QA:NA

DOE/EIS-0360

FINAL ENVIRONMENTAL IMPACT STATEMENT FOR CONSTRUCTION AND OPERATION OF A DEPLETED URANIUM HEXAFLUORIDE CONVERSION FACILITY AT THE PORTSMOUTH, OHIO, SITE

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TITLE: Final Environmental Impact Statement for Construction and Operation of a Depleted Uranium Hexafluoride Conversion Facility at the Portsmouth, Ohio, Site (DOE/EIS-0360)

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ABSTRACT: The U.S. Department of Energy (DOE) proposes, via a contract awarded at the direction of Congress (Public Law 107-206), to design, construct, and operate two conversion facilities for converting depleted uranium hexafluoride (commonly referred to as DUF_6): one at Portsmouth, Ohio, and one at Paducah, Kentucky. DOE 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. This site-specific EIS analyzes the construction, operation, maintenance, and decontamination and decommissioning (D&D) of the proposed DUF_6 conversion facility at three alternative locations within the Portsmouth site; transportation of all cylinders (DUF_6, enriched, and empty) currently stored at the East Tennessee Technology Park (ETTP) near Oak Ridge, Tennessee, to Portsmouth; construction of a new cylinder storage yard at Portsmouth (if required) for ETTP cylinders; transportation of depleted uranium conversion products and waste materials to a disposal facility; transportation and sale of the hydrogen fluoride (HF) produced as a conversion co-product; and neutralization of HF to calcium fluoride (CaF_2) and its sale or disposal in the event that the HF product is not sold. This EIS also considers a no action alternative that assumes continued storage of DUF_6 at the Portsmouth and ETTP sites. A separate EIS has been prepared for the proposed facility at Paducah (DOE/EIS-0359). DOE's preferred alternative is to construct and operate the conversion facility at Location A within the Portsmouth site. DOE plans to decide where to dispose of depleted U_3O_8 conversion product after additional appropriate NEPA review.

* Vertical lines in the right margin of this cover sheet and in the remainder of this EIS document indicate changes that have been added after the public comment period.

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NOTATION

The following is a list of acronyms and abbreviations, chemical names, and units of measure used in this document. Some acronyms used only in tables may be defined only in those tables.

GENERAL ACRONYMS AND ABBREVIATIONS

AEA	Atomic Energy Act of 1954
AEC	U.S. Atomic Energy Commission
AIHA	American Industrial Hygiene Association
ALARA	as low as reasonably achievable
ANL	Argonne National Laboratory
ANP	Advanced Nuclear Power (Framatome ANP, Inc.)
ANSI	American National Standards Institute
AQCR	Air Quality Control Region
BLS	Bureau of Labor Statistics
CAA	Clean Air Act
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR	*Code of Federal Regulations*
CRMP	cultural resource management plan
CROET	Community Reuse Organization of East Tennessee
CWA	Clean Water Act
D&D	decontamination and decommissioning
DNFSB	Defense Nuclear Facilities Safety Board
DNL	day-night average sound level
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
DU	depleted uranium
DUF_6	depleted uranium hexafluoride
EA	environmental assessment
EBE	evaluation basis earthquake
EIS	environmental impact statement
EM	Office of Environmental Management (DOE)
EPA	U.S. Environmental Protection Agency
ERDA	Energy Research and Development Administration
ERPG	Emergency Response Planning Guideline
ETTP	East Tennessee Technology Park (formerly K-25 site)

FONSI	Finding of No Significant Impact
FR	*Federal Register*
FTE	full-time equivalent
FY	fiscal year
GDP	gaseous diffusion plant
GIS	geographic information system
HEPA	high-efficiency particulate air
HMMH	Harris Miller Miller & Hanson, Inc.
HMR	hazardous materials regulation
HMTA	Hazardous Materials Transportation Act
ICRP	International Commission on Radiological Protection
IHE	irreversible health effect
ISC	Industrial Source Complex
LCF	latent cancer fatality
L_{eq}	equivalent steady sound level
LLMW	low-level radioactive mixed waste
LLW	low-level radioactive waste
LMES	Lockheed Martin Energy Systems, Inc.
MCL	maximum concentration limit
MEI	maximally exposed individual
MMES	Martin Marietta Energy Systems, Inc.
MOA	memorandum of agreement
NAAQS	National Ambient Air Quality Standard(s)
NCRP	National Council on Radiation Protection and Measurements
NEPA	National Environmental Policy Act of 1969
NESHAPs	National Emission Standards for Hazardous Air Pollutants
NHPA	National Historic Preservation Act
NOI	Notice of Intent
non-DUF_6	non-depleted uranium hexafluoride
NOV	Notice of Violation
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
NRHP	*National Register of Historic Places*
NTS	Nevada Test Site
OEPA	Ohio Environmental Protection Agency
OIG	Office of Inspector General (DOE)
ORNL	Oak Ridge National Laboratory
ORR	Oak Ridge Reservation
OSHA	Occupational Safety and Health Administration

PA	preliminary assessment
PEA	programmatic environmental assessment
PEIS	programmatic environmental impact statement
PEL	permissible exposure limit
P.L.	Public Law
PM	particulate matter
PM_{10}	particulate matter with a mean aerodynamic diameter of 10 μm or less
$PM_{2.5}$	particulate matter with a mean aerodynamic diameter of 2.5 μm or less
PORTS	Portsmouth Gaseous Diffusion Plant
PSD	prevention of significant deterioration
R&D	research and development
RCRA	Resource Conservation and Recovery Act
RFP	Request for Proposal(s)
ROD	Record of Decision
ROI	region of influence
SAAQS	State Ambient Air Quality Standard(s)
SAR	safety analysis report
SHPO	State Historic Preservation Officer
SVOC	semivolatile organic compound
TDEC	Tennessee Department of Environment and Conservation
TEDE	total effective dose equivalent
TLD	thermoluminescence dosimeter
TRU	transuranic(s)
TSCA	Toxic Substances Control Act
TUS	Termoelectrica U.S., LLC
TVA	Tennessee Valley Authority
UDS	Uranium Disposition Services, LLC
USACE	U.S. Army Corps of Engineers
USC	*United States Code*
USDA	U.S. Department of Agriculture
USEC	United States Enrichment Corporation
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VOC	volatile organic compound
WM PEIS	Waste Management Programmatic Environmental Impact Statement

CHEMICALS

Am	americium
CaF_2	calcium fluoride
Co	cobalt
CO	carbon monoxide
H_2	hydrogen
HF	hydrogen fluoride (slag); hydrofluoric acid
H_2O	water
KF	potassium fluoride
KOH	potassium hydroxide
NH_3	ammonia
NO	nitrogen oxide
NO_2	nitrogen dioxide
NO_x	nitrogen oxides
Np	neptunium
O_3	ozone
PAH	polycyclic aromatic hydrocarbon
Pb	lead
PCB	polychlorinated biphenyl
Pu	plutonium
SO_2	sulfur dioxide
SO_x	sulfur oxides
Tc	technetium
TCE	trichloroethylene
U	uranium
UF_4	uranium tetrafluoride
UF_6	uranium hexafluoride
UO_2	uranium dioxide
UO_3	uranium trioxide
UO_2F_2	uranyl fluoride
U_3O_8	triuranium octaoxide

UNITS OF MEASURE

°C	degree(s) Celsius
Ci	curie(s)
cm	centimeter(s)
d	day(s)
dB	decibel(s)
dB(A)	A-weighted decibel(s)
°F	degree(s) Fahrenheit
ft	foot (feet)
ft^2	square foot (feet)
g	gram(s)
gal	gallon(s)
h	hour(s)
ha	hectare(s)
in.	inch(es)
$in.^2$	square inch(es)
kg	kilogram(s)
km	kilometer(s)
km^2	square kilometer(s)
kPa	kilopascal(s)
L	liter(s)
lb	pound(s)
m	meter(s)
m^2	square meter(s)
m^3	cubic meter(s)
MeV	million electron volts
mg	milligram(s)
mi	mile(s)
mi^2	square mile(s)
min	minute(s)
mL	milliliter(s)
mph	mile(s) per hour
mrem	millirem(s)
mSv	millisievert(s)
MVA	megavolt-ampere(s)
MW	megawatt(s)
MWh	megawatt-hour(s)
nCi	nanocurie(s)
oz	ounce
pCi	picocurie(s)
ppb	part(s) per billion
ppm	part(s) per million
psia	pound(s) per square inch absolute
psig	pound(s) per square inch gauge
rem	roentgen equivalent man
s	second(s)
Sv	sievert(s)
t	metric ton(s)
ton(s)	short ton(s)
wt%	percent by weight
yd^3	cubic yard(s)
yr	year(s)
µg	microgram(s)
µm	micrometer(s)

ENGLISH/METRIC AND METRIC/ENGLISH EQUIVALENTS

Multiply	By	To Obtain
English/Metric Equivalents		
acres	0.4047	hectares (ha)
cubic feet (ft^3)	0.02832	cubic meters (m^3)
cubic yards (yd^3)	0.7646	cubic meters (m^3)
degrees Fahrenheit (°F) -32	0.5555	degrees Celsius (°C)
feet (ft)	0.3048	meters (m)
gallons (gal)	3.785	liters (L)
gallons (gal)	0.003785	cubic meters (m^3)
inches (in.)	2.540	centimeters (cm)
miles (mi)	1.609	kilometers (km)
pounds (lb)	0.4536	kilograms (kg)
short tons (tons)	907.2	kilograms (kg)
short tons (tons)	0.9072	metric tons (t)
square feet (ft^2)	0.09290	square meters (m^2)
square yards (yd^2)	0.8361	square meters (m^2)
square miles (mi^2)	2.590	square kilometers (km^2)
yards (yd)	0.9144	meters (m)
Metric/English Equivalents		
centimeters (cm)	0.3937	inches (in.)
cubic meters (m^3)	35.31	cubic feet (ft^3)
cubic meters (m^3)	1.308	cubic yards (yd^3)
cubic meters (m^3)	264.2	gallons (gal)
degrees Celsius (°C) +17.78	1.8	degrees Fahrenheit (°F)
hectares (ha)	2.471	acres
kilograms (kg)	2.205	pounds (lb)
kilograms (kg)	0.001102	short tons (tons)
kilometers (km)	0.6214	miles (mi)
liters (L)	0.2642	gallons (gal)
meters (m)	3.281	feet (ft)
meters (m)	1.094	yards (yd)
metric tons (t)	1.102	short tons (tons)
square kilometers (km^2)	0.3861	square miles (mi^2)
square meters (m^2)	10.76	square feet (ft^2)
square meters (m^2)	1.196	square yards (yd^2)

SUMMARY[1]

S.1 INTRODUCTION

This document is a site-specific environmental impact statement (EIS) for construction and operation of a proposed depleted uranium hexafluoride (DUF_6) conversion facility at the U.S. Department of Energy (DOE) Portsmouth site in Ohio (Figure S-1). The proposed facility would convert the DUF_6 stored at Portsmouth to a more stable chemical form suitable for use or disposal. The facility would also convert the DUF_6 from the East Tennessee Technology Park (ETTP) site near Oak Ridge, Tennessee.

In a Notice of Intent (NOI) published in the *Federal Register* on September 18, 2001 (*Federal Register*, Volume 66, page 48123 [66 FR 48123]), DOE announced its intention to prepare a single EIS for a proposal to construct, operate, maintain, and decontaminate and decommission two DUF_6 conversion facilities at Portsmouth, Ohio, and Paducah, Kentucky, in accordance with the National Environmental Policy Act of 1969 (NEPA) (*United States Code*, Title 42, Section 4321 et seq. [42 USC 4321 et seq.]) and DOE's NEPA implementing procedures (*Code of Federal Regulations*, Title 10, Part 1021 [10 CFR Part 1021]). Subsequent to award of a contract on August 29, 2002, to Uranium Disposition Services, LLC (hereafter referred to as UDS), for design, construction, and operation of DUF_6 conversion facilities at Portsmouth and Paducah, DOE reevaluated its approach to the NEPA process and decided to prepare separate site-specific EISs. This change was announced in a *Federal Register* Notice of Change in NEPA Compliance Approach published on April 28, 2003 (68 FR 22368); the Notice is included as Attachment B to Appendix C of this EIS.

This EIS addresses the potential environmental impacts from the construction, operation, maintenance, and decontamination and decommissioning (D&D) of the proposed conversion facility at three alternative locations within the Portsmouth site; from the transportation of all ETTP cylinders (DUF_6, normal and enriched UF_6, and empty) to Portsmouth; from the transportation of depleted uranium conversion products to a disposal facility; and from the transportation, sale, use, or disposal of the fluoride-containing conversion products (hydrogen fluoride [HF] or calcium fluoride [CaF_2]). An option of shipping the ETTP cylinders to Paducah is also considered, as is an option of expanding operations. In addition, this EIS evaluates a no action alternative, which assumes continued storage of DUF_6 in cylinders at the Portsmouth and ETTP sites. A separate EIS (DOE/EIS-0359) evaluates potential environmental impacts for the proposed Paducah conversion facility.

S.1.1 Background Information

The current DUF_6 conversion facility project is the culmination of a long history of DUF_6 management activities and events. To put the current project into context and provide

[1] Vertical lines in the right margin of this summary and the remainder of this EIS document indicate changes that have been added after the public comment period.

perspective, this section briefly discusses the origin and size of the DOE cylinder inventory considered in this EIS and then summarizes the management history.

Uranium enrichment in the United States began as part of the atomic bomb development by the Manhattan Project during World War II. Enrichment for both civilian and military uses continued after the war under the auspices of the U.S. Atomic Energy Commission and its successor agencies, including DOE. Three large gaseous diffusion plants (GDPs) were constructed to produce enriched uranium, first at the K-25 site (now called ETTP) and subsequently at Paducah and Portsmouth. The K-25 plant ceased operations in 1985, and the Portsmouth plant ceased operations in 2001. The Paducah GDP continues to operate.

The DUF_6 produced during enrichment has been stored in large steel cylinders at all three gaseous diffusion plant sites since the 1950s. The cylinders are typically stacked two high and are stored outdoors on concrete or gravel yards. Figure S-2 shows typical arrangements for storing cylinders.

DOE is currently responsible for the management of a total of approximately 700,000 metric tons (t) (770,000 short tons [tons])[2] of DUF_6 stored in about 60,000 cylinders at three storage sites. The cylinder inventory considered in this EIS is provided in Table S-1. This EIS considers the conversion of the approximately 250,000 t (275,000 tons) of DUF_6 stored in about 16,000 cylinders at Portsmouth and about 4,800 cylinders at ETTP. In addition, approximately 3,200 cylinders at Portsmouth and 1,100 cylinders at ETTP contain

DUF_6 Management Time Line

1950–1993	DOE generates DUF_6 stored in cylinders at the ETTP, Portsmouth, and Paducah sites.
1985	K-25 (ETTP) GDP ceases operations.
1992	Ohio EPA issues Notice of Violation (NOV) to Portsmouth.
1993	USEC is created by P.L. 102-186.
1994	DOE initiates DUF_6 PEIS.
1995	DNFSB issues Recommendation 95-1, Safety of Cylinders Containing Depleted Uranium. DOE initiates UF_6 Cylinder Project Management Plan.
1996	USEC Privatization Act (P.L. 104-134) is enacted.
1997	DOE issues Draft DUF_6 PEIS.
1998	DOE and Ohio EPA reach agreement on NOV. Two DOE-USEC MOAs transfer 11,400 DUF_6 cylinders to DOE. P.L. 105-204 is enacted.
1999	DOE and TDEC enter consent order. DOE issues Final DUF_6 PEIS and Record of Decision. DOE issues conversion plan in response to P.L. 105-204. DNFSB closes Recommendation 95-1. DOE issues Draft RFP for conversion services.
2000	DOE issues Final RFP for conversion services.
2001	DOE receives five proposals in response to RFP. DOE identifies three proposals in competitive range. DOE publishes NOI for site-specific DUF_6 Conversion EIS. DOE prepares environmental critique to support conversion services procurement process. Portsmouth GDP ceases operations. DOE holds public scoping meetings for the site-specific DUF_6 Conversion EIS.
2002	DOE-USEC agreement transfers 23,000 t (25,684 tons) of DUF_6 to DOE. P.L. 107-206 is enacted. DOE awards conversion services contract to UDS. DOE prepares environmental synopsis to support conversion services procurement process.
2003	DOE announces Notice of Change in NEPA Compliance Approach and issues the draft EIS. DOE issues draft site-specific conversion facility EISs.
2004	Final site-specific conversion facility EISs issued.

2 In general, in this EIS, values in English units are presented first, followed by metric units in parentheses. However, when values are routinely reported in metric units, the metric units are presented first, followed by English units in parentheses.

a  b 

FIGURE S-2 Storage of DUF_6 Cylinders: (a) Cylinders stacked two high. (b) Cylinder storage yards at the Portsmouth site.

TABLE S-1 Inventory of DOE UF_6 Cylinders Considered in This EIS[a]

Location	No. of Cylinders	Weight of UF_6 (t)
Portsmouth – DUF_6	16,109	195,800
Non-DUF_6		
Enriched UF_6	1,444	19
Normal UF_6	1,249	13,500
Empty	485	0
ETTP[b] – DUF_6	4,822	54,300
Non-DUF_6		
Enriched UF_6	881	7
Normal UF_6	221	19
Empty	20	0
Total		
DUF_6	20,931	250,100
Non-DUF_6	3,795	13,544
Empty	505	0

[a] As of January 26, 2004.

[b] The proposed action calls for shipment of the ETTP cylinders to Portsmouth.

enriched UF_6 or normal UF_6 (collectively called "non-DUF_6" cylinders in this EIS) or are empty. This EIS considers the shipment of all ETTP cylinders to Portsmouth, as well as the management of both the Portsmouth and ETTP non-DUF_6 cylinders at Portsmouth. The non-DUF_6 cylinders would not be processed in the conversion facility.

S.1.1.1 Creation of USEC

In 1993, the U.S. government began the process of privatizing uranium enrichment services by creating the United States Enrichment Corporation (USEC), a wholly owned government corporation, pursuant to the *Energy Policy Act of 1992* (Public Law [P.L.] 102-186). The Paducah and Portsmouth GDPs were leased to USEC, but DOE retained responsibility for storage, maintenance, and disposition of 46,422 DUF_6 cylinders produced before 1993 and located at the three gaseous diffusion plant sites (28,351 at Paducah, 13,388 at Portsmouth, and 4,683 at K-25). In 1996, the *USEC Privatization Act* (P.L. 104-134) transferred ownership of USEC from the government to private investors. This act provided for the allocation of USEC's liabilities between the U.S. government (including DOE) and the new private corporation, including liabilities for DUF_6 cylinders generated by USEC before privatization.

In May and June of 1998, USEC and DOE signed two memoranda of agreement (MOAs) regarding the allocation of responsibilities for depleted uranium generated by USEC after 1993. The two MOAs transferred ownership of a total of 11,400 DUF_6 cylinders from USEC to DOE.

On June 17, 2002, DOE and USEC signed a third agreement to transfer up to 23,300 t (25,684 tons) of 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. While title to the DUF_6 is transferred to DOE under this agreement, custody and cylinder management responsibility remains with USEC until DOE requests that USEC deliver the cylinders for processing in the conversion facility.

Cylinder-Related Terms Used in This EIS

Types of UF_6

UF_6	A chemical composed of one atom of uranium combined with six atoms of fluorine. UF_6 is a volatile white crystalline solid at ambient conditions.
Normal UF_6	UF_6 made with uranium that contains the isotope uranium-235 at a concentration equal to that found in nature, that is, 0.7% uranium-235.
DUF_6	UF_6 made with uranium that contains the isotope uranium-235 in concentrations less than the 0.7% found in nature. In general, the DOE DUF_6 contains between 0.2% and 0.4% uranium-235.
Enriched UF_6	UF_6 made with uranium containing more than 0.7% uranium-235. In general, DOE enriched UF_6 considered in this EIS contains less than 5% uranium-235.
Reprocessed UF_6	UF_6 made with uranium that was previously irradiated in a nuclear reactor and chemically separated during reprocessing.

Types of Cylinders

Full DUF_6	Cylinders filled to 62% of their volume with DUF_6 (some cylinders are slightly overfilled).
Partially Full	Cylinders that contain more than 50 lb (23 kg) of DUF_6 but less than 62% of their volume.
Heel	Cylinders that contain less than 50 lb (23 kg) of residual nonvolatile material left after the DUF_6 has been removed.
Empty	Cylinders that have had the DUF_6 and heel material removed and contain essentially no residual material.
Feed	Cylinders used to supply UF_6 into the enrichment process. Most feed cylinders contain natural UF_6, although some historically contained reprocessed UF_6.
Non-DUF_6	A term used in this EIS to refer to cylinders that contain enriched UF_6 or normal UF_6.

S.1.1.2 Growing Concern over the DUF_6 Inventory

In May 1995, the Defense Nuclear Facilities Safety Board (DNFSB), an independent DOE oversight organization within the Executive Branch, issued Recommendation 95-1 regarding storage of the DUF_6 cylinders. This document advised that DOE should take three actions: (1) start an early program to renew the protective coating on cylinders containing DUF_6 from the historical production of enriched uranium, (2) explore the possibility of additional measures to protect the cylinders from the damaging effects of exposure to the elements as well as any additional handling that might be called for, and (3) institute a study to determine whether a more suitable chemical form should be selected for long-term storage of depleted uranium.

In response to Recommendation 95-1, DOE began an aggressive effort to better manage its DUF_6 cylinders, known as the *UF_6 Cylinder Project Management Plan*. This plan incorporated more rigorous and more frequent inspections, a multiyear schedule for painting and refurbishing cylinders, and construction of concrete-pad cylinder yards. In December 1999, the DNFSB determined that DOE's implementation of the *UF_6 Cylinder Project Management Plan* was successful, and, as a result, on December 16, 1999, it closed Recommendation 95-1.

