrently. Although the levels of criteria pollutant emissions during operations will need to be more thoroughly addressed by whichever bidder is chosen, it is expected that the emissions could be controlled to stay within standard levels.

- There appear to be no significant differences in overall environmental impacts associated with conversion to UF_4 versus U_3O_8. In addition, several studies indicate that disposal of depleted uranium either as an oxide or UF_4 should be permissible at a dry location.

5.5 DIFFERENCES IN REQUIRED PERMITS, LICENSES, AND APPROVALS

No proposal stood out as providing a plan that clearly minimizes environmental permitting requirements. Most of the proposals deferred discussion of permitting requirements to the Regulatory and Permitting Management Plan, which the successful bidder must submit to DOE within 90 days after contract award.

6 REFERENCES

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