Several affected states also expressed concern over the DOE DUF_6 inventory. 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. The NOV stated that the 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 entered into discussions with the OEPA that continued through February 1998, when an agreement was reached. Ultimately, in February 1998, DOE and the OEPA agreed to set aside the issue of whether the DUF_6 is subject to state hazardous waste regulation and instituted a negotiated management plan governing the storage of the Portsmouth DUF_6. The agreement also requires DOE to continue its efforts to evaluate the 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 that 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, 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. The consent order further requires DOE to submit a plan, within 60 days of completing NEPA review of its long-term DUF_6 management strategy, that contains schedules for activities related to removal of cylinders from the ETTP site.

In Kentucky, a final Agreed Order between DOE and the Kentucky Natural Resources and Environmental Protection Cabinet concerning DUF_6 cylinder management was entered in October 2003. This Agreed Order requires that DOE provide the Kentucky Department of Environmental Protection with an inventory of all DUF_6 cylinders for which DOE has management responsibility at the Paducah site and, with regard to that inventory, that DOE implement the DUF_6 Cylinder Management Plan, which is Attachment 1 to the Agreed Order.

S.1.1.3 Programmatic NEPA Review and Congressional Interest

In 1994, DOE began work on a *Programmatic Environmental Impact Statement for Alternative Strategies for the Long-Term Management and Use of Depleted Uranium Hexafluoride* (DUF_6 PEIS) (DOE/EIS-0269) to evaluate potential broad management options for DOE's DUF_6 inventory. Alternatives considered included continued storage of DUF_6 in cylinders at the gaseous diffusion plant sites or at a consolidated site, and the use of technologies for converting the DUF_6 to a more stable chemical form for long-term storage, use, or disposal. DOE issued the draft DUF_6 PEIS for public review and comment in December 1997 and held hearings near each of the three sites where DUF_6 is currently stored (Paducah, Kentucky; Oak Ridge, Tennessee; and Portsmouth, Ohio) and in Washington, D.C. In response to its efforts, DOE received some 600 comments.

In July 1998, while the PEIS was being prepared, the President signed into law P.L. 105-204. The text of P.L. 105-204 pertinent to the management of DUF_6 is as follows:

> *(a) PLAN. – The Secretary of Energy shall prepare, and the President shall include in the budget request for fiscal year 2000, a Plan and proposed legislation to ensure that all amounts accrued on the books of the United States Enrichment Corporation for the disposition of depleted uranium hexafluoride will be used to commence construction of, not later than January 31, 2004, and to operate, an onsite facility at each of the gaseous diffusion plants at Paducah, Kentucky, and Portsmouth, Ohio, to treat and recycle depleted uranium hexafluoride consistent with the National Environmental Policy Act.*

DOE began, therefore, to prepare a responsive plan while it proceeded with the PEIS.

On March 12, 1999, DOE submitted the plan to Congress; no legislation was proposed. In April 1999, DOE issued the final DUF_6 PEIS. The PEIS identified conversion of DUF_6 to another chemical form for use or long-term storage as part of the preferred management alternative. In the Record of Decision (ROD) (64 FR 43358, August 10, 1999), DOE decided to promptly convert the DUF_6 inventory to a more stable uranium oxide form. DOE also stated that it would use the depleted uranium oxide as much as possible and store the remaining depleted uranium oxide for potential future uses or disposal, as necessary. In addition, DUF_6 would be converted to depleted uranium metal only if uses for metal were available. DOE did not select a specific site or sites for the conversion facilities but reserved that decision for subsequent NEPA review. (This EIS is that site-specific review.)

Then, in July 1999, DOE issued the *Final Plan for the Conversion of Depleted Uranium Hexafluoride as Required by Public Law 105-204*. The Conversion Plan describes the steps that would allow DOE to convert the DUF_6 inventory to a more stable chemical form. It incorporates information received from the private sector in response to a DOE request for expressions of interest; ideas from members of the affected communities, Congress, and other interested stakeholders; and the results of the analyses for the final DUF_6 PEIS. The Conversion Plan describes DOE's intent to chemically process the DUF_6 to create products that would present a lower long-term storage hazard and provide a material suitable for use or disposal.

S.1.1.4 DOE Request for Contractor Proposals and Site-Specific NEPA Review

DOE initiated the Final Conversion Plan on July 30, 1999, and announced the availability of a draft Request for Proposals (RFP) for a contractor to design, construct, and operate DUF_6 conversion facilities at the Paducah and Portsmouth sites.

In early 2000, the RFP was modified to allow for a wider range of potential conversion product forms and process technologies than had been previously reviewed in the DUF_6 PEIS (the PEIS considered conversion to triuranium octaoxide [U_3O_8] and uranium dioxide [UO_2] for disposal and conversion to uranium metal for use). DOE stated that if the selected conversion technology would generate a previously unconsidered product (e.g., depleted uranium tetrafluoride [UF_4]), DOE would review the potential environmental impacts as part of the site-specific NEPA review.

On October 31, 2000, DOE issued a final RFP to procure a contractor to design, construct, and operate DUF_6 conversion facilities at the Paducah and Portsmouth sites. The RFP stated that any conversion facilities that would be built would have to convert the DUF_6 within a 25-year period to a more stable chemical form that would be suitable for either beneficial use or disposal. The selected contractor would use its proposed technology to design, construct, and operate the conversion facilities for an initial 5-year period. Operation would include (1) maintaining the DUF_6 inventories and conversion product inventories; (2) transporting all UF_6 storage cylinders currently located at ETTP to a conversion facility at the Portsmouth site, as appropriate; and (3) transporting to an appropriate disposal site any conversion product for which no use was found. The selected contractor would also be responsible for preparing such excess material for disposal.

In March 2001, DOE announced the receipt of five proposals in response to the RFP, three of which proposed conversion to U_3O_8 and two of which proposed conversion to UF_4. In August 2001, DOE deemed three of these proposals to be within the competitive range; two conversion to U_3O_8 proposals and one conversion to UF_4 proposal.

On September 18, 2001, DOE published the NOI in the *Federal Register* (66 FR 48123), announcing its intention to prepare an EIS for the proposed action to construct, operate, maintain, and decontaminate and decommission two DUF_6 conversion facilities at Portsmouth, Ohio, and Paducah, Kentucky. DOE held three scoping meetings to provide the public with an opportunity to present comments on the scope of the EIS and to ask questions and discuss concerns with DOE officials regarding the EIS. The scoping meetings were held in Piketon, Ohio, on November 28, 2001; in Oak Ridge, Tennessee, on December 4, 2001; and in Paducah, Kentucky, on December 6, 2001.

The alternatives identified in the NOI included a two-plant alternative (one at the Paducah site and another at the Portsmouth site), a one-plant alternative (only one plant would be built, at either the Paducah or the Portsmouth site), an alternative using existing UF_6 conversion capacity at commercial nuclear fuel fabrication facilities, and a no action alternative. For alternatives that involved constructing one or two new plants, DOE planned to consider alternative conversion technologies, local siting alternatives within the Paducah and Portsmouth site boundaries, and the shipment of DUF_6 cylinders stored at ETTP to either the Portsmouth site or to the Paducah site. The technologies to be considered in the EIS were those submitted in response to the October 2000 RFP, plus any other technologies that DOE believed must be considered.

S.1.1.5 Public Law 107-206 Passed by Congress

During the site-specific NEPA review process, Congress acted again regarding DUF_6 management, and on August 2, 2002, the President signed the *2002 Supplemental Appropriations Act for Further Recovery from and Response to Terrorist Attacks on the United States* (P.L. 107-206). The pertinent part of P.L. 107-206 had several requirements: that no later than 30 days after enactment, DOE must select for award of a contract for the scope of work described in the October 2000 RFP, including design, construction, and operation of a DUF_6 conversion facility at each of the Department's Paducah, Kentucky, and Portsmouth, Ohio, gaseous diffusion sites; that the contract require groundbreaking for construction to occur no later than July 31, 2004; that the contract require construction to proceed expeditiously thereafter; that the contract include as an item of performance the transportation, conversion, and disposition of DU contained in cylinders located at ETTP, consistent with environmental agreements between the State of Tennessee and the Secretary of Energy; and that no later than 5 days after the date of groundbreaking for each facility, the Secretary of Energy shall submit to Congress a certification that groundbreaking has occurred. The relevant portions of the Appropriations Act are set forth in Appendix A of this EIS.

In response to P.L. 107-206, on August 29, 2002, DOE awarded a contract to UDS, for construction and operation of two conversion facilities. DOE also reevaluated the appropriate scope of its site-specific NEPA review and decided to prepare two separate EISs, one for the plant proposed for the Paducah site and a second for the Portsmouth site. This change in approach was announced in the *Federal Register* on April 28, 2003 (68 FR 22368).

The two draft site-specific conversion facility EISs were mailed to stakeholders in late November 2003, and a notice of availability was published by the U.S. Environmental Protection Agency (EPA) in the *Federal Register* on November 28, 2003 (68 FR 66824). Comments on the draft EISs were accepted during a 67-day review period, from November 28, 2003, until February 2, 2004. Public hearings on the draft EISs were held near Portsmouth, Ohio, on January 7, 2004; Paducah, Kentucky, on January 13, 2004; and Oak Ridge, Tennessee, on January 15, 2004.

S.1.1.6 Characteristics of DUF_6

The gaseous diffusion process uses uranium in the form of UF_6, primarily because UF_6 can conveniently be used in gaseous form for processing, in liquid form for filling or emptying containers, and in solid form for storage. Solid UF_6 is a white, dense, crystalline material that resembles rock salt. Depleted uranium is uranium that, through the enrichment process, has been stripped of a portion of the uranium-235 that it once contained so that its proportion is lower than the 0.7 percent by weight (wt%) found in nature. The uranium in most of DOE's DUF_6 has between 0.2 wt% and 0.4 wt% uranium-235.

The chemical and physical characteristics of DUF_6 pose potential health risks, and the material is handled accordingly. Uranium and its decay products in DUF_6 emit low levels of alpha, beta, gamma, and neutron radiation. If DUF_6 is released to the atmosphere, it reacts with water vapor in the air to form HF and a uranium oxyfluoride compound called uranyl fluoride (UO_2F_2), which can be harmful to human health if inhaled or ingested in sufficient quantities. Uranium is a heavy metal that, in addition to being radioactive, can have toxic chemical effects (primarily on the kidneys) if it enters the bloodstream by means of ingestion or inhalation. HF is an extremely corrosive gas that can damage the lungs and cause death if inhaled at high enough concentrations. In light of such characteristics, DOE stores DUF_6 in a manner designed to minimize the risk to workers, the public, and the environment.

As the inventory of DUF_6 cylinders ages, some cylinders have begun to show evidence of external corrosion. A total of three cylinder breaches have occurred at Portsmouth, five breaches have occurred at ETTP, and three breaches have occurred at Paducah (see text box on next page). However, since DUF_6 is solid at ambient temperatures and pressures, it is not readily released after a cylinder leak or breach due to corrosion. When a hole develops in a cylinder, moist air reacts with the exposed solid DUF_6 and iron, forming a dense plug of solid uranium and iron compounds and a small amount of HF gas. The plug limits the amount of material released from a breached cylinder. When a hole in a cylinder is identified, the cylinder is typically repaired or its contents are transferred to a new cylinder. Following a large release of solid UF_6 (generally only possible if a cylinder is involved in a fire), the UF_6 would slowly react with moisture in the air, forming UO_2F_2 and HF, which would be dispersed downwind. The presence of a fire can result in a more rapid reaction and a larger release of UO_2F_2 and HF.

Because reprocessed uranium was enriched in the early years of gaseous diffusion, some of the DUF_6 inventory is contaminated with small amounts of technetium (Tc) and the transuranic (TRU) elements plutonium (Pu), neptunium (Np), and americium (Am). The final RFP for conversion services concluded that any DUF_6 contaminated with TRU elements and Tc at the concentrations expected could be safely handled in a conversion facility. As discussed in this EIS, the risk associated with potential contamination would be relatively small, and those cylinders would be processed in the same manner as cylinders not containing TRU and Tc contamination.

Some of the cylinders manufactured before 1978 were painted with coatings containing polychlorinated biphenyls (PCBs). (Although PCBs are no longer in production in the United States, from the 1950s to the late 1970s, PCBs were added to some paints as fungicides and to increase durability and flexibility.) The long persistence of PCBs in the environment and the tendency for bioaccumulation in the foodchain has resulted in regulations to prevent their release and distribution in the environment. Potential issues associated with PCB-containing cylinder coatings are addressed in more detail in Appendix B of the EIS. As discussed in Appendix B, the presence of PCBs in the coatings of some cylinders is not expected to result in health and safety risks to workers or the public.

Summary Data for Breached Cylinders at the Storage Sites through 2003

Portsmouth Site, three breached cylinders: Two identified in 1990 were initiated by mechanical damage during stacking; the damage was not noticed immediately, and subsequent corrosion occurred at the point of damage. The largest breach size was about 9 in. × 18 in. (23 cm × 46 cm); the estimated mass of DUF_6 lost was between 17 and 109 lb (7.7 and 49 kg). The next largest cylinder breach had an area of about 2 in. (5.1 cm) in diameter; the estimated DUF_6 lost was less than 4 lb (1.8 kg). The third breached cylinder occurred in 1996 and was the result of handling equipment knocking off a cylinder plug.

ETTP Site, five breached cylinders: Four were identified in 1991 and 1992. Two of these were initiated by mechanical damage during stacking, and two were caused by external corrosion due to prolonged ground contact. The breach areas for these four cylinders were about 2 in. (5.1 cm), 6 in. (15 cm), and 10 in. (25 cm) in diameter for three circular breaches, and 17 in. × 12 in. for a rectangular-shaped breach. The mass of material loss from the cylinders could not be estimated because equipment to weigh the cylinders was not available at the ETTP site. The fifth breach occurred in 1998 and was caused by steel grit blasting, which resulted in a breach at the location of an as-fabricated weld defect (immediately repaired without loss of DUF_6).

Paducah Site, three breached cylinders: One identified in 1992 was initiated by mechanical damage during stacking. The breached area was about 0.06 in. × 2 in. (0.16 cm × 5.1 cm). Estimated material loss was 0. The other two cylinder breaches were identified as breached because of missing cylinder plugs; they were identified between 1998 and 2002. Material loss from these cylinders was not estimated.

S.1.2 Purpose and Need

DOE needs to convert its inventory of DUF_6 to a more stable chemical form for use or disposal. This need follows directly from (1) the decision presented in the August 1999 ROD for the PEIS, namely, to begin conversion of the DUF_6 inventory as soon as possible, and (2) P.L. 107-206, which directs DOE to award a contract for construction and operation of conversion facilities at both the Paducah site and the Portsmouth site.

S.1.3 Proposed Action

The proposed action evaluated in this EIS is to construct and operate a conversion facility at the Portsmouth site for conversion of the Portsmouth and ETTP DUF_6 inventories into depleted uranium oxide (primarily U_3O_8) and other conversion products. The action includes construction, operation, maintenance, and D&D of the proposed DUF_6 conversion facility at the Portsmouth site; transportation of DUF_6 cylinders from ETTP to Portsmouth for conversion, as well as transportation of the non-DUF_6 cylinders from ETTP to Portsmouth; construction of a new cylinder storage yard at Portsmouth (if required) for ETTP cylinders; transportation of depleted uranium conversion products and waste materials to a disposal facility; transportation and sale of the HF produced as a conversion co-product; and neutralization of HF to CaF_2 and its sale or disposal in the event that the HF product is not sold. The EIS also considers an option of shipping the cylinders stored at ETTP to Paducah rather than to Portsmouth and an option of expanding facility operations.

S.1.4 Scope

The scope of an EIS refers to the range of actions, alternatives, and impacts it considers. As noted in Section S.1.1.4, on September 18, 2001, DOE published a NOI in the *Federal Register* (66 FR 48123) announcing its intention to prepare an EIS for a proposal to construct, operate, maintain, and decontaminate and decommission two DUF_6 conversion facilities at Portsmouth, Ohio, and Paducah, Kentucky. The NOI announced that the scoping period for the EIS would be open until November 26, 2001. The scoping period was later extended to January 11, 2002. During the scoping process, the public was given six ways to submit comments on the DUF_6 proposal to DOE, including public meetings, mail, facsimile transmission, voice messages, electronic mail, and through a dedicated Web site. DOE held public scoping meetings near Paducah, Kentucky, Portsmouth, Ohio, and Oak Ridge, Tennessee, to give the public an opportunity to present comments on the scope of the EIS and to ask questions and discuss concerns regarding the EIS with DOE officials. The scoping meetings were held in Piketon, Ohio, on November 28, 2001, and in Oak Ridge, Tennessee, on December 4, 2001. Approximately 140 comments were received from about 30 individuals and organizations during the scoping period via all media. These comments were examined to determine the proposed scope of this EIS. Comments were related primarily to five major issues: (1) DOE policy; (2) alternatives; (3) cylinder inventory, maintenance, and surveillance; (4) transportation; and (5) general environmental concerns. Comments received in response to the April 28, 2003, Notice of Change in NEPA Compliance Approach were similar to those made during the public scoping period and were also considered.

The alternatives that are evaluated and compared in this EIS represent reasonable alternatives for converting DUF_6. Three alternative locations within the Portsmouth site are evaluated in detail in this EIS for the proposed action as well as a no action alternative. In addition, this EIS considers the effects on the Portsmouth conversion facility if an option of shipping the cylinders at ETTP to Paducah is selected (although current proposals call for these cylinders to be shipped to Portsmouth) and an option of expanding the conversion facility operations. These alternatives and options, as well as alternatives considered but not evaluated in detail, are described in more detail in Chapter 2.

S.1.5 Public Review of the Draft EIS

The two draft site-specific conversion facility EISs were mailed to stakeholders in late November 2003, and a notice of availability was published by the EPA in the *Federal Register* on November 28, 2003 (68 FR 66824). In addition, each EIS was also made available in its entirety on the Internet at the same time, and e-mail notification was sent to those on the project Web site mailing list. Stakeholders were encouraged to provide comments on the draft EISs during a 67-day review period, from November 28, 2003, until February 2, 2004. Comments could be submitted by calling a toll-free number, by fax, by letter, by e-mail, or through the project Web site. Comments could also be submitted at public hearings held near Portsmouth, Ohio, on January 7, 2004; Paducah, Kentucky, on January 13, 2004; and Oak Ridge, Tennessee, on January 15, 2004. The public hearings were announced on the project Web site and in local newspapers prior to the meetings.

A total of about 210 comments was received during the comment period. The comments received and DOE's responses to those comments are presented in Volume 2 of this EIS. Because of the similarities in the proposed actions and the general applicability of many of the comments to both the Portsmouth and the Paducah site-specific conversion facility EISs, all comments received on both EISs are included in Volume 2. In addition, all comments received were considered in the preparation of both final EISs.

The most common issues raised by reviewers were related to support for the proposed action and preferred alternative, transportation of cylinders, removal of cylinders from the ETTP site, the potential for DOE to accept additional DUF_6 cylinders from other sources, the recently announced USEC American Centrifuge Facility, and general health and safety concerns. Several revisions were made to the two site-specific conversion facility draft EISs on the basis of the comments received (changes are indicated by vertical lines in the right margin of the document). The vast majority of the changes were made to provide clarification and additional detail. Specific responses to each comment received on the draft EISs are presented in Volume 2 of this EIS.

S.1.6 Relationship to Other NEPA Reviews

This DUF_6 Conversion EIS, along with the Paducah conversion facility EIS (DOE/EIS-0359), represent the second level of a tiered environmental review process being used to evaluate and implement DOE's DUF_6 Management Program. The project-level review in these conversion facility EISs incorporates, by reference, the programmatic analysis, as appropriate, from the DUF_6 PEIS published by DOE in 1999.

In addition to the Paducah conversion facility EIS, which is directly related to this EIS, DOE has prepared (or is preparing) other NEPA reviews that are related to the management of DUF_6 or to the current DUF_6 storage sites. These reviews were evaluated and their results taken into consideration in the preparation of this EIS. The related reviews included continued waste management activities, winterization activities associated with cold-standby of the Portsmouth GDP, industrial reuse of sections of the Portsmouth site, long-term management for DOE's inventory of potentially reusable uranium, and waste management activities at the Oak Ridge Reservation.

In addition, DOE prepared a Supplement Analysis for the shipment of up to 1,700 DUF_6 cylinders that meet transportation requirements from ETTP to Portsmouth in fiscal years (FYs) 2003 through 2005. Based on the Supplement Analysis, DOE issued an amended ROD to the PEIS concluding that the estimated impacts for the proposed transport of up to 1,700 cylinders were less than or equal to those considered in the PEIS and that no further NEPA documentation was required (68 FR 53603). Nonetheless, this EIS considers shipment of all DUF_6 and non-DUF_6 at ETTP to Portsmouth by truck and rail.

S.1.7 Organization of This Environmental Impact Statement

This DUF_6 Conversion EIS consists of two volumes. Volume 1 contains 10 chapters and 8 appendixes. Chapter 1 describes background information, the purpose and need for the DOE action, the scope of the assessment, and related NEPA reviews and other studies. Chapter 2 defines the alternatives and options considered in this EIS. Chapter 3 discusses the environmental setting at the Portsmouth and ETTP sites. Chapter 4 addresses the assumptions, approach, and methods used in the impact analyses. Chapter 5 discusses the potential environmental impacts of the alternatives, and Chapter 6 identifies the major laws, regulations, and other requirements applicable to implementing the alternatives. Chapter 7 lists the cited references used in preparing this EIS, and Chapter 8 lists the names of those who prepared this EIS. Chapter 9 is a glossary of technical terms used in this EIS, and Chapter 10 is a subject matter index.

The eight appendixes in Volume 1 include a summary of the pertinent text from P.L. 107-206 (Appendix A), a discussion of issues associated with potential TRU and Tc contamination (Appendix B), comments received during public scoping and from the Notice of Change in NEPA Compliance Approach (Appendix C), the environmental synopsis prepared to support the DUF_6 conversion procurement process (Appendix D), the potential sale of HF and CaF_2 and estimated health and socioeconomic impacts associated with their use (Appendix E), a description of discipline-specific assessment methodologies (Appendix F), letters of consultation (Appendix G), and the contractor disclosure statement (Appendix H).

Volume 2 of the EIS is the comment response document prepared after the public review of the draft EIS. Volume 2 contains an overview of the public review process, copies of the letters or other documents that contained comments to DOE, and the responses to all comments received.

S.2 ALTERNATIVES

The alternatives considered in this EIS are summarized in Table S-2 and described below.

S.2.1 No Action Alternative

Under the no action alternative, it is assumed that DUF_6 cylinder storage would continue indefinitely at the Portsmouth and ETTP sites. The no action alternative assumes that DOE would continue surveillance and maintenance activities to ensure the continued safe storage of cylinders. Potential environmental impacts are estimated through the year 2039. The year 2039 was selected to be consistent with the PEIS, which evaluated a 40-year cylinder storage period

(1999–2039). In addition, long-term impacts (i.e., occurring after 2039) from potential cylinder breaches are assessed.

> **Alternatives Considered in This EIS**
>
> ***No Action:*** NEPA regulations require evaluation of a no action alternative as a basis for comparing alternatives. In this EIS, the no action alternative is storage of DUF_6 and non-DUF_6 cylinders indefinitely in yards at the Portsmouth and ETTP sites, with continued cylinder surveillance and maintenance activities.
>
> ***Proposed Action:*** Construction and operation of a conversion facility at the Portsmouth site for conversion of the Portsmouth and ETTP DUF_6 inventories into depleted uranium oxide (primarily U_3O_8) and other conversion products.
>
> ***Action Alternatives:*** Three action alternatives focus on where to construct the conversion facility within the Portsmouth site (Alternative Locations A, B, and C) The preferred alternative is Location A.

Specifically, the activities assumed to occur under no action include routine cylinder inspections, ultrasonic testing of the wall thicknesses of selected cylinders, painting of selected cylinders to prevent corrosion, cylinder yard surveillance and maintenance, and relocation of some cylinders. It was assumed that cylinders would be painted every 10 years. On the basis of these activities, an assessment of the potential impacts on workers, members of the general public, and the environment was conducted.

For assessment purposes in this EIS, two cylinder breach cases were evaluated. In the first case, it was assumed that the planned cylinder maintenance and painting program would maintain the cylinders in a protected condition and control further corrosion. In this case, it was assumed that after the initial painting, some cylinder breaches would occur from handling damage; the total numbers of future breaches estimated to occur through 2039 were 16 for the Portsmouth site and 7 for the ETTP site. In the second case, it was assumed that external corrosion would not be halted by improved storage conditions, cylinder maintenance, and painting. This case was considered in order to account for uncertainties with regard to how effective painting would be in controlling cylinder corrosion and uncertainties in the future painting schedule. In this case, the numbers of future breaches estimated through 2039 were 74 for the Portsmouth site and 213 for the ETTP site.

The estimated numbers of future breaches at the Portsmouth and ETTP sites were used to estimate potential impacts that might occur during the repair of breached cylinders and impacts from releases that might occur during continued cylinder storage.

S.2.2 Proposed Action Alternatives

The proposed action evaluated in this EIS is to construct and operate a conversion facility at the Portsmouth site for conversion of the Portsmouth and ETTP DUF_6 inventories into depleted uranium oxide (primarily U_3O_8) and other conversion products. Three alternative locations within the Portsmouth site are evaluated (see Table S-2). The proposed action includes shipping the ETTP cylinders to Portsmouth and construction of a new cylinder storage yard at Portsmouth for the ETTP cylinders, if required. The conversion facility would convert DUF_6 into a stable chemical form for beneficial use/reuse and/or disposal. The off-gas from the conversion process would yield aqueous HF, which would be processed and marketed or converted to a solid for sale or disposal. To support the conversion operations, the emptied DUF_6 cylinders would be stored, handled, and processed for reuse as uranium oxide disposal containers to the extent practicable. The time period considered is a construction period of approximately 2 years, an operational period of 18 years, and a 3-year period for the D&D of the facility. Current plans call for construction to begin in the summer of 2004. The assessment is based on the conceptual conversion facility design proposed by the selected contractor, UDS (see text box below).

Proposed Action

The proposed action in this EIS is construction and operation of a conversion facility at the Portsmouth site for conversion of the Portsmouth and ETTP DUF_6 inventories into depleted uranium oxide (primarily U_3O_8) and other conversion products. DUF_6 and non-DUF_6 cylinders would be transported from ETTP to Portsmouth; and a cylinder storage yard would be constructed at Portsmouth for ETTP cylinders, if required. Three alternative locations within the Portsmouth site are evaluated (Locations A, B, and C).

The action alternatives focus on where to site the conversion facility within the Portsmouth site. The Portsmouth site was evaluated to identify alternative locations for a conversion facility. The three alternative locations identified at the Portsmouth site, denoted Locations A, B, and C, are shown in Figure S-3.

S.2.2.1 Alternative Location A (Preferred Alternative)

Location A is the preferred location for the conversion facility and is located in the west-central portion of the site, encompassing 26 acres (10 ha). This location has three existing structures that were formerly used to store containerized lithium hydroxide monohydrate. The site was rough graded, and storm water ditch systems were installed. Two railroad spurs existed at one time in this area. One has had the track and ties removed, and the other has fallen into disrepair. This location was identified in the RFP for conversion services as the site for which bidders were to design their proposed facilities.

Conversion Facility Design

This EIS is based on the conversion facility design being developed by UDS, the selected conversion contractor. At the time the draft EIS was prepared, the UDS design was in the 30% conceptual stage, with several facility design options being considered.

Following the public comment period, the draft EIS was revised on the basis of comments received and on the basis of UDS 100% conceptual facility design. This final EIS identifies and evaluates design options to the extent possible.

S.2.2.2 Alternative Location B

Location B is in the southwest portion of the site and encompasses approximately 50 acres (20 ha). The site has two existing structures built as part of the gas centrifuge enrichment project that was begun in the early 1980s and was terminated in 1985. The open field to the east of the buildings was developed during the same time period; it was rough graded, and storm water systems were installed. USEC is currently in the process of developing and demonstrating an advanced enrichment technology based on gas centrifuges. A license for a lead test facility to be operated at the Portsmouth site was issued by the U.S. Nuclear Regulatory Commission (NRC) in February 2004. The lead facility would be located in the existing gas centrifuge buildings within Location B. In addition, USEC announced in January 2004 that it planned to site its American Centrifuge Facility at Portsmouth, although it did not identify an exact location. Therefore, Location B might not be available for construction of the conversion facility.

S.2.2.3 Alternative Location C

Location C is in the southeast portion of the site and has an area of about 78 acres (31 ha). This location consists of a level to very gently rolling grass field. It was graded during the construction of the Portsmouth site and has been maintained as grass fields since then.

S.2.2.4 Conversion Process Description

The proposed conversion system is based on a proven commercial process in operation at the Framatome Advanced Nuclear Power fuel fabrication facility in Richland, Washington. The UDS dry conversion is a continuous process in which DUF_6 is vaporized and converted to a mixture of uranium oxides (primarily U_3O_8) by reaction with steam and hydrogen in a fluidized-bed conversion unit. The hydrogen is generated using anhydrous ammonia (NH_3). Nitrogen is also used as an inert purging gas and is released to the atmosphere through the building stack as part of the clean off-gas stream. The depleted U_3O_8 powder is collected and packaged for disposition. The process equipment would be arranged in parallel lines. Each line would consist of two autoclaves, two conversion units, a HF recovery system, and process off-gas scrubbers. The Portsmouth facility would have three parallel conversion lines. Equipment would also be installed to collect the HF co-product and process it into any combination of several marketable products. A backup HF acid neutralization system would be provided to convert up to 100% of the HF acid to CaF_2 for storage, sale, or disposal in the future, if necessary. Figure S-4 is an overall material flow diagram for the conversion facility; Figure S-5 is a conceptual facility site plan. A summary of key facility characteristics is presented in Table S-3.

The conversion facility will be designed to convert 13,500 t (15,000 tons) of DUF_6 per year, requiring 18 years to convert the Portsmouth and ETTP inventories. The footprint of the Portsmouth process building would be approximately 148 ft × 271 ft (45 m × 83 m). The conversion facility would occupy a total of approximately 10 acres (4 ha), with up to 65 acres

TABLE S-3 Summary of Portsmouth Conversion Facility Parameters

Parameter/Characteristic	Value
Construction start	2004
Construction period	2 years
Start of operations	2006
Operational period	18 years
Facility footprint	10 acres (4 ha)
Facility throughput	13,500 t/yr (15,000 tons/yr) DUF_6 (≈1,000 cylinders/yr)
Conversion products	
Depleted U_3O_8	10,800 t/yr (11,800 tons/yr)
CaF_2	18 t/yr (20 tons/yr)
70% HF acid	2,500 t/yr (2,800 tons/yr)
49% HF acid	5,800 t/yr (6,300 tons/yr)
Steel (emptied cylinders, if not used as disposal containers)	1,177 t/yr (1,300 tons/yr)

(26 ha) of land disturbed during construction (including temporary construction lay-down areas and utility access). Some of the disturbed areas would be areas cleared for railroad or utility access, not adjacent to the construction area.

The conversion process would generate four conversion products that have a potential use or reuse: depleted U_3O_8, HF, CaF_2, and steel from emptied DUF_6 cylinders (if not used as disposal containers). DOE has been working with industrial and academic researchers for several years to identify potential uses for these products. Some potential uses for depleted uranium exist or are being developed, and DOE believes that a viable market exists for the HF generated during conversion. To take advantage of these to the extent possible, DOE requested in the RFP that the bidders for conversion services investigate and propose viable uses. Table S-4 summarizes the probable disposition paths identified by UDS for each of the conversion products.

S.2.2.5 Preparation and Transportation of ETTP Cylinders to Portsmouth

DOE proposes to ship the DUF_6 and non-DUF_6 cylinders at ETTP to Portsmouth. All shipments of ETTP cylinders would have to be made consistent with U.S. Department of Transportation (DOT) regulations for the shipment of radioactive materials as specified in Title 49 of the CFR (see text box on page S-24). A large number of the ETTP DUF_6 cylinders do not meet the DOT requirements intended to maintain the safety of shipments during both routine and accident conditions. Some cylinders have physically deteriorated such that they no longer meet the DOT requirements. Currently, it is estimated that 1,700 cylinders are DOT compliant.

TABLE S-4 Summary of Proposed Conversion Product Treatment and Disposition

Conversion Product	Packaging/Storage	Proposed Disposition	Optional Disposition
Depleted U_3O_8	Packaged in emptied cylinders for disposal (bulk bags are an option).	Disposal at Envirocare of Utah, Inc.[a]	Disposal at Nevada Test Site (NTS).[a]
CaF_2	Packaged for sale or disposal.	Commercial sale pending DOE approval of authorized release limits, as appropriate.	Disposal at Envirocare of Utah, Inc.[a]
HF acid (70% and 49%)	HF would be commercial grade and stored on site until loaded into rail tank cars.	Sale to commercial HF acid supplier pending DOE approval of authorized release limits, as appropriate.	Neutralization of HF to CaF_2 for use or disposal.
Steel (emptied cylinders)	If bulk bags were used for U_3O_8 disposal, emptied cylinders would be processed for disposal; otherwise used for disposal of U_3O_8.	Disposal at Envirocare of Utah, Inc.[a]	Disposal at NTS.[a]

[a] DOE plans to decide the specific disposal location(s) for the depleted U_3O_8 conversion product after additional appropriate NEPA review. Accordingly, DOE will continue to evaluate its disposal options and will consider any further information or comments relevant to that decision. DOE will give a minimum 45-day notice before making the specific disposal decision and will provide any supplemental NEPA analysis for public review and comment.

Before shipment, each cylinder would be inspected to determine if it met DOT requirements. This inspection would include a record review to determine if the cylinder was overfilled; a visual inspection for damage or defects; a pressure check to determine if the cylinder was overpressurized; and an ultrasonic wall thickness measurement (based on a visual inspection, if necessary). If a cylinder passed the inspection, the appropriate documentation would be prepared, and the cylinder would be loaded directly for shipment.

This EIS considers three options for shipping noncompliant cylinders from ETTP: obtaining an exemption from the DOT to ship the cylinders "as-is" or following repairs, use of cylinder overpacks, and use of a cylinder transfer facility. For an exemption to be granted, DOE would have to demonstrate that the proposed shipments would achieve a level of safety that would be at least equal to the level required by the regulations, likely requiring some type of compensatory measures. An overpack (the second option) is a container into which a cylinder is placed for shipment. The overpack would be designed, tested, and certified to meet all DOT shipping requirements. It would be suitable for containing, transporting, and storing the cylinder contents regardless of cylinder condition. The third option considers the transfer of the DUF_6 from substandard cylinders to new or used cylinders that would meet all DOT requirements. This option could require the construction of a new cylinder transfer facility at ETTP, for which there are no current plans. If a decision were made to construct such a facility, additional NEPA review would be conducted. Transportation impacts are estimated for shipment by both truck and rail after cylinder preparation.

S.2.2.6 Construction of a New Cylinder Storage Yard at Portsmouth

It may be necessary to construct an additional yard at Portsmouth for storing the ETTP cylinders, depending on when and at what rate the ETTP cylinders are shipped. DOE is currently in the process of determining if a new yard is required, or if existing storage yard space could be used for the ETTP cylinders. The potential environmental impacts from the construction of a new cylinder storage yard at two possible locations have been included in this EIS to account for current uncertainties (Figure S-6).

S.2.2.7 Option of Shipping ETTP Cylinders to Paducah

As discussed above, DOE proposes to ship the DUF_6 and non-DUF_6 cylinders at ETTP to Portsmouth. However, this EIS considers shipping the ETTP cylinders to Paducah as an option. If the ETTP cylinders were shipped to Paducah, the Portsmouth conversion facility would have to operate for 14 rather than 18 years to convert the Portsmouth inventory. In Chapter 5, this EIS presents a discussion of the potential environmental impacts associated with this reduction in the operational period. Potential impacts associated with transportation of the ETTP cylinders to Paducah are evaluated in detail in the site-specific Paducah conversion facility EIS (DOE/EIS-0359).

Transportation Requirements for DUF_6 Cylinders

All shipments of UF_6 cylinders have to be made in accordance with applicable DOT regulations for the shipment of radioactive materials; specifically, the provisions of 49 CFR Part 173, Subpart I. The DOT regulations require that each UF_6 cylinder be designed, fabricated, inspected, tested, and marked in accordance with the various engineering standards that were in effect at the time the cylinder was manufactured. The DOT requirements are intended to maintain the safety of shipments during both routine and accident conditions. The following provisions are particularly important relative to DUF_6 cylinder shipments:

1. A cylinder must be filled to less than 62% of the certified volumetric capacity (the fill limit was reduced from 64% to 62% in about 1987).
2. The pressure within a cylinder must be less than 14.8 psia (subatmospheric pressure).
3. A cylinder must be free of cracks, excessive distortion, bent or broken valves or plugs, and broken or torn stiffening rings or skirts, and it must not have a shell thickness that has decreased below a specified minimum value. (Shell thicknesses are assessed visually by a code vessel inspector, and ultrasonic testing may be specified at the discretion of the inspector to verify wall thickness, when and in areas the inspector deems necessary.)
4. A cylinder must be designed so that it will withstand (1) a hydraulic test at an internal pressure of at least 1.4 megapascals (200 psi) without leakage; (2) a free drop test onto a flat, horizontal surface from a height of 1 ft (0.3 m) to 4 ft (1.2 m), depending on the cylinder's mass, without loss or dispersal; and (3) a 30-minute thermal test equivalent to being engulfed in a hydrocarbon fuel/air fire having an average temperature of at least 800°C (1,475°F) without rupture of the containment system.

S.2.2.8 Option of Expanding Conversion Facility Operations

The conversion facility at Portsmouth is currently being designed to process the DOE DUF_6 cylinder inventory at the site over 18 years by using three process lines (see Sections S.2.2.4 and 2.2.2). There are no current plans to operate the conversion facility beyond this time period or to increase the throughput of the facility by adding a fourth process line. However, a future decision to extend conversion facility operations or increase throughput at the site could be made for several reasons. Consequently, this EIS includes an evaluation of the environmental impacts associated with expanding conversion facility operations at the site (either by increasing throughput or by extending operations beyond 18 years) in order to provide future planning flexibility (impacts are discussed in Section S.5.22 and presented in detail in Section 5.2.8). The possible reasons for expanding operations in the future are discussed below.

The DOE Office of Inspector General (OIG) issued a final audit report in March 2004 recommending that the Office of Environmental Management (EM) conduct a cost benefit analysis to determine the optimum size of the Portsmouth conversion facility and, on the basis of the results of that review, implement the most cost-effective approach. The report states that by adding an additional process line to the Portsmouth facility, the time to process the Portsmouth and ETTP inventories of DUF_6 could be shortened by 5 years at a substantial cost savings of 55 million dollars. As stated in the DOE EM response to the OIG report, DOE is not planning to increase the number of process lines within the Portsmouth conversion facility in response to the OIG recommendations. Instead, on the basis of experience with other projects, DOE believes that higher throughput rates can be achieved by improving the efficiency of the planned equipment. Although there are no plans to increase the throughput at the Portsmouth facility by adding an additional process line, the potential environmental impacts associated with increasing the plant throughput, by both process improvements and by the addition of a fourth process line, are evaluated in the EIS (see Section S.5.22).

A future decision to extend operations or expand throughput might also result from the fact that DOE could assume management responsibility for DUF_6 in addition to the current inventory. The possible reasons include future DOE management responsibility for DUF_6 due to regulatory changes or possible MOAs between USEC and DOE; development of an advanced enrichment technology by USEC at Portsmouth that would generate DUF_6 that might be transferred to DOE; and new commercial uranium enrichment facilities that may be built and operated in the United States by commercial companies other than USEC. In addition, because the Portsmouth facility would conclude operations approximately 7 years before the current Paducah inventory would be converted at the Paducah site, it is possible that some DUF_6 cylinders could be transferred from Paducah to Portsmouth, particularly if DOE assumes responsibility for additional DUF_6 at Paducah. These possibilities are discussed and evaluated in this EIS in order to provide future planning flexibility.

S.2.3 Alternatives Considered but Not Analyzed in Detail

S.2.3.1 Use of Commercial Conversion Capacity

An alternative examined was using existing UF_6 conversion capacity at commercial nuclear fuel fabrication facilities that convert natural or enriched UF_6 to UO_2 in lieu of constructing new conversion capacity for DUF_6. This alternative was not analyzed in detail because the small capacity possibly available to DOE, coupled with the low interest level expressed by facility owners, indicates that the feasibility of this suggested alternative is low, and the duration of the conversion period is long (more than 125 years).

S.2.3.2 Sites Other Than Portsmouth

The consideration of alternative sites was limited to alternative locations within the Portsmouth site in response to Congressional direction. As discussed in detail in Section 1.1, Congress has acted twice regarding the construction and operation of DUF_6 conversion facilities at Portsmouth and Paducah. Both P.L. 105-204 and P.L. 107-206 directed DOE to construct and operate conversion facilities at these two sites.

S.2.3.3 Alternative Conversion Processes

Potential environmental impacts associated with alternative conversion processes were considered during the procurement process, including the preparation of an environmental critique and environmental synopsis (Appendix D of this EIS), which were prepared in accordance with the requirements of 10 CFR 1021.216. The environmental synopsis concluded that, on the basis of assessment of potential environmental impacts presented in the critique, no proposal received by DOE was clearly environmentally preferable. The potential environmental impacts associated with the proposals were found to be similar to, and generally less than, those presented in the DUF_6 PEIS for representative conversion technologies.

S.2.3.4 Long-Term Storage and Disposal Alternatives

There are no current plans for long-term storage of conversion products; long-term storage alternatives were analyzed in the PEIS, including storage as DUF_6 and storage as an oxide (either U_3O_8 or UO_2). The potential environmental impacts from long-term storage were evaluated in the PEIS for representative and generic sites. Therefore, long-term storage alternatives were not evaluated in this EIS.

With respect to disposal, this EIS evaluates the impacts from packaging, handling, and transporting depleted uranium conversion products from the conversion facility to a LLW disposal facility that would be (1) selected in a manner consistent with DOE policies and orders and (2) authorized or licensed to receive the conversion products by DOE (in conformance with

DOE orders), the NRC (in conformance with NRC regulations), or an NRC Agreement State agency (in conformance with state laws and regulations determined to be equivalent to NRC regulations). Assessment of the impacts and risks from on-site handling and disposal at the LLW disposal facility is deferred to the disposal site's site-specific NEPA or licensing documents. However, this EIS covers the impacts from transporting the DUF_6 conversion products to both the Envirocare of Utah, Inc., facility and the NTS. DOE plans to decide the specific disposal location(s) for the depleted U_3O_8 conversion product after additional appropriate NEPA review. Accordingly, DOE will continue to evaluate its disposal options and will consider any further information or comments relevant to that decision. DOE will give a minimum 45-day notice before making the specific disposal decision and will provide any supplemental NEPA analysis for public review and comment.

S.2.3.5 Other Transportation Modes

Transportation by air and barge were considered but not analyzed in detail. Transportation by air was deemed to not be reasonable for the types and quantities of materials that would be transported to and from the conversion site. Transportation by barge was also considered and deemed to be unreasonable. ETTP is the only site with a nearby barge facility. Portsmouth would either have to build new facilities or use existing facilities that are located 20 to 30 mi (32 to 48 km) from the Portsmouth site. Use of existing facilities would require on-land transport by truck or rail over the 20- to 30-mi (32- to 48-km) distance, and the cylinders would have to go through one extra unloading/loading step at the end of the barge transport. Currently, there are no initiatives to build new barge facilities closer to the Portsmouth site. If barge shipment was proposed in the future and considered to be reasonable, an additional NEPA review would be conducted.

S.2.3.6 One Conversion Plant for Two Sites

In the NOI published in the *Federal Register* on September 18, 2001, construction and operation of one conversion plant was identified as a preliminary alternative that would be considered in the conversion EIS. However, with the passage of P.L. 107-206, which mandates the award of a contract for the construction and operation of conversion facilities at both Paducah and Portsmouth, the one conversion plant alternative was considered but not analyzed in this EIS.

S.3 AFFECTED ENVIRONMENT

This EIS considers the proposed action at the Portsmouth site for conversion of the Portsmouth and ETTP DUF_6 inventories. Chapter 3 presents a detailed description of the affected environment at and around the Portsmouth and ETTP sites. Environmental resources and values that could potentially be affected at Portsmouth and ETTP include the following:

- Cylinder yards,
- Site infrastructure,
- Air quality,
- Noise,
- Soils,
- Surface and groundwater,
- Vegetation,
- Wildlife,
- Wetlands,
- Threatened and endangered species,
- Public and occupational safety and health,
- Socioeconomics,
- Waste management,
- Land use,
- Cultural resources, and
- Environmental justice.

S.4 ENVIRONMENTAL IMPACT ASSESSMENT APPROACH, ASSUMPTIONS, AND METHODOLOGY

Potential environmental impacts were assessed by examining all of the activities required to implement each alternative, including construction of the required facility, operation of the facility, and transportation of materials between sites (Figure S-7). For continued cylinder storage under the no action alternative, potential long-term impacts from cylinder breaches occurring at Portsmouth and ETTP were also estimated. For each alternative, potential impacts to workers, members of the general public, and the environment were estimated for both normal operations and for potential accidents.

The analysis for this EIS considered all potential areas of impact and emphasized those that might have a significant impact on human health or the environment, would be different under different alternatives, or would be of special interest to the public (such as potential radiation effects). The estimates of potential environmental impacts for the action alternatives were based on characteristics of the proposed UDS conversion facility.

The process of estimating environmental impacts from the conversion of DUF_6 is subject to some uncertainty because final facility designs are not yet available. In addition, the methods used to estimate impacts have uncertainties associated with their results. This EIS impact assessment was designed to ensure — through selection of assumptions, models, and input parameters — that impacts would not be underestimated and that relative comparisons among the alternatives would be valid and meaningful. Although uncertainty may characterize estimates of the absolute magnitude of impacts, a uniform approach to impact assessment enhances the ability to make valid comparisons among alternatives. This uniform approach was implemented in the analyses conducted for this EIS to the extent practicable.

Table S-5 summarizes the major assumptions and parameters that formed the basis of the analyses in this EIS.

S.5 CONSEQUENCES AND COMPARISON OF ALTERNATIVES

This EIS analyzes potential impacts at the Portsmouth and ETTP sites under both the no action alternative and the proposed action alternatives. Under the no action alternative, potential impacts associated with the continued storage of DUF_6 cylinders in yards are evaluated through 2039; in addition, the long-term impacts that could result from releases of DUF_6 and HF from future cylinder breaches are evaluated. For the proposed action, potential impacts are evaluated at three alternative locations for a construction period of 2 years and an operational period of 18 years; impacts at ETTP from the preparation of cylinders for shipment is also included.

The potential environmental impacts at Portsmouth under the proposed action alternatives and under the no action alternative are presented in Table S-6 (placed at the end of this summary). To supplement the information in Table S-6, each area of impact evaluated in this EIS is discussed below. Major similarities and differences among the alternatives are highlighted. Additional details and discussion are provided in Chapter 5 for each alternative.

S.5.1 Human Health and Safety — Construction and Normal Facility Operations

Under the no action and action alternatives, it is estimated that potential exposures of workers and members of the general public to radiation and chemicals would be well within applicable public health standards and regulations during normal facility operations (including 10 CFR 835, 40 CFR 61 Subpart H, and DOE Order 5400.5). The estimated doses and risks from radiation and/or chemical exposures of the general public and noninvolved workers would be very low, with zero latent cancer fatalities (LCFs) expected among these groups over the time periods considered, and with minimal adverse health impacts from chemical exposures expected. (Dose and risk estimates are shown in Table S-6.) In general, the location of a conversion facility within the Portsmouth site would not significantly affect potential impacts (i.e., no significant differences in impacts from alternative Locations A, B, or C were identified) to workers or the general public during normal facility operations.

Key Concepts in Estimating Risks from Radiation

The health effect of concern from exposure to radiation at levels typical of environmental and occupational exposures is the inducement of cancer. Radiation-induced cancers may take years to develop following exposure and are generally indistinguishable from cancers caused by other sources. Current radiation protection standards and practices are based on the premise that any radiation dose, no matter how small, can result in detrimental health effects (cancer) and that the number of effects produced is in direct proportion to the radiation dose. Therefore, doubling the radiation dose is assumed to result in doubling the number of induced cancers. This approach is called the "linear-no-threshold hypothesis" and is generally considered to result in conservative estimates (i.e., over-estimates) of the health effects from low doses of radiation.

Involved workers (persons directly involved in the handling of radioactive or hazardous materials) could be exposed to low-level radiation emitted by uranium during the normal course of their work activities, and this exposure could result in a slight increase in the risk for radiation-induced LCFs to individual involved workers. (The possible presence of TRU and Tc contamination in the cylinder inventory would not contribute to exposures during normal operations.) The annual number of workers exposed could range from about 33 (under the no action alternative for Portsmouth and ETTP combined) to 163 under the action alternatives. Under all alternatives, it is estimated that radiation exposure of involved workers would be unlikely to result in additional LCFs among the entire involved worker populations (risks from radiation exposure range from a 1-in-10 chance of one additional LCF among the entire conversion facility involved worker population over the life of the project to a 1-in-5 chance of one additional LCF among the involved cylinder maintenance workers at Portsmouth under the no action alternative).

Possible radiological exposures from using groundwater potentially contaminated as a result of releases from breached cylinders or facility releases were also evaluated. In general, these exposures would be within applicable public health standards and regulations. However, the uranium concentration in groundwater could exceed 20 μg/L (the drinking water guideline used for comparison in this EIS) at some time in the future under the no action alternative if cylinder corrosion was not controlled. This scenario is highly unlikely because ongoing cylinder inspections and maintenance would prevent significant releases from occurring.

S.5.2 Human Health and Safety — Facility Accidents

S.5.2.1 Physical Hazards

Under all alternatives, workers could be injured or killed as a result of on-the-job accidents unrelated to radiation or chemical exposure. On the basis of accident statistics for similar industries, it is estimated that under the no action alternative, zero fatalities and about 70 injuries might occur through 2039 at the Portsmouth and ETTP sites (about 1 injury per year at Portsmouth, and about 0.7 injury per year at ETTP). Under the action alternatives, the risk of physical hazards would not depend on the location of the conversion facility. No fatalities are predicted, but about 11 injuries during conversion facility construction and up to 142 injuries during operations could occur at the conversion facility (about 6 injuries per year during a 2-year construction period and about 8 injuries per year during operations). In addition, 1 injury would be expected from construction of a new cylinder yard for ETTP cylinders. Accidental injuries and deaths are not unusual in industries that use heavy equipment to manipulate heavy objects and bulk materials.

S.5.2.2 Facility Accidents Involving Radiation or Chemical Releases

Under all alternatives, it is possible that accidents could release radiation or chemicals to the environment, potentially affecting both the workers and members of the general public. Of all the accidents considered, those involving DUF_6 cylinders and those involving chemicals at the conversion facility would have the largest potential effects.

The DUF_6 Management Plan (DOE 1996e) outlines required cylinder maintenance activities and procedures to be undertaken in the event of a cylinder breach and/or release of DUF_6 from one or more cylinders. Under all alternatives, there is a low probability that accidents involving DUF_6 cylinders could occur at the current storage locations. If an accident occurred, DUF_6 could be released to the environment. The DUF_6 would combine with moisture in the air, forming gaseous HF and UO_2F_2, a soluble solid in the form of small particles. The depleted uranium and HF could be dispersed downwind, potentially exposing workers and members of the general public to radiation and chemical effects. The amount released would depend on the severity of the accident and the number of cylinders involved. The probability of cylinder accidents would decrease under the action alternatives as the DUF_6 was converted and the number of cylinders in storage decreased as a result.

Health Effects from Accidental Chemical Releases

The impacts from accidental chemical releases were estimated by determining the numbers of people downwind who might experience adverse effects and irreversible adverse effects:

Adverse Effects: Any adverse health effects from exposure to a chemical release, ranging from mild and transient effects, such as respiratory irritation or skin rash (associated with lower chemical concentrations), to irreversible (permanent) effects, including death or impaired organ function (associated with higher chemical concentrations).

Irreversible Adverse Effects: A subset of adverse effects, irreversible adverse effects are those that generally occur at higher concentrations and are permanent in nature. Irreversible effects may include death, impaired organ function (such as central nervous system or lung damage), and other effects that may impair everyday functions.

For releases involving DUF_6 and other uranium compounds, both chemical and radiological effects could occur if the material was ingested or inhaled. The chemical effect of most concern associated with internal uranium exposure is kidney damage, and the radiological effect of concern is an increase in the probability of developing cancer. With regard to uranium, chemical effects occur at lower exposure levels than do radiological effects. Exposure to HF from accidental releases could result in a range of health effects, from eye and respiratory irritation to death, depending on the exposure level. Large anhydrous NH_3 releases could also cause severe respiratory irritation and death (NH_3 is used to generate hydrogen, which is required for the conversion process).

Chemical and radiological exposures to involved workers under accident conditions would depend on how rapidly the accident developed, the exact location and response of the workers, the direction and amount of the release, the physical forces causing or caused by the accident, meteorological conditions, and the characteristics of the room or building if the accident occurred indoors. Impacts to involved workers under accident conditions would likely be dominated by physical forces from the accident itself; thus, quantitative dose/effect estimates would not be meaningful. For these reasons, the impacts to involved workers during accidents are not quantified in this EIS. However, it is recognized that injuries and fatalities among involved workers would be possible if an accident did occur.

Under the no action alternative, for accidents involving cylinders that might happen at least once in 100 years (i.e., likely accidents), it is estimated that the off-site concentrations of HF and uranium would be considerably below levels that would cause adverse chemical effects among members of the general public from exposure to these chemicals (see text box). However, up to 70 noninvolved workers might experience potential adverse effects from exposure to HF and uranium (mild and temporary effects, such as respiratory irritation or temporary decrease in kidney function). It is estimated that up to 3 noninvolved workers would experience potential irreversible adverse effects that are permanent in nature (such as lung damage or kidney damage); no fatalities are expected. Radiation exposures would be unlikely to result in additional LCFs among noninvolved workers or members of the general public for these types of accidents.

Cylinder accidents that are less likely to occur could be more severe, having greater consequences that could potentially affect off-site members of the general public. These types of accidents are considered extremely unlikely, expected to occur with a frequency of between once in 10,000 years and once in 1 million years of operations. Based on the expected frequency, through 2039, the probability of this type of accident was estimated to be about 1 chance in 2,500. Among all the cylinder accidents analyzed, the postulated accident that would result in the largest number of people with adverse effects (including mild and temporary as well as permanent effects) would be an accident that involves rupture of cylinders in a fire. If this type of accident occurred at the Portsmouth site, it is estimated that up to 680 members of the general public and up to 1,000 noninvolved workers might experience adverse chemical effects from HF and uranium exposure (mild and temporary effects, such as respiratory irritation or temporary decrease in kidney function).

The postulated cylinder accident that would result in the largest number of persons with irreversible adverse health effects is a corroded cylinder spill under wet conditions, with an estimated frequency of between once in 10,000 years and once in 1 million years of operations. If this accident occurred, it is estimated that 1 member of the general public and up to 140 noninvolved workers might experience irreversible adverse effects (such as lung damage or kidney damage). No fatalities are expected among members of the general public; there would be a potential for 1 fatality among noninvolved workers from chemical effects. Radiation exposures would be unlikely to result in additional LCFs among noninvolved workers (1 chance in 100) or the general public (1 chance in 30).

Accident Categories and Frequency Ranges

Likely: Accidents estimated to occur one or more times in 100 years of facility operations (frequency $\geq 1 \times 10^{-2}$/yr).

Unlikely: Accidents estimated to occur between once in 100 years and once in 10,000 years of facility operations (frequency = from 1×10^{-2}/yr to 1×10^{-4}/yr).

Extremely Unlikely: Accidents estimated to occur between once in 10,000 years and once in 1 million years of facility operations (frequency = from 1×10^{-4}/yr to 1×10^{-6}/yr).

Incredible: Accidents estimated to occur less than one time in 1 million years of facility operations (frequency $< 1 \times 10^{-6}$/yr).

In addition to the cylinder accidents discussed above is a certain class of accidents that the DOE investigated; however, because of security concerns, information about such accidents is not available for public review but is presented in a classified appendix to the EIS. All classified information will be presented to state and local officials, as appropriate.

The number of persons actually experiencing adverse or irreversible adverse effects from cylinder accidents would likely be considerably fewer than those estimated for this analysis and would depend on the actual circumstances of the accident and the individual chemical sensitivities of the affected persons. For example, although exposures to releases from cylinder accidents could be life-threatening (especially with respect to immediate effects from inhalation of HF at high concentrations), the guideline exposure level of 20 parts per million (ppm) of HF used to estimate the potential for irreversible adverse effects from HF exposure is likely to result in overestimates. This is because no animal or human deaths have been known to occur as a result of acute exposures (i.e., 1 hour or less) at concentrations of less than 50 ppm; generally, if death does not occur quickly after HF exposure, recovery is complete.

Similarly, the guideline intake level of 30 mg used to estimate the potential for irreversible adverse effects from the intake of uranium in this EIS is the level suggested in NRC guidance. This level is somewhat conservative; that is, it is intended to overestimate rather than underestimate the potential number of irreversible adverse effects in the exposed population following uranium exposure. In more than 40 years of cylinder handling activities, no accidents involving releases from cylinders containing *solid* UF_6 have occurred that have caused diagnosable irreversible adverse effects among workers. In previous accidental exposure incidents involving *liquid* UF_6 in gaseous diffusion plants, some worker fatalities occurred immediately after the accident as a result of inhalation of HF generated from the UF_6. However, no fatalities occurred as a result of the toxicity of the uranium exposure. A few workers were exposed to amounts of uranium estimated to be about three times the guideline level (30 mg) used for assessing irreversible adverse effects; none of these workers, however, actually experienced such effects.

Under the action alternatives, low-probability accidents involving chemicals at the conversion facility could have large potential consequences for noninvolved workers and members of the general public. At a conversion site, accidents involving chemical releases, such as NH_3 and HF, could occur. NH_3 is used to generate hydrogen for conversion, and HF can be produced as a co-product of converting DUF_6. Although the UDS proposal uses NH_3 to generate hydrogen, hydrogen can also be produced using natural gas. In that case, the accident impacts would be less than those discussed in this section for NH_3 accidents. (Details about potential NH_3 and other accidents are in Section 5.2.3.2 [conversion facility] and Section 5.2.5 [transportation].)

The conversion accident estimated to have the largest potential consequences is an accident involving the rupture of tanks containing either 70% HF or anhydrous NH_3. Such an accident could be caused by a large earthquake and is expected to occur with a frequency of less than once in 1 million years of operations. The probability of this type of accident occurring during the operation of a conversion facility is a function of the period of operation; over 18 years of operations, the accident probability would be less than 1 chance in 56,000.

If an aqueous HF or anhydrous NH_3 tank ruptured at the conversion facility, a maximum of up to about 2,300 members of the general public might experience adverse effects (mild and temporary effects, such as respiratory irritation or temporary decrease in kidney function) as a result of chemical exposure. A maximum of about 210 people might experience irreversible adverse effects (such as lung damage or kidney damage), with the potential for about 4 fatalities. With regard to noninvolved workers, up to about 1,400 workers might experience adverse effects (mild and temporary) as a result of chemical exposures. A maximum of about 1,400 noninvolved workers might experience irreversible adverse effects, with the potential for about 30 fatalities.

The location of the conversion facility within the Portsmouth site would affect the number of noninvolved workers and the general public who might experience adverse or irreversible adverse effects from an HF or anhydrous NH_3 tank rupture accident. However, the differences among the locations within each site would generally be small and within the uncertainties associated with the exact accident sequence and weather conditions at the time of the accident. An exception would be that the number of noninvolved workers impacted would be higher for Location B for both potential adverse and irreversible adverse effects.

Although such high-consequence accidents at a conversion facility are possible, they are expected to be extremely rare. The risk (defined as consequence × probability) for these accidents would be less than 1 fatality and less than 1 irreversible adverse health effect for noninvolved workers and members of the public combined. NH_3 and HF are commonly used for industrial applications in the United States, and there are well-established accident prevention and mitigative measures for HF and NH_3 storage tanks. These include storage tank siting principles, design recommendations, spill detection measures, and containment measures. These measures would be implemented, as appropriate.

Under the action alternatives, the highest consequence radiological accident is estimated to be an earthquake damaging the depleted U_3O_8 product storage building. If this accident occurred, it is estimated that about 135 lb (61 kg) of depleted U_3O_8 would be released to the atmosphere outside of the building. The maximum collective doses received by the general public and noninvolved workers would be about 30 person-rem and 530 person-rem, respectively. There would be about a 1-in-50 chance of an LCF among the general public and a 1-in-5 chance of an LCF among the noninvolved workers. Because the accident has a probability of occurrence that is about 1 chance in 6,000, the risk posed by the accident would be essentially zero LCFs among both the public and the workers.

S.5.3 Human Health and Safety — Transportation

Under the no action alternative, only small amounts of the LLW and low-level radioactive mixed waste (LLMW) that would be generated during routine cylinder maintenance activities would require transportation (about one shipment per year). Only negligible impacts are expected from such shipments. No DUF_6 or non-DUF_6 cylinders would be transported between sites.

Under the action alternatives, the total number of shipments would include the following:

1. If U_3O_8 was disposed of in emptied cylinders, there would be approximately 4,200 railcar shipments of depleted U_3O_8 from the conversion facility to Envirocare (proposed) or NTS (option), or up to 21,000 truck shipments (alternative) to either Envirocare or NTS. The numbers of shipments would be about 8,800 for trucks or 2,200 for railcars if bulk bags were used as disposal containers.

2. About 8,200 truck or 1,640 railcar shipments of aqueous (70% and 49%) HF could occur; alternatively, the aqueous HF could be neutralized to CaF_2, requiring a total of about 13,600 truck or 3,400 railcar shipments. Currently, the destination for these shipments is not known.

3. About 700 truck or 350 railcar shipments of anhydrous NH_3 from a supplier to the site. Currently, the origin of these shipments is not known.

4. Emptied heel cylinders to Envirocare or NTS, if bulk bags were used to dispose of the depleted U_3O_8.

5. Approximately 5,400 truck or 1,400 railcar shipments of cylinders from ETTP to Portsmouth.

During normal transportation operations, radioactive material and chemicals would be contained within their transport packages. Health impacts to crew members (i.e., workers) and members of the general public along the routes could occur if they were exposed to low-level external radiation in the vicinity of uranium material shipments. In addition, exposure to vehicle emissions (engine exhaust and fugitive dust) could potentially cause latent fatalities from inhalation.

The risk estimates for emissions are based on epidemiological data that associate mortality rates with particulate concentrations in ambient air. (Increased latent mortality rates resulting from cardiovascular and pulmonary diseases have been linked to incremental increases in particulate concentrations.) Thus, the increase in ambient air particulate concentrations caused by a transport vehicle, with its associated fugitive dust and diesel exhaust emissions, is related to such premature latent fatalities in the form of risk factors. Because of the conservatism of the assumptions made to reconcile results among independent epidemiological studies and associated uncertainties, the latent fatality risks estimated for normal vehicle emissions should be considered to be an upper bound.[3] For the transport of conversion products and co-products (depleted U_3O_8, aqueous HF, and emptied cylinders, if not used as disposal containers), it is conservatively estimated that a total of about 10 fatalities from vehicle emissions could occur if

[3] For perspective, in a recently published EIS for a geologic repository at Yucca Mountain, Nevada, the same risk factors were used for vehicle emissions; however, they were adjusted to reduce the amount of conservatism in the estimated health impacts. As reported in the Yucca Mountain EIS, the adjustments resulted in a reduction in the emission risks by a factor of about 30.

shipments were only by truck and if aqueous HF product was sold and transported 620 mi (1,000 km) from the site (about 20 fatalities are estimated if HF was neutralized to CaF_2 and transported 620 mi [1,000 km] from the site). The number of fatalities occurring from exhaust emissions if shipment were only by rail would be less than 1 if the HF was sold and about 1 if the HF was neutralized to CaF_2.

Exposure to external radiation during normal transportation operations is estimated to cause less than 1 LCF under both truck and rail options. Members of the general public living along truck and rail transportation routes would receive extremely small doses of radiation from shipments, less than 0.1 mrem over the duration of the program. This would be true even if a single person was exposed to every shipment of radioactive material during the program.

Traffic accidents could occur during the transportation of radioactive materials and chemicals. These accidents could potentially affect the health of workers (i.e., crew members) and members of the general public, either from the accident itself or from accidental releases of radioactive materials or chemicals.

The total number of traffic fatalities (unrelated to the type of cargo) was estimated on the basis of national traffic statistics on shipments by both truck and rail. If the aqueous HF was sold, about 1 traffic facility would be estimated under both transportation modes. If HF was neutralized to CaF_2, about 2 fatalities would be estimated for the truck option and 1 fatality for the rail option.

Severe transportation accidents could also result in a release of radioactive material or chemicals from a shipment. The consequences of such a release would depend on the material released, location of the accident, and atmospheric conditions at the time. Potential consequences would be greatest in urban areas because more people could be exposed. Accidents that occurred when the atmospheric conditions were very stable (typical of nighttime) would have higher potential consequences than accidents that occurred when the conditions were unstable (i.e., turbulent, typical of daytime) because the stability would determine how quickly the released material dispersed and diluted to lower concentrations as it moved downwind.

For the action alternatives, the highest potential accident consequences during transportation activities would be caused by a rail accident involving anhydrous NH_3. Although anhydrous NH_3 is a hazardous gas, it has many industrial applications and is commonly safely transported by industry as a pressurized liquid in trucks and rail tank cars.

The occurrence of a severe anhydrous NH_3 railcar accident in a highly populated urban area under stable atmospheric conditions is extremely rare. The probability of such an accident occurring if all the anhydrous NH_3 needed was transported 620 mi (1,000 km) is estimated to be less than 1 chance in 400,000. Nonetheless, if such an accident (i.e., release of anhydrous NH_3 from a railcar in a densely populated urban area under stable atmospheric conditions) occurred, up to 5,000 persons might experience irreversible adverse effects (such as lung damage), with the potential for about 100 fatalities. If the same type of NH_3 rail accident occurred in a typical rural area, which would have a smaller population density than an urban area, potential impacts would be considerably less. It is estimated that in a rural area, approximately 20 persons might experience irreversible adverse effects, with no expected fatalities. The atmospheric conditions at the time of an accident would also significantly affect the consequences of a severe NH_3 accident. The consequences of an NH_3 accident would be less severe under unstable conditions, the most likely conditions in the daytime. Unstable conditions would result in more rapid dispersion of the airborne NH_3 plume and lower downwind concentrations. Under unstable conditions in an urban area, approximately 400 persons could experience irreversible adverse effects, with the potential for about 8 fatalities. If the accident occurred in a rural area under unstable conditions, 1 person would be expected to experience an irreversible adverse effect, with zero fatalities expected. When the probability of an NH_3 accident occurring is taken into account, it is expected that no irreversible adverse effects and no fatalities would occur over the shipment period.

For perspective, anhydrous NH_3 is routinely shipped commercially in the United States for industrial and agricultural applications. On the basis of information provided in the DOT *Hazardous Material Incident System (HMIS) Database* for 1990 through 2002, 2 fatalities and 19 major injuries to the public or to transportation or emergency response personnel have occurred as a result of anhydrous NH_3 releases during nationwide commercial truck and rail operations. These fatalities and injuries occurred during transportation or loading and unloading operations. Over that period, truck and rail NH_3 spills resulted in more than 1,000 and 6,000 evacuations, respectively. Five very large spills, more than 10,000 gal (38,000 L), have occurred; however, these spills were all en route derailments from large rail tank cars. The two largest spills, both around 20,000 gal (76,000 L), occurred in rural or lightly populated areas and resulted in 1 major injury. Over the past 30 years, the safety record for transporting anhydrous NH_3 has significantly improved. Safety measures contributing to this improved safety record include the installation of protective devices on railcars, fewer derailments, closer manufacturer supervision of container inspections, and participation of shippers in the Chemical Transportation Emergency Center.

After anhydrous NH_3, the types of accidents that are estimated to result in the second highest consequences are those involving shipment of 70% aqueous HF produced during the conversion process. The estimated numbers of irreversible adverse effects for 70% HF rail accidents are about one-third of those from the anhydrous NH_3 accidents. However, the number of estimated fatalities is about one-sixth of those from NH_3 accidents, because the percent of fatalities among the individuals experiencing irreversible adverse effects is 1% as opposed to 2% for NH_3 exposures. For perspective, since 1971, the period covered by DOT records, no fatal or serious injuries to the public or to transportation or emergency response personnel have occurred as a result of anhydrous HF releases during transportation. (Most of the HF transported in the United States is anhydrous HF, which is more hazardous than aqueous HF.) Over that period, 11 releases from railcars were reported to have no evacuations or injuries associated with them. The only major release (estimated at 6,400 lb [29,000 kg] of HF) occurred in 1985 and resulted in approximately 100 minor injuries. Another minor HF release during transportation occurred in 1990. The safety record for transporting HF has improved in the past 10 years for the same reasons as those discussed above for NH_3. Transportation accidents involving the shipment of DUF_6 cylinders were also evaluated, with the estimated consequences being less than those discussed above for NH_3 and HF (see Section 5.2.5.3).

S.5.4 Air Quality and Noise

Under the no action alternative, air quality from construction and operations would be within national and state ambient air quality standards. If continued cylinder maintenance and painting are effective in controlling corrosion, as expected, concentrations of HF would be kept within air quality standards at the Portsmouth and ETTP sites. If cylinder corrosion was not controlled, the maximum 24-hour HF concentration at the ETTP site boundary could be about equal to the Tennessee primary standard of 2.9 $\mu g/m^3$ around the year 2020 (standards would not be exceeded at Portsmouth). However, because of the on-going cylinder maintenance program, it is not expected that this high breach rate would occur at the ETTP site.

Under the action alternatives, air quality impacts during construction were found to be similar for all three alternative locations. The total (modeled plus the measured background value representative of the site) concentrations due to emissions of most criteria pollutants — such as sulfur dioxide (SO_2), nitrogen oxides (NO_x), and carbon monoxide (CO) — would be well within applicable air quality standards. As is often the case for construction, the primary concern would be particulate matter (PM) released from near-ground-level sources. Total concentrations of PM_{10} and $PM_{2.5}$ (PM with an aerodynamic diameter of 10 µm or less and 2.5 µm or less, respectively) at the construction site boundaries would be close to or above the standards because of the high background concentrations and the proximity of the new cylinder yard and the proposed conversion facility to potentially publicly accessible areas. The background data used are the maximum values from the last 5 years of monitoring at the nearest monitoring location (operated by the Ohio Environmental Protection Agency [OEPA]) to the site, located about 20 mi (32 km) away in the town of Portsmouth. On the basis of these values, exceedance of the annual $PM_{2.5}$ standard would be unavoidable, because the background concentration already exceeds the standard (background is 24.1 $\mu g/m^3$, in comparison with the standard of 15 $\mu g/m^3$). Accordingly, construction activities should be conducted so as to minimize further impacts on ambient air quality. To mitigate impacts, water could be sprayed on disturbed areas more often, and dust suppressant or pavement could be applied to roads with frequent traffic.

During operations, it is estimated that total concentrations for all annual average criteria pollutants except $PM_{2.5}$ would be well within standards. The background level of $PM_{2.5}$ in the area of the Portsmouth site approaches or already exceeds the standard. Again, impacts during operations were found to be similar for all three alternative locations.

Noise impacts are expected to be negligible under the no action alternative. Under the action alternatives, estimated noise levels at the nearest residence (located 0.9 km [0.6 mi] from the alternative locations) would be below the U.S. Environmental Protection Agency (EPA) guideline of 55 dB(A)[4] as day-night average sound level (DNL)[5] for residential zones during construction and operations.

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[4] dB(A) is a unit of weighted sound-pressure level, measured by the use of the metering characteristics and the A-weighting specified in the *American National Standard Specification for Sound Level Meters*, ANSI S1.4-1983, and in Amendment S1.4A-1985.

[5] DNL is the 24-hour average sound level, expressed in dB(A), with a 10-dB penalty artificially added to the nighttime (10 p.m.–7 a.m.) sound level to account for noise-sensitive activities (e.g., sleep) during these hours.

S.5.5 Water and Soil

Under the no action alternative, uranium concentrations in surface water, groundwater, and soil would remain below guidelines throughout the project duration. However, if cylinder maintenance and painting were not effective in reducing cylinder corrosion rates, the uranium concentration in groundwater could be greater than the guideline at both the Portsmouth and ETTP sites at some time in the future (no earlier than about 2100). If continued cylinder maintenance and painting were effective in controlling corrosion, as expected, groundwater uranium concentrations would remain less than the guideline.

During construction of the conversion facility, construction material spills could contaminate surface water, groundwater, or soil. However, by implementing storm water management, sediment and erosion controls (e.g., temporary and permanent seeding; mulching and matting; sediment barriers, traps, and basins; silt fences; runoff and earth diversion dikes), and good construction practices (e.g., covering chemicals with tarps to prevent interaction with rain, promptly cleaning up any spills), concentrations in soil and wastewater (and therefore surface water and groundwater) could be kept well within applicable standards or guidelines.

During operations, no appreciable impacts on surface water, groundwater, or soils would result from the conversion facility because no contaminated liquid effluents are anticipated, and because airborne emission would be at very low levels (e.g., <0.25 g/yr of uranium). Impacts among the three alternative locations would be similar.

S.5.6 Socioeconomics

The socioeconomic analysis evaluates the effects of construction and operation of a new cylinder yard and conversion facility on population, employment, income, regional growth, housing, and community resources in the region of influence (ROI) around the site. In general, socioeconomic impacts tend to be positive, creating jobs and income, with only minor impacts on housing, public finances, and employment in local public services.

The no action alternative would result in a small socioeconomic impact at both the Portsmouth and ETTP sites combined, creating a total of 130 jobs during operations (direct and indirect jobs) and generating a total of $5.3 million in personal income per operational year. No significant impacts on regional growth and housing, local finances, and public service employment in the ROI are expected.

Under the action alternatives, jobs and income would be generated during both construction and operation. Construction of the conversion facility would create 280 jobs (direct and indirect) and generate $9 million in personal income in the peak construction year (construction occurs over a 2-year period). Operation of the conversion facility would create 320 jobs and generate $13 million in personal income each year. No significant impacts on regional growth and housing, local finances, and public service employment in the ROI are expected. The socioeconomic impacts are not dependent on the location of the conversion facility; therefore, the impacts would be the same for alternative Locations A, B, and C.

S.5.7 Ecology

Under the no action alternative, continued cylinder maintenance and surveillance activities would have negligible impacts on ecological resources (i.e., vegetation, wildlife, threatened and endangered species). No yard reconstruction is planned for either the Portsmouth or ETTP sites. It is estimated that potential concentrations of contaminants in the environment from future cylinder breaches would be below levels harmful to biota. However, there is a potential for impacts to aquatic biota from cylinder yard runoff during painting activities.

For the action alternatives, the total area disturbed during conversion facility construction would be 65 acres (26 ha). Vegetation communities would be impacted in this area with a loss of habitat. However, for all three alternative locations, impacts could be minimized depending on exactly where the facility was placed within each location. These habitat losses would constitute less than 1% of available land at the site. It was found that concentrations of contaminants in the environment during operations would be below harmful levels. Negligible impacts to vegetation and wildlife are expected at all locations.

Wetlands at or near Locations A, B, and C could be adversely affected at the Portsmouth site. Impacts to wetlands could be minimized depending on where exactly the facility was placed within each location. Unavoidable impacts to wetlands that are within the jurisdiction of the U.S. Army Corps of Engineers may require a Clean Water Act (CWA) Section 404 Permit, which would trigger the requirement for a CWA 401 water quality certification from Ohio. Impacts at Location A may potentially be avoided by an alternative routing of the entrance road, or mitigation may be developed in coordination with the appropriate regulatory agencies. A mitigation plan might be required prior to the initiation of construction.

Construction of the conversion facility should not directly affect federal- or state-listed species. However, impacts on deciduous forest might occur. Impacts to forested areas could be avoided if temporary construction areas were placed in previously disturbed locations. Trees with exfoliating bark, such as shagbark hickory or dead trees with loose bark, can be used by the Indiana bat (federal- and state-listed as endangered) as roosting trees during the summer. There is a potential that such trees could be disturbed during construction at Locations A or C at Portsmouth. If either live or dead trees with exfoliating bark are encountered on construction areas, they should be saved if possible. If necessary, the trees should be cut before April 15 or after September 15.

S.5.8 Waste Management

Under the no action alternative, LLW, LLMW, and PCB-containing waste could be generated from cylinder scraping and painting activities. The amount of wastes generated would represent an increase of less than 1% in the sites' loads of these wastes, representing negligible impacts on site waste management operations.

Under the action alternatives, waste management impacts would not depend on the location of the facility within the site and would be the same for alternative Locations A, B, and C. Waste generated during construction and operations would have negligible impacts on the Portsmouth site waste management operations, with the exception of possible impacts from disposal of CaF_2. Industrial experience indicates that HF, if produced, would contain only trace amounts of depleted uranium (less than 1 ppm). It is expected that HF would be sold for use. If sold for use, the sale would be subject to review and approval by DOE in coordination with the NRC, depending on the specific use (as discussed in Appendix E of this EIS).

The U_3O_8 produced during conversion would generate about 4,700 yd^3 (3,570 m^3) per year of LLW. This is 5% of Portsmouth's annual projected volume and would have a low impact on site LLW management.

If the HF was not sold but instead neutralized to CaF_2, it is currently unknown whether (1) the CaF_2 could be sold, (2) the low uranium content would allow the CaF_2 to be disposed of as nonhazardous solid waste, or (3) disposal as LLW would be required. The low level of uranium contamination expected (i.e., less than 1 ppm) suggests that sale or disposal as nonhazardous solid waste would be most likely. If sold for use, the sale would be subject to review and approval by DOE in coordination with the NRC, depending on the specific use. Waste management for disposal as nonhazardous waste could be handled through appropriate planning and design of the facilities. If the CaF_2 had to be disposed of as LLW, it could represent a potentially large impact on waste management operations.

A small quantity of TRU could be entrained in the gaseous DUF_6 during the cylinder emptying operations. These contaminants would be captured in the filters between the cylinders and the conversion equipment. The filters would be monitored and replaced routinely to maintain concentrations below regulatory limits for TRU waste. The spent filters would be disposed of as LLW, generating up to 25 drums of LLW waste over the life of the project.

Current UDS plans are to leave the heels in the emptied cylinders, add a stabilizer, and use the cylinders as disposal containers for the U_3O_8 product, to the extent practicable. An alternative is to process the emptied cylinders and dispose of them directly as LLW. Either one of these approaches is expected to meet the waste acceptance criteria of the disposal facilities and minimize the potential for generating TRU waste through washing of the cylinders to remove the heels. Although cylinder washing is not considered a foreseeable option at this time, for completeness, an analysis of the maximum potential quantities of TRU waste that could be generated from cylinder washing is included in Appendix B of this EIS, as is a discussion of PCBs contained in some cylinder coatings.

S.5.9 Resource Requirements

Resource requirements include construction materials, fuel, electricity, process chemicals, and containers. In general, all alternatives would have a negligible effect on the local or national availability of these resources.

S.5.10 Land Use

Under the no action alternative, all activities would occur in areas previously used for conducting similar activities; therefore, no land use impacts are expected. Under the action alternatives, a total of 65 acres (26 ha) could be disturbed for the conversion facility, with some areas cleared for railroad or utility access and not adjacent to the construction site. Up to 6.3 additional acres (2.5 ha) could also be disturbed for construction of a new cylinder yard. All three alternative locations are within an already-industrialized facility, and impacts to land use would be similar for the three locations. The permanently altered areas represent less than 1% of available land already developed for industrial purposes. Negligible impacts on land use are thus expected.

S.5.11 Cultural Resources

Under the no action alternative, impacts on cultural resources at the current storage locations would be unlikely because all activities would occur in areas already dedicated to cylinder storage. Under the action alternatives, impacts on cultural resources could be possible for all three alternative locations. Archaeological and architectural surveys have not been finalized for the candidate locations and must be completed prior to initiation of the action alternatives. However, if archaeological resources were encountered, or historical or traditional cultural properties were identified, a mitigation plan would be required.

S.5.12 Environmental Justice

No disproportionately high and adverse human health or environmental impacts are expected to minority or low-income populations during normal facility operations under the action alternatives. Although the consequences of facility accidents could be high if severe accidents occurred, the risk of irreversible adverse effects (including fatalities) among members of the general public from these accidents (taking into account the consequences and probability of the accidents) would be less than 1. Furthermore, transportation accidents with high and adverse impacts are unlikely; their locations cannot be projected, and the types of persons who would be involved cannot be reliably predicted. Thus, there is no reason to expect that minority and low-income populations would be affected disproportionately by high and adverse impacts.

S.5.13 Impacts from Cylinder Preparation at ETTP

The cylinders at ETTP would have to be prepared to be shipped by either truck or rail. Approximately 5,900 cylinders (4,800 DUF_6 cylinders for conversion and about 1,100 non-DUF_6 cylinders) would require preparation for shipment at ETTP. Three cylinder preparation options are considered for the shipment of noncompliant cylinders.

In general, the use of cylinder overpacks would result in small potential impacts. Overpacking operations would be similar to current cylinder handling operations, and impacts would be limited to involved workers. No LCFs among involved workers from radiation exposure are expected. Impacts would be similar if noncompliant cylinders were shipped "as-is" under a DOT exemption, assuming appropriate compensatory measures.

The use of a cylinder transfer facility would likely require the construction of a new facility at ETTP; there are no current plans to build such a facility. Operational impacts would generally be small and limited primarily to external radiation exposure of involved workers, with no LCFs expected. Transfer facility operations would generate a large number of emptied cylinders requiring disposition. If a decision were made to construct and operate a transfer facility at ETTP, additional NEPA review would be conducted.

If ETTP cylinders were transported to Paducah for conversion, the operational period at Portsmouth would be reduced by 4 years. Annual impacts would be the same as discussed for each technical discipline. No significant decrease in overall impacts would be expected.

S.5.14 Impacts Associated with Conversion Product Sale and Use

The conversion of the DUF_6 inventory produces products having some potential for reuse (no large-scale market exists for depleted U_3O_8). These products include HF and CaF_2, which are commonly used as commercial materials. An investigation of the potential reuse of HF and CaF_2 has been included as part of this EIS. Areas examined include the characteristics of these materials as produced within the conversion process, the current markets for these products, and the potential socioeconomic impacts should these products be provided to the commercial sector. Because there would be some residual radioactivity associated with these materials, the DOE process for authorizing release of materials for unrestricted use (referred to as "free release") and an estimate of the potential human health effects of such free release have also been included in this investigation. The results of the analysis of HF and CaF_2 use are included in Table S-6.

If the products were to be released for restricted use (e.g., in the nuclear industry for the manufacture of nuclear fuel), the impacts would be less than those for unrestricted release.

Conservative estimates of the amount of uranium and technetium that might transfer into the HF and CaF_2 were used to evaluate the maximum expected dose to workers using the material if it was released for commercial use or the general public. On the basis of very conservative assumptions concerning use, the maximum dose to workers was estimated to be less than 1 mrem/yr, much less than the regulatory limit of 100 mrem/yr specified for members of the general public. Doses to the general public would be even lower.

Socioeconomic impact analyses were conducted to evaluate the impacts of the introduction of the conversion-produced HF or CaF_2 into the commercial marketplace. A potential market for the aqueous HF has been identified as the current aqueous HF acid producers. The impact of HF sales on the local economy in which the existing producers are located and on the U.S. economy as a whole is likely to be minimal. No market for the CaF_2 that might be produced in the conversion facility has been identified. Should such a market be found, the impact of CaF_2 sales on the U.S. economy is also predicted to be minimal.

S.5.15 Impacts from D&D Activities

D&D would involve the disassembly and removal of all radioactive and hazardous components, equipment, and structures. For the purposes of analysis in this EIS, it was also assumed that the various buildings would be dismantled and "greenfield" (unrestricted use) conditions would be achieved. The "clean" waste will be sent to a landfill that accepts construction debris. Low-level waste will be sent to a licensed or DOE disposal facility, where it will likely be buried in accordance with the waste acceptance criteria and other requirements in effect at that time. Hazardous and mixed waste will be disposed of in a licensed facility in accordance with applicable regulatory requirements. D&D impacts to involved workers would be primarily from external radiation; expected exposures would be a small fraction of operational doses; no LCFs would be expected. It is estimated that no fatalities and up to five injuries would result from occupational accidents. Impacts from waste management would include total generation of about 275 yd^3 (210 m^3) of LLW, 157 yd^3 (120 m^3) of LLMW, and 157 yd^3 (120 m^3) of hazardous waste; these volumes would result in low impacts in comparison with projected site annual generation volumes.

S.5.16 Cumulative Impacts

The Council on Environmental Quality (CEQ) guidelines for implementing NEPA define cumulative effects as the impacts on the environment resulting from the incremental impact of an action under consideration when added to other past, present, and reasonably foreseeable future actions (40 CFR 1508.7) Activities considered for cumulative analysis include those in the vicinity of the Portsmouth site that might affect environmental conditions at or near that locality under both the no action alternative and the proposed action alternatives. Activities considered also include those at the ETTP site associated with transporting cylinders to Portsmouth (under the proposed action) and continued long-term storage of DUF_6 (under the no action alternative).

One action considered reasonably foreseeable under cumulative impacts is the development of a uranium enrichment facility at either the Paducah or Portsmouth site. An agreement between USEC and DOE on June 17, 2002, established the possibility of constructing an enrichment plant at either site. In January 2004, USEC announced that it planned to site its American Centrifuge Facility at the Portsmouth site. This EIS assumes that such an enrichment facility would employ the existing gas centrifuge technology and would generate impacts similar to those outlined in a 1977 analysis of environmental consequences that considered such an action. (The facility proposed in 1977 was never completed or operated.)

Other actions planned at the Portsmouth site include continued waste management activities, waste disposal activities, environmental restoration activities, industrial reuse of sections of the site, and the DUF_6 management activities considered in this EIS. Activities involving gaseous diffusion uranium enrichment at Portsmouth were discontinued early in 2002. Cumulative impacts at the Portsmouth site and vicinity would be as follows for the no action alternative and the proposed action alternatives:

- The cumulative radiological exposure to the off-site population would be considerably below the maximum DOE dose limit of 100 mrem per year to the off-site maximally exposed individual (MEI) and below the limit of 25 mrem/yr specified in 40 CFR 190 for uranium fuel cycle facilities. Annual individual doses to involved workers would be monitored to maintain exposure below the regulatory limit of 5 rem per year.

- Under the no action alternative cumulative impacts assessment, although less than 1 shipment per year of radioactive wastes is expected from cylinder management activities, up to 3,500 rail shipments and 4,500 truck shipments could be associated with existing and planned actions. Under the action alternatives, up to 6,800 rail shipments and 12,300 truck shipments of radioactive material could occur. The cumulative maximum dose to the MEI along the transportation route near the site entrance would be less than 1 mrem/yr under all alternatives for all transportation options considered.

- The Portsmouth site is located in an attainment region. However, the background annual-average $PM_{2.5}$ concentration exceeds the standard. Cumulative impacts would not affect the attainment status.

- Data from the 2000 annual groundwater monitoring showed that five pollutants exceeded primary drinking water regulation levels in groundwater at the Portsmouth site. Alpha and beta activity were also detected. Good engineering and construction practices should ensure that indirect impacts associated with the conversion facility would be minimal.

- Cumulative ecological impacts should be negligible, with little change to intact ecosystems contributed by any alternative considered in this EIS in conjunction with the effects of other activities.

- Impacts on land use similarly would be minimal, with DUF_6 conversion activities confined to the Portsmouth site, which is already heavily developed for such activities.

- It is unlikely that any noteworthy cumulative impacts on cultural resources would occur under any alternative, and any such impacts would be adequately mitigated before activities for the chosen action would continue.

- Given the absence of high and adverse cumulative impacts for any impact area considered in this EIS, no environmental justice cumulative impacts are anticipated for the Portsmouth site, despite the presence of disproportionately high percentages of low-income populations in the vicinity.

- Socioeconomic impacts under all the alternatives considered are anticipated to be generally positive, often temporary, and relatively small.

Actions planned at the ETTP site include continued waste management activities, reindustrialization of the ETTP site, environmental restoration activities, possibly other DOE programs involving the disposition of enriched uranium, and the DUF_6 management activities considered in this EIS. Cumulative impacts at the ETTP site and vicinity would not be large under either the no action or the action alternatives.

S.5.17 Mitigation

On the basis of the analyses conducted for this EIS, the following recommendations can be made to reduce the impacts of the proposed action:

- Current cylinder management activities, including inspecting cylinders, carrying out cylinder maintenance activities (such as painting), and promptly cleaning up releases from any breached DUF_6 cylinders, should be continued to avoid future impacts on site air and groundwater. In addition, runoff from cylinder yards should be collected and sampled so that contaminants can be detected and their release to surface water or groundwater can be avoided. If future cylinder painting results in permit violations, treating cylinder yard runoff prior to release may be required.

- Temporary impacts on air quality from fugitive dust emissions during construction of any new facility should be controlled by the best available practices to avoid temporary exceedances of the PM_{10} and $PM_{2.5}$ standard. Technologies that will be used to mitigate air quality impacts during construction include using water sprays on dirt roadways and on bare soils in work areas for dust control; covering open-bodied trucks transporting materials likely to become airborne when full and at all times when in motion; water spraying and covering bunkered or staged excavated and replacement soils; maintaining paved roadways in good repair and in a clean condition; using barriers and windbreaks around construction areas such as soil banks, temporary screening, and/or vegetative cover; mulching or covering exposed bare soil areas until vegetation has time to recover or paving has been installed; and prohibiting any open burning.

- During construction, impacts to water quality and soil can be minimized through implementing storm water management, sediment and erosion controls (e.g., temporary and permanent seeding; mulching and matting; sediment barriers, traps, and basins; silt fences; runoff and earth diversion dikes), and good construction practices (e.g., covering chemicals with tarps to prevent interaction with rain, promptly cleaning up any spills).

- Potential impacts to wetlands at the Portsmouth site could be minimized or eliminated by maintaining a buffer near adjacent wetlands during construction. Impacts at Location A may potentially be avoided by an alternative routing of the entrance road, or mitigation may be developed in coordination with the appropriate regulatory agencies.

- If trees (either live or dead) with exfoliating bark were encountered on construction areas, they should be saved if possible to avoid destroying potential habitat for the Indiana bat. If necessary, the trees should be cut before April 15 or after September 15.

- The quantity of radioactive and hazardous materials stored on site, including the products of the conversion process, should be minimized.

- The construction of a DUF6 conversion facility at Portsmouth would have the potential to impact cultural resources. Neither an archaeological nor an architectural survey has been completed for the Portsmouth site as a whole or for any of the alternative locations, although an archaeological sensitivity study has been conducted. In accordance with Section 106 of the National Historic Preservation Act, the adverse effects of this undertaking must be evaluated once a location is chosen.

- Testing should be conducted either prior to or during the conversion facility startup operations to determine if the air vented from the autoclaves should be monitored or if any alternative measures would need to be taken to ensure that worker exposures to PCBs above allowable Occupational Safety and Health Administration limits do not occur.

- The nuclear properties of DUF_6 are such that the occurrence of a nuclear criticality is not a concern, regardless of the amount of DUF_6 present. However, criticality is a concern for the handling, packaging, and shipping of enriched UF_6. For enriched UF_6, criticality control is accomplished by employing, individually or collectively, specific limits on uranium-235 enrichment, mass, volume, geometry, moderation, and spacing for each type of cylinder. The amount of enriched UF_6 that may be contained in an individual cylinder and the total number of cylinders that may be transported together are determined by the nuclear properties of enriched UF_6. Spacing of enriched UF_6 cylinders in transit during routine and accident conditions is ensured by use of regulatory approval packages that provide protection against impact and fire.

- Because of the relatively high consequences estimated for some accidents, special attention will be given to the design and operational procedures for components that may be involved in such accidents. For example, the tanks holding hazardous chemicals on site such as anhydrous NH_3 and aqueous HF would be designed to all applicable codes and standards, and special procedures would be in place for gaining access to the tanks and for filling of the tanks. In addition, although the probabilities of occurrence for a high-consequence accident are extremely low, emergency response plans and procedures would be in place to respond to any emergencies should an accident occur.

S.5.18 Unavoidable Adverse Impacts

Unavoidable adverse impacts are those impacts that cannot be mitigated by choices associated with siting and facility design options. Such impacts would be unavoidable, no matter which options were selected, and would include the following:

- Exposure of workers to radiation in the storage yards and the conversion facility that would be below applicable standards;
- Generation of vehicle exhaust and particulate air emissions during construction (emissions that would exceed air quality standards would be mitigated);
- Disturbance of up to 65 acres (26 ha) of land during construction, with approximately 10 acres (4 ha) required for the facility footprint;
- Loss of terrestrial and aquatic habitats from construction and disturbance of wildlife during operations; and
- Generation of vehicle exhaust and particulate air emissions during transportation.

S.5.19 Irreversible and Irretrievable Commitment of Resources

A commitment of a resource is considered *irreversible* when the primary or secondary impacts from its use limit the future options for its use. An *irretrievable* commitment refers to the use or consumption of a resource that is neither renewable nor recoverable for later use by future generations. The major irreversible and irretrievable commitment of natural and man-made resources related to the alternatives analyzed in this EIS include the land used to dispose of any conversion products, energy usage, and materials used for construction of the facility that could not be recovered or recycled.

S.5.20 Relationship between Short-Term Use of the Environment and Long-Term Productivity

Disposal of solid nonhazardous waste resulting from new facility construction, operations, and D&D would require additional land at a sanitary landfill site, which would be unavailable for other uses in the long term. Any radioactive or hazardous waste generated by the various alternatives would involve the commitment of associated land, transportation, and disposal resources, and resources associated with the processing facilities for waste management.

For the construction and operation of the conversion facility, the associated construction activities would result in both short-term and long-term losses of terrestrial and aquatic habitats from natural productivity. After closure of the new facility, it would be decommissioned and could be reused, recycled, or remediated.

S.5.21 Pollution Prevention and Waste Minimization

Implementation of the EIS alternatives would be conducted in accordance with all applicable pollution prevention and waste minimization guidelines. A consideration of opportunities for reducing waste generation at the source, as well as for recycling and reusing material, will be incorporated to the extent possible into the engineering and design process for the conversion facility. Pollution prevention and waste minimization will be major factors in determining the final design of any facility to be constructed. Specific pollution prevention and waste minimization measures will be considered in designing and operating the final conversion facility.

S.5.22 Potential Impacts Associated with the Option of Expanding Conversion Facility Operations

As discussed in Sections S.2.2.8 and 2.2.7, several reasonably foreseeable activities could result in a future decision to increase the conversion facility throughput or extend the operational period at one or both of the conversion facility sites. Although there are no current plans to do so, to account for these future possibilities and provide future planning flexibility, Section 5.2.8 includes an evaluation of the environmental impacts associated with expanding conversion facility operations at Portsmouth, either by increasing throughput (such as by adding a fourth process line) or by extending operations.

The throughput of the Portsmouth facility could be increased either by making process efficiency improvements or by adding an additional (fourth) process line. As described in Section 5.2.8, a throughput increase through process improvements would not be expected to significantly change the overall environmental impacts when compared with the current plant design (three process lines). Efficiency improvements are generally on the order of 10%, which is within the uncertainty that is inherent in the impact estimate calculations. Slight variations in plant throughput are not unusual from year to year because of operational factors (e.g., equipment maintenance or replacement) and are generally accounted for by the conservative nature of the impact calculations.

In contrast to process efficiency improvements, the addition of a fourth process line at the Portsmouth facility would require the installation of additional plant equipment and would result in a nominal 33% increase in throughput compared with the current base design. The plant capacity would be similar to the capacity planned for the Paducah site (evaluated in DOE/EIS-0359). This throughput increase would reduce the time necessary to convert the Portsmouth and ETTP DUF_6 inventories by about 5 years. The construction impacts presented above and summarized in Table S-6 for three process lines would be the same if a fourth line was added, because a fourth line would fit within the current process building design.

In general, a 33% increase in throughput (e.g., by the addition of a fourth line) would not result in significantly greater environmental impacts during operations than those discussed above and summarized in Table S-6 for three process lines. Although annual impacts in certain areas might increase up to 33% (proportional to the throughput increase), the estimated annual impacts during operations would remain well within applicable guidelines and regulations, with collective and cumulative impacts being quite low.

One exception is the $PM_{2.5}$ concentration during construction, which could exceed standards because of the regionally high background level under both the three- and four-process-line cases. The background data used are the maximum values from the last 5 years of monitoring at the nearest monitoring location (operated by the OEPA) to the site, located about 20 mi (32 km) away in the town of Portsmouth. On the basis of these values, exceedance of the annual $PM_{2.5}$ standard would be unavoidable, because the background concentration already exceeds the standard (background is 24.1 $\mu g/m^3$, in comparison with the standard of 15 $\mu g/m^3$).

Because a 33% increase in throughput would reduce the operational period of the facility by approximately 5 years, positive socioeconomic impacts associated with employment of the conversion facility workforce would last approximately 13 years, compared with 18 years under the base design.

The conversion facility operations could also be expanded by operating the facility longer than the currently anticipated 18 years. There are no current plans to operate the conversion facilities beyond this period. However, with routine facility and equipment maintenance and periodic equipment replacements or upgrades, it is believed that the conversion facility could be operated safely beyond this time period to process any additional DUF_6 for which DOE might assume responsibility. As discussed in Section 5.2.8, if operations were extended beyond 18 years and if the operational characteristics (e.g., estimated releases of contaminants to air and water) of the facility remained unchanged, it is expected that the annual impacts would be essentially the same as those presented above and summarized in Table S-6 for three process lines. Impacts associated with expanded operations are shown in brackets in Table S-6 where they would differ from those presented for the proposed design. The overall cumulative impacts from the operation of the facility would increase proportionately with the increased life of the facility.

S.6 ENVIRONMENTAL AND OCCUPATIONAL SAFETY AND HEALTH PERMITS AND COMPLIANCE REQUIREMENTS

DUF_6 cylinder management as well as construction and operation of the proposed DUF_6 conversion facility would be subject to many federal, state, local, and other legal requirements. In accordance with such legal requirements, a variety of permits, licenses, and other consents must be obtained. Chapter 6 of this EIS contains a detailed listing of applicable requirements.

S.7 PREFERRED ALTERNATIVE

The preferred alternative is to construct and operate the proposed DUF_6 conversion facility at alternative Location A, which is in the west-central portion of the Portsmouth site.

1 INTRODUCTION

Over the last five decades, the U.S. Department of Energy (DOE) has enriched large quantities of uranium for nuclear applications by means of gaseous diffusion. This enrichment has taken place at three DOE 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 (Figure 1-1). "Depleted" uranium hexafluoride (commonly referred to as DUF_6) is a product of this process. It is being stored at the three sites. The total DUF_6 inventory at the three sites weighs approximately 700,000 metric tons (t) (770,000 short tons [tons])[1] and is stored in about 60,000 steel cylinders.

This document is a site-specific environmental impact statement (EIS) for construction and operation of a proposed DUF_6 conversion facility at the Portsmouth site. The proposed facility would convert the DUF_6 stored at Portsmouth and ETTP to a more stable chemical form suitable for use or disposal. A separate EIS (DOE 2004a) evaluates potential impacts for a proposed conversion facility to be constructed at the Paducah site. The EISs have been prepared in accordance with the National Environmental Policy Act of 1969 (NEPA) (*United States Code*, Title 42, Section 4321 et seq. [42 USC 4321 et seq.]), Council on Environmental Quality (CEQ) NEPA regulations (*Code of Federal Regulations*, Title 40, Parts 1500–1508 [40 CFR Parts 1500–1508]), and DOE's NEPA implementing procedures (10 CFR Part 1021).

National Environmental Policy Act (NEPA) Regulations

For major federal actions with the potential for significant environmental impacts, NEPA regulations require federal agencies to discuss a proposed action and all reasonable alternatives in an environmental impact statement (EIS). The information in the EIS must be sufficient for reviewers to evaluate the relative merits of each alternative.

The agency must briefly discuss any alternatives that were eliminated from further analysis. The agency should identify its preferred alternatives, if one or more exist, in the draft EIS and must identify its preferred alternative in the final EIS unless another law prohibits naming a preference. After completing the final EIS and in order to implement an alternative, the federal agency must issue a Record of Decision that announces the decision that was made and identifies the alternatives that were considered.

This EIS addresses the potential environmental impacts at the Portsmouth site from the construction, operation, maintenance, and decontamination and decommissioning (D&D) of the proposed conversion facility; from the transportation of the ETTP cylinders to Portsmouth; from the transportation of depleted uranium conversion products to a disposal facility; and from the transportation, sale, use, or disposal of the fluoride-containing conversion products (hydrogen fluoride [HF] or calcium fluoride [CaF_2]). Three alternative locations within the Portsmouth site are evaluated for the

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1 In general, in this EIS, values in English units are presented first, followed by metric units in parentheses. However, when values are routinely reported in metric units, the metric units are presented first, followed by English units in parentheses.

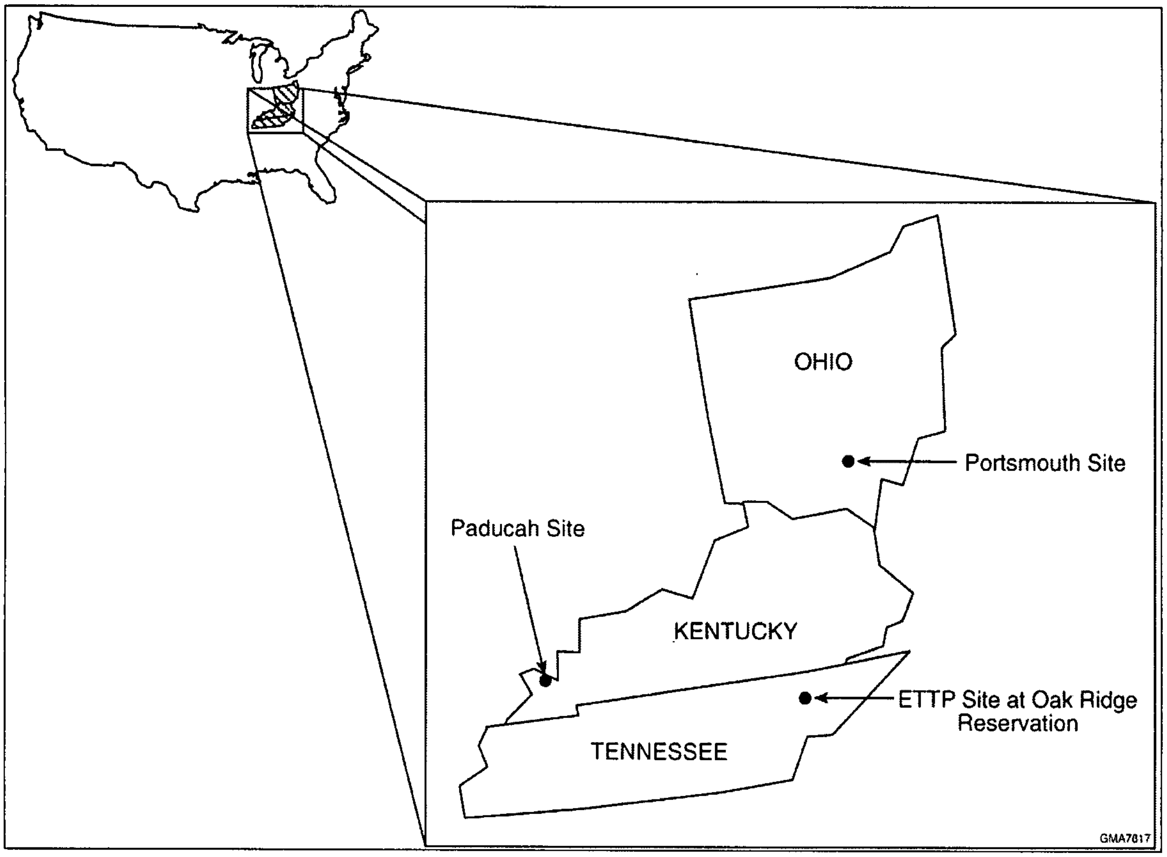

FIGURE 1-1 DUF_6 Storage Locations

conversion facility. An option of shipping the ETTP cylinders to Paducah is also considered, as is an option of expanding facility operations. This EIS also evaluates a no action alternative, which assumes continued storage of DUF_6 in cylinders at the Portsmouth and ETTP sites.

1.1 BACKGROUND INFORMATION

The current DUF_6 conversion facility project is the culmination of a long history of DUF_6 management activities and events. To put the current project into context and provide perspective, this section provides a brief summary of this history. Additional background information on the storage and characteristics of DUF_6 and the DUF_6 cylinder inventory is provided in Section 1.2.

Uranium enrichment in the United States began as part of the atomic bomb development by the Manhattan Project during World War II. Enrichment for both civilian and military uses continued after the war under the auspices of the U.S. Atomic Energy Commission (AEC) and its successor agencies, including DOE. Three large gaseous diffusion plants (GDPs) were constructed to produce enriched uranium, first at the K-25 site (now called ETTP) and subsequently at Paducah and Portsmouth. The K-25 plant ceased operations in 1985, and the

Portsmouth plant ceased operations in 2001. The Paducah GDP continues to operate (see Section 1.1.1).

The DUF_6 produced during enrichment has been stored in large steel cylinders at all three gaseous diffusion plant sites since the 1950s. The cylinders are typically stacked two high and are stored outdoors on concrete or gravel yards. Figure 1.1-1 shows typical arrangements for storing cylinders.

1.1.1 Creation of USEC

In 1993, the U.S. government began the process of privatizing uranium enrichment services by creating the United States Enrichment Corporation (USEC), a wholly owned government corporation, pursuant to the *Energy Policy Act of 1992* (Public Law [P.L.] 102-186). The Paducah and Portsmouth GDPs were leased to USEC, but DOE retained responsibility for storage, maintenance, and disposition of about 46,422 DUF_6 cylinders produced before 1993 and located at the three gaseous diffusion plant sites (28,351 at Paducah, 13,388 at Portsmouth, and 4,683 at K-25). In 1996, the *USEC Privatization Act* (P.L. 104-134) transferred ownership of USEC from the government to private investors. This act provided for the allocation of USEC's liabilities between the U.S. government (including DOE) and the new private corporation, including liabilities for DUF_6 cylinders generated by USEC before privatization.

In May and June of 1998, USEC and DOE signed two memoranda of agreement (MOAs) regarding the allocation of responsibilities for depleted uranium generated by USEC after 1993 (DOE and USEC 1998a,b). The two MOAs transferred ownership of a total of 11,400 DUF_6 cylinders from USEC to DOE.

DUF_6 Management Time Line

1950–1993	DOE generates DUF_6 stored in cylinders at the ETTP, Portsmouth, and Paducah sites.
1985	K-25 (ETTP) GDP ceases operations.
1992	Ohio EPA issues Notice of Violation (NOV) to Portsmouth.
1993	USEC is created by P.L. 102-186.
1994	DOE initiates DUF_6 PEIS.
1995	DNFSB issues Recommendation 95-1, Safety of Cylinders Containing Depleted Uranium. DOE initiates UF_6 Cylinder Project Management Plan.
1996	USEC Privatization Act (P.L. 104-134) is enacted.
1997	DOE issues Draft DUF_6 PEIS.
1998	DOE and Ohio EPA reach agreement on NOV. Two DOE-USEC MOAs transfer 11,400 DUF_6 cylinders to DOE. P.L. 105-204 is enacted.
1999	DOE and TDEC enter consent order. DOE issues Final DUF_6 PEIS. DOE issues conversion plan in response to P.L. 105-204. DNFSB closes Recommendation 95-1. DOE issues Draft RFP for conversion services.
2000	DOE issues Final RFP for conversion services.
2001	DOE receives five proposals in response to RFP. DOE identifies three proposals in competitive range. DOE publishes NOI for site-specific DUF_6 Conversion EIS. DOE prepares environmental critique to support conversion services procurement process. Portsmouth GDP ceases operations. DOE holds public scoping meetings for the site-specific DUF_6 Conversion EIS.
2002	DOE-USEC agreement transfers 23,000 t (25,684 tons) of DUF_6 to DOE. P.L. 107-206 is enacted. DOE awards conversion services contract to UDS. DOE prepares environmental synopsis to support conversion services procurement process.
2003	DOE announces Notice of Change in NEPA Compliance Approach and issues the draft EIS. DOE issues draft site-specific conversion facility EISs.
2004	Final site-specific conversion facility EISs issued.

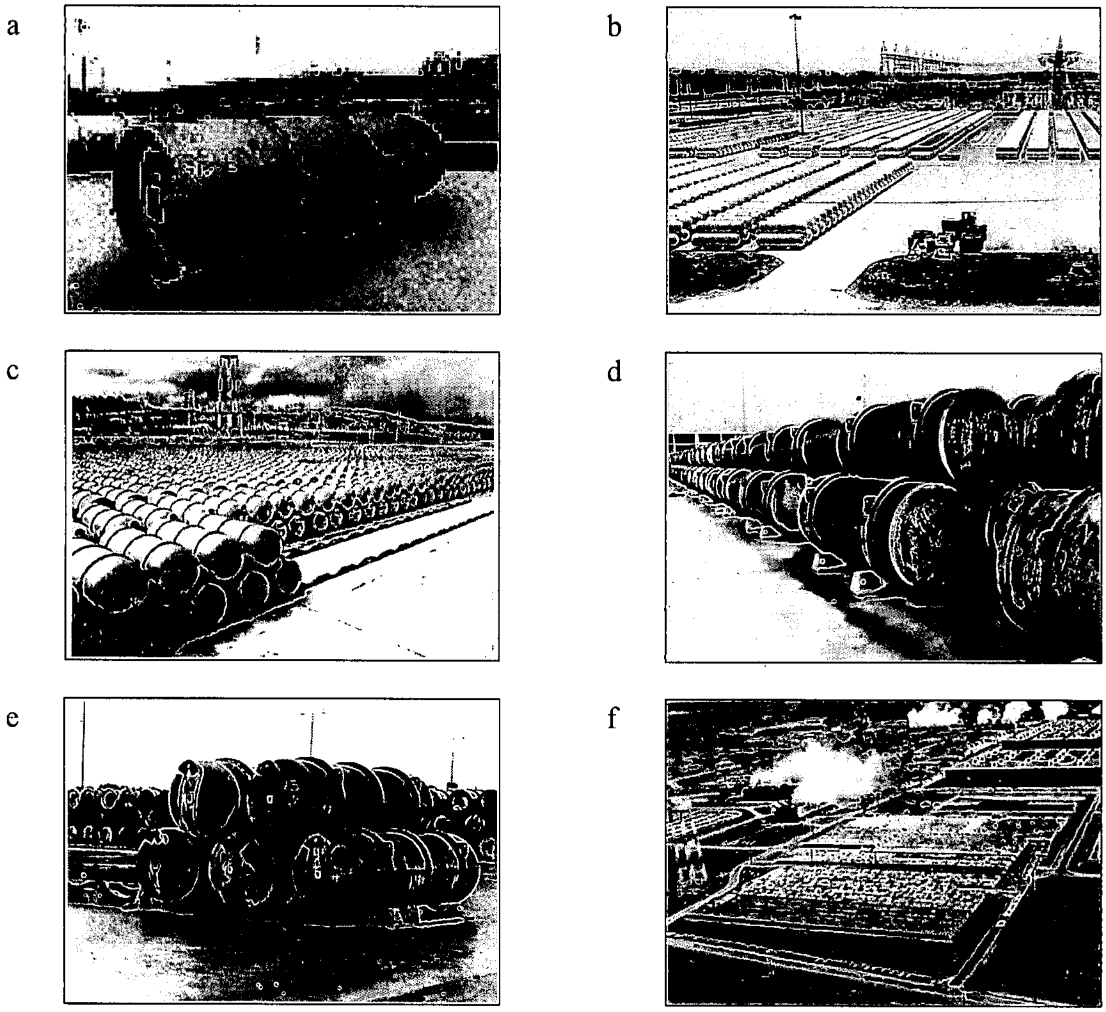

FIGURE 1.1-1 Storage of DUF_6 Cylinders: (a) Typical 14-ton (12-t) skirted cylinder. (b) New cylinder storage yard at the Paducah site. (c, d, e) Cylinders stacked two high on concrete chocks. (f) Cylinder yards at the Portsmouth site.

On June 17, 2002, DOE and USEC signed a third agreement (DOE and USEC 2002) to transfer up to 23,300 t (25,684 tons) of 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. While title to the DUF_6 is transferred to DOE under this agreement, custody and cylinder management responsibility remains with USEC until DOE requests that USEC deliver the cylinders for processing in the conversion facility.

1.1.2 Growing Concern over the DUF_6 Inventory

In May 1995, the Defense Nuclear Facilities Safety Board (DNFSB), an independent DOE oversight organization within the Executive Branch, issued Recommendation 95-1 regarding storage of the DUF_6 cylinders. This document advised that DOE should take three actions: (1) start an early program to renew the protective coating on cylinders containing DUF_6 from the historical production of enriched uranium, (2) explore the possibility of additional measures to protect the cylinders from the damaging effects of exposure to the elements as well as any additional handling that might be called for, and (3) institute a study to determine whether a more suitable chemical form should be selected for long-term storage of depleted uranium.

In response to Recommendation 95-1, DOE began an aggressive effort to better manage its DUF_6 cylinders, known as the *UF_6 Cylinder Project Management Plan* (Lockheed Martin Energy Systems, Inc. [LMES] 1997a). This plan incorporated more rigorous and more frequent inspections, a multiyear schedule for painting and refurbishing cylinders, and construction of concrete-pad cylinder yards. In December 1999, the DNFSB determined that DOE's implementation of the *UF_6 Cylinder Project Management Plan* was successful, and, as a result, on December 16, 1999, it closed Recommendation 95-1.

Several affected states also expressed concern over the DOE DUF_6 inventory. 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. The NOV stated that the 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 entered into discussions with the OEPA that continued through February 1998, when an agreement was reached. Ultimately, in February 1998, DOE and the OEPA agreed to set aside the issue of whether the DUF_6 is subject to state hazardous waste regulation and instituted a negotiated management plan governing the storage of the Portsmouth DUF_6. The agreement also requires DOE to continue its efforts to evaluate the 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 that 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, 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. The consent order further requires DOE to submit a plan, within 60 days of completing NEPA review of its long-term DUF_6 management strategy, that contains schedules for activities related to removal of cylinders from the ETTP site.

In Kentucky, a final Agreed Order between DOE and the Kentucky Natural Resources and Environmental Protection Cabinet concerning DUF_6 cylinder management was entered in October 2003. This Agreed Order requires that DOE provide the Kentucky Department of Environmental Protection with an inventory of all DUF_6 cylinders for which DOE has management responsibility at the Paducah site and, with regard to that inventory, that DOE implement the DUF_6 Cylinder Management Plan, which is Attachment 1 to the Agreed Order.

1.1.3 Programmatic NEPA Review and Congressional Interest

In 1994, DOE began work on a *Programmatic Environmental Impact Statement for Alternative Strategies for the Long-Term Management and Use of Depleted Uranium Hexafluoride* (DUF_6 PEIS) (DOE 1999a) (DOE/EIS-0269) to evaluate potential broad management options for DOE's DUF_6 inventory. Alternatives considered included continued storage of DUF_6 in cylinders at the gaseous diffusion plant sites or at a consolidated site, and the use of technologies for converting the DUF_6 to a more stable chemical form for long-term storage, use, or disposal. DOE issued the draft DUF_6 PEIS for public review and comment in December 1997 and held hearings near each of the three sites where DUF_6 is currently stored (Paducah, Kentucky; Oak Ridge, Tennessee; and Portsmouth, Ohio) and in Washington, D.C. In response to its efforts, DOE received some 600 comments.

In July 1998, while the PEIS was being prepared, the President signed into law P.L. 105-204. The text of P.L. 105-204 pertinent to the management of DUF_6 is as follows:

> *(a) PLAN. – The Secretary of Energy shall prepare, and the President shall include in the budget request for fiscal year 2000, a Plan and proposed legislation to ensure that all amounts accrued on the books of the United States Enrichment Corporation for the disposition of depleted uranium hexafluoride will be used to commence construction of, not later than January 31, 2004, and to operate, an onsite facility at each of the gaseous diffusion plants at Paducah, Kentucky, and Portsmouth, Ohio, to treat and recycle depleted uranium hexafluoride consistent with the National Environmental Policy Act.*

DOE began, therefore, to prepare a responsive plan while it proceeded with the PEIS.

On March 12, 1999, DOE submitted the plan to Congress; no legislation was proposed. In April 1999, DOE issued the final DUF_6 PEIS. The PEIS identified conversion of DUF_6 to another chemical form for use or long-term storage as part of the preferred management alternative. In the Record of Decision (ROD; *Federal Register*, Volume 64, page 43358 [64 FR 43358]), DOE decided to promptly convert the DUF_6 inventory to a more stable uranium oxide form (DOE 1999b). DOE also stated that it would use the depleted uranium oxide as much as possible and store the remaining depleted uranium oxide for potential future uses or disposal, as necessary. In addition, DUF_6 would be converted to depleted uranium metal only if uses for metal were available. DOE did not select a specific site or sites for the conversion facilities but reserved that decision for subsequent NEPA review. (This EIS is that site-specific review.)

Then, in July 1999, DOE issued the *Final Plan for the Conversion of Depleted Uranium Hexafluoride as Required by Public Law 105-204* (DOE 1999c). The Conversion Plan describes the steps that would allow DOE to convert the DUF_6 inventory to a more stable chemical form. It incorporates information received from the private sector in response to a DOE request for expressions of interest; ideas from members of the affected communities, Congress, and other interested stakeholders; and the results of the analyses for the final DUF_6 PEIS. The Conversion

Plan describes DOE's intent to chemically process the DUF_6 to create products that would present a lower long-term storage hazard and provide a material suitable for use or disposal.

1.1.4 DOE Request for Contractor Proposals and Site-Specific NEPA Review

DOE initiated the final Conversion Plan on July 30, 1999, and announced the availability of a draft Request for Proposals (RFP) for a contractor to design, construct, and operate DUF_6 conversion facilities at the Paducah and Portsmouth sites.

In early 2000, the RFP was modified to allow for a wider range of potential conversion product forms and process technologies than had been previously reviewed in the DUF_6 PEIS (the PEIS considered conversion to triuranium octaoxide [U_3O_8] and uranium dioxide [UO_2] for disposal and conversion to uranium metal for use). DOE stated that, if the selected conversion technology would generate a previously unconsidered product (e.g., depleted uranium tetrafluoride [UF_4]), DOE would review the potential environmental impacts as part of the site-specific NEPA review.

On October 31, 2000, DOE issued a final RFP to procure a contractor to design, construct, and operate DUF_6 conversion facilities at the Paducah and Portsmouth sites. The RFP stated that any conversion facilities that would be built would have to convert the DUF_6 within a 25-year period to a more stable chemical form that would be suitable for either beneficial use or disposal. The selected contractor would use its proposed technology to design, construct, and operate the conversion facilities for an initial 5-year period. Operation would include (1) maintaining the DUF_6 inventories and conversion product inventories; (2) transporting all UF_6 storage cylinders currently located at ETTP to a conversion facility at the Portsmouth site, as appropriate; and (3) transporting to an appropriate disposal site any conversion product for which no use was found. The selected contractor would also be responsible for preparing such excess material for disposal.

In March 2001, DOE announced the receipt of five proposals in response to the RFP, three of which proposed conversion to U_3O_8 and two of which proposed conversion to UF_4. In August 2001, DOE deemed three of these proposals to be within the competitive range; two conversion to U_3O_8 proposals and one conversion to UF_4 proposal.

On September 18, 2001, DOE published a Notice of Intent (NOI) in the *Federal Register* (66 FR 48123) announcing its intention to prepare an EIS for the proposed action to construct, operate, maintain, and decontaminate and decommission two DUF_6 conversion facilities at Portsmouth, Ohio, and Paducah, Kentucky. DOE held three scoping meetings to provide the public with an opportunity to present comments on the scope of the EIS and to ask questions and discuss concerns with DOE officials regarding the EIS. The scoping meetings were held in Piketon, Ohio, on November 28, 2001; in Oak Ridge, Tennessee, on December 4, 2001; and in Paducah, Kentucky, on December 6, 2001.

The alternatives identified in the NOI included a two-plant alternative (one at the Paducah site and another at the Portsmouth site), a one-plant alternative (only one plant would be built, at either the Paducah or the Portsmouth site), an alternative using existing UF_6 conversion capacity at commercial nuclear fuel fabrication facilities, and a no action alternative. For alternatives that involved constructing one or two new plants, DOE planned to consider alternative conversion technologies, local siting alternatives within the Paducah and Portsmouth site boundaries, and the shipment of DUF_6 cylinders stored at ETTP to either the Portsmouth site or to the Paducah site. The technologies to be considered in the EIS were those submitted in response to the October 2000 RFP, plus any other technologies that DOE believed must be considered.

1.1.5 Public Law 107-206 Passed by Congress

During the site-specific NEPA review process, Congress acted again regarding DUF_6 management, and on August 2, 2002, the President signed the *2002 Supplemental Appropriations Act for Further Recovery from and Response to Terrorist Attacks on the United States* (P.L. 107-206). The pertinent part of P.L. 107-206 had several requirements: that no later than 30 days after enactment, DOE must select for award of a contract for the scope of work described in the October 2000 RFP, including design, construction, and operation of a DUF_6 conversion facility at each of the Department's Paducah, Kentucky, and Portsmouth, Ohio, gaseous diffusion sites; that the contract require groundbreaking for construction to occur no later than July 31, 2004; that the contract require construction to proceed expeditiously thereafter; that the contract include as an item of performance the transportation, conversion, and disposition of DU contained in cylinders located at ETTP, consistent with environmental agreements between the state of Tennessee and the Secretary of Energy; and that no later than 5 days after the date of groundbreaking for each facility, the Secretary of Energy shall submit to Congress a certification that groundbreaking has occurred. The relevant portions of the Appropriations Act are set forth in Appendix A.

In response to P.L. 107-206, on August 29, 2002, DOE awarded a contract to Uranium Disposition Services, LLC (hereafter referred to as UDS) for construction and operation of two conversion facilities. DOE also reevaluated the appropriate scope of its site-specific NEPA review and decided to prepare two separate EISs, one for the plant proposed for the Paducah site and a second for the Portsmouth site. This change was announced in the *Federal Register* Notice of Change in NEPA Compliance Approach published on April 28, 2003 (68 FR 22368).

The two draft site-specific conversion facility EISs were mailed to stakeholders in late November 2003, and a notice of availability was published by the EPA in the *Federal Register* on November 28, 2003 (68 FR 66824). Comments on the draft EISs were accepted during a 67-day review period, from November 28, 2003, until February 2, 2004. Public hearings on the draft EISs were held near Portsmouth, Ohio, on January 7, 2004; Paducah, Kentucky, on January 13, 2004; and Oak Ridge, Tennessee, on January 15, 2004. (Section 1.6.3 provides additional information on the public review of the draft EISs).

1.2 CHARACTERISTICS OF DUF_6

DUF_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 that the proportion of the uranium-235 isotope found in natural uranium, which is approximately 0.7% by weight (wt%), be increased through an isotopic separation process. To achieve this increase, a uranium-235 enrichment process called gaseous diffusion is 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 gaseous form for processing, in liquid form for filling or emptying containers, and in solid form for storage. Solid UF_6 is a white, dense, crystalline material that resembles rock salt.

Depleted uranium is uranium that, through the enrichment process, has been stripped of a portion of the uranium-235 that it once contained so that its proportion is lower than the 0.7 wt% found in nature. The uranium in most of DOE's DUF_6 has between 0.2 wt% and 0.4 wt% uranium-235.

The chemical and physical characteristics of DUF_6 pose potential health risks, and the material is handled accordingly. Uranium and its decay products in DUF_6 emit low levels of alpha, beta, gamma, and neutron radiation. The radiation levels measured on the outside surface of filled DUF_6 storage cylinders are typically about 2 to 3 millirem per hour (mrem/h), decreasing to about 1 mrem/h at a distance of 1 ft (0.3 m). If DUF_6 is released to the atmosphere, it reacts with water vapor in air to form HF and a uranium oxyfluoride compound called uranyl fluoride (UO_2F_2), which can be harmful to human health if inhaled or ingested in sufficient quantities. Uranium is a heavy metal that, in addition to being radioactive, can have harmful chemical effects (primarily on the kidneys) if it enters the bloodstream by means of ingestion or inhalation. HF is an extremely corrosive gas that can

Cylinder-Related Terms Used in This EIS

Types of UF_6

UF_6	A chemical composed of one atom of uranium combined with six atoms of fluorine. UF_6 is a volatile white crystalline solid at ambient conditions.
Normal UF_6	UF_6 made with uranium that contains the isotope uranium-235 at a concentration equal to that found in nature, that is, 0.7% uranium-235.
DUF_6	UF_6 made with uranium that contains the isotope uranium-235 in concentrations less than the 0.7% found in nature. In general, the DOE DUF_6 contains between 0.2% and 0.4% uranium-235.
Enriched UF_6	UF_6 made with uranium containing more than 0.7% uranium-235. In general, DOE enriched UF_6 considered in this EIS contains less than 5% uranium-235.
Reprocessed UF_6	UF_6 made with uranium that was previously irradiated in a nuclear reactor and chemically separated during reprocessing.

Types of Cylinders

Full DUF_6	Cylinders filled to 62% of their volume with DUF_6 (some cylinders are slightly overfilled).
Partially full	Cylinders that contain more than 50 lb (23 kg) of DUF_6 but less than 62% of their volume.
Heel	Cylinders that contain less than 50 lb (23 kg) of residual nonvolatile material left after the DUF_6 has been removed.
Empty	Cylinders that have had the DUF_6 and heel material removed and contain essentially no residual material.
Feed	Cylinders used to supply UF_6 into the enrichment process. Most feed cylinders contain natural UF_6, although some historically contained reprocessed UF_6.
Non-DUF_6	A term used in this EIS to refer to cylinders that contain enriched UF_6 or normal UF_6.

damage the lungs and cause death if inhaled at high enough concentrations. In light of such characteristics, DOE stores DUF_6 in a manner designed to minimize the risk to workers, the public, and the environment.

DUF_6 has been stored at all three storage sites since the 1950s in large steel cylinders. Several different cylinder types are in use, although the vast majority of cylinders have a 14-ton (12-t) capacity. (Typical cylinders in storage are shown in Figure 1.1-1.) The cylinders with a 14-ton (12-t) capacity are 12 ft (3.7 m) long by 4 ft (1.2 m) in diameter; most have a steel wall that is 5/16 in. (0.79 cm) thick. The cylinders have external stiffening rings that provide support. Lifting lugs for handling are attached to the stiffening rings. A small percentage of the cylinders have skirted ends (extensions of the cylinder walls past the rounded ends of the cylinder), as shown in Figure 1.1-1. Each cylinder has a single valve for filling and emptying located on one end at the 12 o'clock position. Similar but slightly smaller cylinders with a capacity of 10 tons (9 t) are also in use. Most of the cylinders were manufactured in accordance with an American National Standards Institute standard (ANSI N14.1, *American National Standard for Nuclear Materials — Uranium Hexafluoride — Packaging for Transport*) as specified in 49 CFR 173.420, the federal regulations governing transport of DUF_6.

1.2.1 Cylinder Inventory

This EIS considers conversion of the DUF_6 inventory stored at the Portsmouth site for which DOE has management responsibility, as well as conversion of the DUF_6 stored at ETTP after it has been shipped to Portsmouth. Statistics on the cylinders managed by DOE at the Portsmouth and ETTP sites as of January 26, 2004, are summarized in Table 1.1-1. The EIS considers the conversion of about 21,000 cylinders containing 250,000 t (275,000 tons) of DUF_6. In addition, this EIS considers the transportation to Portsmouth of about 1,100 cylinders from ETTP that contain enriched UF_6 or normal UF_6 (collectively called "non-DUF_6" cylinders in this EIS) or are empty. The management of these non-DUF_6 cylinders, along with the non-DUF_6 cylinders currently at Portsmouth, is also included; however, they would not be processed in the conversion facility.

The conversion facility proposed for Portsmouth is designed to convert 13,500 t (14,881 tons) of DUF_6 per year (approximately 1,000 cylinders per year). At that rate of throughput, it will take approximately 18 years to convert the Portsmouth and ETTP cylinder inventories.

In addition to the Portsmouth and ETTP inventories, approximately 36,200 cylinders are managed at the Paducah site. Construction and operation of a conversion facility at the Paducah site for conversion of the Paducah inventory is the subject of a separate EIS (DOE 2004a).

As shown in Table 1.1-1, the total number of non-DUF_6 cylinders is 2,693 at Portsmouth and 1,102 at ETTP. The non-DUF_6 cylinders contain a total of approximately 13,545 t (14,900 tons) of UF_6 (26 t [29 tons] of enriched UF_6 plus 13,519 t [14,871 tons] of normal UF_6) (Hightower 2004). Nearly 100% of the Portsmouth enriched UF_6 and over 98% of the ETTP

TABLE 1.1-1 Inventory of DOE UF_6 Cylinders Considered in This EIS[a]

Location	No. of Cylinders	Weight of UF_6 (t)
Portsmouth – DUF_6	16,109	195,800
Non-DUF_6		
Enriched UF_6	1,444	19
Normal UF_6	1,249	13,500
Empty	485	0
ETTP[b] – DUF_6	4,822	54,300
Non-DUF_6		
Enriched UF_6	881	7
Normal UF_6	221	19
Empty	20	0
Total		
DUF_6	20,931	250,100
Non-DUF_6	3,795	13,544
Empty	505	0

[a] As of January 26, 2004 (Hightower 2004).

[b] The proposed action calls for shipment of the ETTP cylinders to Portsmouth.

enriched UF_6 contains less than 5% uranium-235. This EIS considers the shipment of the ETTP non-DUF_6 cylinders to Portsmouth. It is assumed that the normal UF_6 and enriched UF_6 from both sites would be put to beneficial uses; therefore, conversion of the contents of the non-DUF_6 cylinders is not considered.

Although the current proposal is to ship all the cylinders at ETTP to Portsmouth, this EIS does consider an option of shipping the ETTP cylinders to Paducah. If the ETTP cylinders were shipped to Paducah, the Portsmouth conversion facility would operate for approximately 14 years rather than 18 to convert the DUF_6 cylinders.

The evaluation of the no action alternative in this EIS is based on the assessment conducted for the PEIS, which was revised to reflect updated information. To account for uncertainties related to the amount of USEC-generated DUF_6 to be managed in the future, the PEIS analysis used for this EIS assumed that a total of approximately 16,400 DUF_6 cylinders at the Portsmouth site would need to be managed.

Several reasonably foreseeable activities could potentially result in a future increase in the number of DUF_6 cylinders for which DOE has management responsibility. These include potential transfers of DUF_6 to DOE from continued USEC gaseous diffusion plant operations at Paducah; from a future USEC advanced enrichment technology plant at Portsmouth, Paducah, or elsewhere; and from some unspecified future commercial uranium enrichment facility licensed and operated in the United States. Such an inventory increase could result in a future decision to extend conversion facility operations or expand throughput at one or both of the conversion facility sites. An option of expanding operations at the conversion facility is considered in the EIS, as discussed in detail in Section 2.2.7 and in the assessment of impacts presented in Chapter 5.

1.2.2 Cylinder Condition and Potential Contamination

As the inventory of DUF_6 cylinders ages, some cylinders have begun to show evidence of external corrosion. As of August 2002, at all three storage sites combined, 11 cylinders had developed holes (breaches) (see text box). The majority of these breaches were the result of handling damage during stacking or handling damage followed by corrosion. Only 2 of 11 breaches are believed to have resulted from corrosion alone. At Portsmouth, a total of three cylinder breaches have occurred. Five breaches have occurred at ETTP. (The remaining three breaches have occurred at Paducah.) However, since DUF_6 is solid at ambient temperatures and pressures, it is not readily released after a cylinder leak or breach. When a cylinder is breached, moist air reacts with the exposed solid DUF_6 and iron, forming a dense plug of solid uranium and iron compounds and a small amount of HF gas. The plug limits the amount of material released from a breached cylinder. When a cylinder breach is identified, the cylinder is typically repaired or its contents are transferred to a new cylinder.

Because reprocessed uranium was enriched in the early years of gaseous diffusion, some of the DUF_6 inventory is contaminated with small amounts of technetium (Tc) and the transuranic (TRU)

Summary Data for Breached Cylinders at the Storage Sites through 2003

Portsmouth Site, three breached cylinders: Two identified in 1990 were initiated by mechanical damage during stacking; the damage was not noticed immediately, and subsequent corrosion occurred at the point of damage. The largest breach size was about 9 in. × 18 in. (23 cm × 46 cm); the estimated mass of DUF_6 lost was between 17 and 109 lb (7.7 and 49 kg). The next largest cylinder breach had an area of about 2 in. (5.1 cm) in diameter; the estimated DUF_6 lost was less than 4 lb (1.8 kg). The third breached cylinder occurred in 1996 and was the result of handling equipment knocking off a cylinder plug.

ETTP Site, five breached cylinders: Four were identified in 1991 and 1992. Two of these were initiated by mechanical damage during stacking, and two were caused by external corrosion due to prolonged ground contact. The breach areas for these four cylinders were about 2 in. (5.1 cm), 6 in. (15 cm), and 10 in. (25 cm) in diameter for three circular breaches, and 17 in. × 12 in. for a rectangular-shaped breach. The mass of material loss from the cylinders could not be estimated because equipment to weigh the cylinders was not available at the ETTP site. The fifth breach occurred in 1998 and was caused by steel grit blasting, which resulted in a breach at the location of an as-fabricated weld defect (immediately repaired without loss of DUF_6).

Paducah Site, three breached cylinders: One identified in 1992 was initiated by mechanical damage during stacking. The breached area was about 0.06 in. × 2 in. (0.16 cm × 5.1 cm). Estimated material loss was 0. The other two cylinder breaches were identified as breached because of missing cylinder plugs; they were identified between 1998 and 2002. Material loss from these cylinders was not estimated.

elements plutonium (Pu), neptunium (Np), and americium (Am). In 2000, DOE, on the basis of existing process knowledge and results from additional sampling of cylinders, characterized the TRU and Tc contamination in the DUF_6 cylinders. As indicated in a report by Oak Ridge National Laboratory (ORNL) (Hightower et al. 2000), nondetectable or very low levels of TRU elements were found to be dispersed in the DUF_6 stored in the cylinders. However, higher levels of TRU elements, associated with the "heels" remaining in a small number of cylinders formerly used to store reprocessed uranium, are expected to occur. (The term "heel" refers to the residual amount of nonvolatile material left in a cylinder following removal of the DUF_6, typically less than 50 lb [23 kg].) The final RFP for providing conversion services concluded that any DUF_6 contaminated with TRU elements and Tc at the concentrations expected to be encountered could be safely handled in a conversion facility. The data and assumptions used in this EIS to evaluate potential impacts from the DUF_6 contaminated with Tc and TRU elements are described in Appendix B.

Some of the cylinders manufactured before 1978 were painted with coatings containing polychlorinated biphenyls (PCBs). (Although PCBs are no longer in production in the United States, from the 1950s to the late 1970s, PCBs were added to some paints as fungicides and to increase durability and flexibility.) The long persistence of PCBs in the environment and the tendency for bioaccumulation in the foodchain has resulted in regulations to prevent their release and distribution in the environment. As a result, the cylinders with PCB-containing coatings may require special measures during transport, such as bagging, to ensure that PCB-containing paint chips are not released. Additionally, environmental monitoring and maintenance of cylinder storage and process areas may be required to ensure that PCBs are not released during storage or processing. Potential issues associated with PCB-containing cylinder coatings are discussed in Appendix B. As discussed in Appendix B, the presence of PCBs in the coatings of some cylinders is not expected to result in health and safety risks to workers or the public.

1.3 PURPOSE AND NEED

DOE needs to convert its inventory of DUF_6 to a more stable chemical form for use or disposal. This need follows directly from (1) the decision presented in the August 1999 ROD for the PEIS, namely, to begin conversion of the DUF_6 inventory as soon as possible, and (2) P.L. 107-206, which directs DOE to award a contract for construction and operation of conversion facilities at both the Paducah site and the Portsmouth site.

1.4 PROPOSED ACTION

The proposed action evaluated in this EIS is to construct and operate a conversion facility at the Portsmouth site for conversion of the Portsmouth and ETTP DUF_6 inventories into depleted uranium oxide (primarily U_3O_8) and other conversion products. The proposed action includes the shipment of DUF_6 and non-DUF_6 cylinders from the ETTP site to Portsmouth and the construction of a new cylinder storage pad at Portsmouth for the ETTP cylinders, if required. The time period considered is a construction period of approximately 2 years, an operational period of 18 years, and a 3-year period for D&D of the facility.

This EIS assesses the potential environmental impacts from the following proposed activities:

- Construction, operation, maintenance, and D&D of the proposed DUF_6 conversion facility at the Portsmouth site;
- Transportation of DUF_6 cylinders from ETTP to Portsmouth for conversion, as well as transportation of the non-DUF_6 cylinders from ETTP to Portsmouth;
- Construction of a new cylinder storage yard (if required) for ETTP cylinders;
- Transportation of uranium conversion products and waste materials to a disposal facility;
- Transportation and sale of the HF produced as a co-product of conversion; and
- Neutralization of HF to CaF_2 and its sale or disposal in the event that the HF product is not sold.

Three alternative locations for the conversion facility within the Portsmouth site are considered. In addition, this EIS includes an evaluation of the impacts that would result from a no action alternative (i.e., continued DUF_6 cylinder storage at the Portsmouth and ETTP sites).

1.5 DOE DUF_6 MANAGEMENT PROGRAM

In fiscal year (FY) 2001, the responsibility for all uranium program activities was transferred from DOE's Office of Nuclear Energy, Science, and Technology (NE) to its Office of Environmental Management (EM). All activities related to this program are managed by DOE's Lexington Office. The uranium program supports important government activities associated with the federal enrichment program that were not transferred to USEC under the provisions of the National Energy Policy Act of 1992 (P.L. 102-486), including management of highly enriched uranium; management of the facilities at the Paducah and Portsmouth sites; responsibility for preexisting liabilities; management of DOE's inventories of DUF_6 and other surplus uranium; and oversight of the construction of DUF_6 conversion facilities.

Within the uranium program is DOE's DUF_6 management program, whose mission is to safely and efficiently manage DOE's inventory of DUF_6 in a way that protects the health and safety of workers and the public and protects the environment until the DUF_6 is either used or disposed of. In addition to the conversion activities that are the subject of this EIS, the DUF_6 management program involves two other primary activities: (1) surveillance and maintenance of cylinders and (2) development of beneficial uses for depleted uranium.

Since it may take 25 years to convert the DUF_6 in the inventory to a more stable chemical form, DOE intends to ensure the continued surveillance and maintenance of the DUF_6 cylinders currently in storage. Day-to-day management includes actions designed to cost-effectively improve cylinder storage conditions, such as:

- Performing regular inspections and general maintenance of cylinders and storage yards, including:
    - Restacking and respacing the cylinders to improve drainage and allow for more thorough inspections,
    - Repainting cylinder bodies and the ends of skirted cylinders as needed to arrest corrosion, and
    - Constructing new concrete cylinder storage yards and reconditioning existing yards from gravel to concrete to improve storage conditions.
- Performing routine cylinder valve surveys and maintenance.

DOE is committed to exploring the safe, beneficial use of depleted uranium and other materials that result from the conversion of DUF_6 (e.g., HF and empty carbon steel cylinders) in order to conserve more resources and increase savings over levels achieved through disposal. Accordingly, a DOE research and development (R&D) program on uses for depleted uranium has been initiated. This program is exploring the risks and benefits associated with several uses for depleted uranium, such as a radiation shielding material, a catalyst, and a semiconductor material in electronic devices. More information about DOE's R&D on depleted uranium uses is available on the *Depleted UF_6 Management Program Information Network* Web site (http://web.ead.anl.gov/uranium). In addition, in the RFP for conversion services, DOE requested that the bidders investigate and propose viable uses for the conversion products.

1.6 SCOPE

The scope of an EIS refers to the range of actions, alternatives, and impacts it considers. An agency generally determines the scope of an EIS through a two-part process: internal scoping and public scoping. Internal scoping refers to the agency's efforts to identify potential alternatives and important issues and to determine which analyses to include in an EIS. Public scoping refers to the agency's request for public comments on the proposed action and on the results from its internal scoping. It involves consultations with federal, state, and local agencies as well as requests for comments from stakeholder organizations and members of the general public. The EIS scoping process provides a means for the public to provide input into the decision-making process. DOE is committed to ensuring that the public has ample opportunity to participate in the review. This section summarizes the public scoping conducted for this EIS (Section 1.6.1), discusses the range of issues and alternatives that resulted from the internal and public scoping process (Section 1.6.2), and summarizes the public review of the draft EIS (Section 1.6.3).

1.6.1 Public Scoping Process for This Environmental Impact Statement

On September 18, 2001, DOE published a NOI in the *Federal Register* (66 FR 48123) announcing its intention to prepare an EIS for a proposal to construct, operate, maintain, and decontaminate and decommission DUF_6 conversion facilities at Portsmouth, Ohio, and/or Paducah, Kentucky. The purpose of the NOI was to encourage early public involvement in the EIS process and to solicit public comments on the proposed scope of the EIS, including the issues and alternatives it would analyze. To facilitate public comments, the NOI included a detailed discussion of the project background, a list of the preliminary alternatives and environmental impacts that DOE proposed to evaluate in the EIS, and a project schedule. The NOI announced that the scoping period for the EIS would be open until November 26, 2001. The scoping period was later extended to January 11, 2002.

During the scoping process, the public was given six ways to submit comments on the DUF_6 proposal to DOE:

1. Attendance at public scoping meetings held in Piketon, Ohio; Oak Ridge, Tennessee; and Paducah, Kentucky;

2. Traditional mail delivery;

3. Toll-free facsimile transmission;

4. Toll-free voice message;

5. Electronic mail; and

6. Directly through the *Depleted UF_6 Management Information Network* Web site on the Internet (http://web.ead.anl.gov/uranium).

Numerous ways to communicate about issues and submit comments were provided to encourage maximum participation. All comments, regardless of how they were submitted, received equal consideration.

A total of approximately 100 individuals attended the three scoping meetings, and 20 of these individuals provided oral comments. Individuals in attendance included federal officials, state regulators, local officials, site oversight committee members, representatives of interested companies, members of local media, and private individuals. In addition, about 20 individuals and organizations provided comments through the other means available (fax, telephone, mail, e-mail, and Web site). Some of the comments received through these other means were duplicates of comments made at the scoping meetings. During the scoping period (September 18, 2001, through January 11, 2002), the *Depleted UF_6 Management Information Network* Web site was used a great deal; a total of 64,366 pages were viewed (averaging 554 per day) during 9,983 user sessions (averaging 85 per day) by 4,784 unique visitors.

Approximately 140 comments were received from about 30 individuals and organizations during the scoping period. Appendix C of this EIS provides a summary of these comments. These comments were examined to finalize the proposed scope of this EIS. Comments were related primarily to five major issues: (1) DOE policy; (2) alternatives; (3) cylinder inventory, maintenance, and surveillance; (4) transportation; and (5) general environmental concerns.

Most of the comments made during the public scoping period were related to issues that DOE was already planning to discuss in this EIS. Such comments helped to clarify the need for addressing those issues. However, a few issues were raised that DOE was not able to address in this EIS. These issues and the reasons why they are not addressed are summarized below.

- A request was made to clean up the Portsmouth site before building another facility there. Activities related to remediation of the site are considered in the cumulative impacts section of this EIS. However, waiting until all remediation activities have been completed to start construction of the conversion facility would not be consistent with the requirements of P.L. 107-206.

- One commentor stated that DOE should not consider any alternatives other than the two conversion plants alternative because Congress had mandated that two plants be built: one at Paducah and one at Portsmouth. NEPA requires that the no action alternative be one of the alternatives considered. Therefore, the no action alternative has been included in this EIS.

- A request was made to designate specific routes and perform route-specific risk analyses for transporting the ETTP cylinders to Portsmouth. Specific routes will not be known until the selected contractor is ready to ship the cylinders from ETTP. The exact routes will be determined on the basis of the shipment mode selected (truck or rail), applicable regulations, and other factors, as appropriate. Before the shipments occur, a transportation plan will be coordinated with the appropriate regulatory agencies. However, this EIS does present an evaluation of transportation risks for representative routes that were identified by using route prediction models for truck and rail modes.

- Requests were made to analyze the impacts associated with the use of conversion products. As described further below, no large-scale uses of the depleted uranium conversion product have been identified, and current plans assume disposal of the material. The DUF_6 PEIS (DOE 1999a) analyzed the generic impacts associated with the manufacture of waste containers using depleted uranium and depleted UO_2. Impacts associated with actual use of any depleted uranium products will be analyzed if specific uses are identified and any necessary licenses, permits, or exemptions are obtained. This EIS does evaluate impacts associated with the potential sale and use of fluoride-containing conversion products (i.e., HF and CaF_2).

1.6.2 Scope of This Environmental Impact Statement

In response to the congressional mandate to build conversion plants at the Portsmouth and Paducah sites (P.L. 107-206), DOE reevaluated the appropriate scope of its NEPA review and decided to prepare two separate site-specific EISs in parallel; one EIS for the facility proposed for the Paducah site and a second EIS for the Portsmouth site. This change in approach was announced in a *Federal Register* Notice published on April 28, 2003 (DOE 2003b).

This EIS addresses the potential environmental impacts at Portsmouth from the construction, operation, maintenance, and D&D of the proposed conversion facility; from the transportation of the ETTP cylinders to Portsmouth; from the transportation of depleted uranium conversion products to a disposal facility; and from the transportation, sale, use, or disposal of the fluoride-containing conversion products (HF or CaF_2). Three alternative locations within the Portsmouth site are evaluated for the conversion facility. An option of shipping the ETTP cylinders to Paducah for conversion is also considered. In addition, this EIS evaluates a no action alternative, which assumes continued storage of DUF_6 in cylinders at the Portsmouth and ETTP sites. Additional details are provided in the sections below.

1.6.2.1 Alternatives

The alternatives that are evaluated and compared in this EIS include a no action alternative and three action alternatives that focus on where to site the conversion facility within the Portsmouth site:

1. *No Action Alternative.* Under the no action alternative, conversion would not occur. Current cylinder management activities (handling, inspection, monitoring, and maintenance) would continue, so the status quo would be maintained at Portsmouth and ETTP indefinitely, consistent with the *UF_6 Cylinder Project Management Plan* (LMES 1997a) and the Ohio and Tennessee consent orders, which cover actions needed to meet safety and environmental requirements.

2. *Action Alternatives.* The proposed action considers the construction and operation of a conversion facility at the Portsmouth site. Three alternative locations within the site are evaluated (Locations A [preferred], B, and C, which are defined in Chapter 2). The proposed action includes the transportation of the cylinders currently stored at the ETTP site to Portsmouth. In addition, an option of transporting the ETTP cylinders to Paducah is considered, as well as an option of expanding conversion facility operations.

These alternatives and options, as well as the alternatives that were considered but not evaluated in detail, are described more fully in Chapter 2.

1.6.2.2 Depleted Uranium Conversion Technologies and Products

As noted in Section 1.1.5, DOE awarded a conversion services contract to UDS on August 29, 2002. The proposed UDS facility would convert DUF_6 to a mixture of depleted uranium oxides (primarily U_3O_8), a form suitable for disposal if uses are not identified. In addition to depleted U_3O_8, the UDS conversion facility would produce aqueous HF, which is a product that has commercial value and could potentially be sold for industrial use. The evaluation of the proposed action in this EIS is based on the proposed UDS conversion technology and facility design, which is described in Section 2.2.

The conversion project RFP did not specify the conversion product technology or form. Three proposals submitted in response to the RFP were deemed to be in the competitive range; two of these proposals involved conversion of DUF_6 to U_3O_8 and the third involved conversion to depleted UF_4. Potential environmental impacts associated with these proposals were considered during the procurement process, which involved the preparation of an environmental critique and environmental synopsis that were prepared in accordance with the requirements of 10 CFR 1021.216.

The environmental critique, which contains proprietary information, focuses on environmental issues pertinent to a decision among the proposals within the competitive range and includes a discussion of the purpose of the procurement and each offer, a discussion of the salient characteristics of each offer, and a comparative evaluation of the environmental impacts of the offers. The environmental synopsis is a summary document based on the environmental critique; it does not include proprietary information. The synopsis documents the evaluation of potential environmental impacts associated with the proposals in the competitive range and does not contain procurement-sensitive information. The environmental synopsis is presented in Appendix D.

The environmental synopsis concludes that, on the basis of the assessment of potential environmental impacts presented in the critique, no proposal was 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. In addition, the potential environmental impacts associated with the proposals were found to be similar to, and generally less than, those presented in the DUF_6 PEIS (DOE 1999a) for representative conversion technologies.

1.6.2.3 Transportation Modes

This EIS considers shipping the cylinders at ETTP to Portsmouth, including DUF_6 and non-DUF_6 cylinders. This EIS considers several transportation methods for preparing the DUF_6 and non-DUF_6 cylinders and shipping them to the conversion facility. Many of the cylinders currently stored at ETTP do not meet U.S. Department of Transportation (DOT) requirements for shipment without some type of preparation first. The DUF_6 PEIS (DOE 1999a) and a separate transportation impact assessment (Biwer et al. 2001) contain detailed information on cylinder conditions, regulations, and preparation methods. As described in detail in Section 2.2.4, three options for preparing noncompliant cylinders are considered in this EIS: (1) use of overpacks, certified to meet DOT shipping requirements, into which cylinders could be placed; (2) use of a cylinder transfer facility, in which the UF_6 contents could be transferred from noncompliant cylinders to compliant ones; and (3) obtaining an exemption from DOT allowing the cylinders to be shipped "as-is" or following repairs. This EIS also considers the transportation of conversion products to a user or disposal facility. Transportation of DUF_6 cylinders and conversion products by two modes, truck and train, are analyzed in this EIS.

1.6.2.4 Conversion Product Disposition

As noted, the products of the DUF_6 conversion process would consist of depleted U_3O_8 and HF. DOE has been working with industrial and academic researchers for several years to identify potential uses for both products. Some potential uses for depleted uranium exist or are being developed, and DOE believes that a viable market exists for the HF generated during conversion. To take advantage of these to the extent possible, DOE requested in the RFP that the bidders for conversion services investigate and propose viable uses.

Currently, there are several uses for depleted uranium, including (1) reactor fuel in breeder reactors; (2) conventional military applications, such as tank armor and armor-piercing projectiles; (3) biological shielding, which provides protection from x-rays or gamma rays; and (4) counterweights for use in aircraft applications. One characteristic of all these applications is that the amount of depleted uranium that they require is small, and existing demand can be met by depleted uranium stocks separate from the DUF_6 considered in this EIS; thus, these applications do not and are not expected to have a significant effect on the inventory of depleted uranium contained in the DOE DUF_6 inventory.

In the RFP, DOE acknowledges that uses for much of the depleted uranium may not be found, thus requiring that it be dispositioned as low-level radioactive waste (LLW). In its proposal, UDS confirmed that widescale applications of the depleted U_3O_8 conversion product are not currently available and that the material will likely require disposal. Studies conducted by ORNL for DOE indicate that both the Nevada Test Site (NTS) (a DOE facility) and Envirocare of Utah, Inc. (a commercial facility) are potential disposal facilities for depleted uranium (Croff et al. 2000a,b). These studies included reviews of the LLW acceptance programs and disposal capacities of both NTS and Envirocare of Utah, Inc. It was concluded that either facility would have the capacity needed to dispose of the U_3O_8 product from the proposed DOE DUF_6 conversion program, and that the U_3O_8 material to be sent to these facilities would likely meet each site's waste acceptance criteria. In its proposal to design, construct, and operate the DUF_6 conversion facilities, UDS provided evidence that both sites can presently accept the U_3O_8 and identified the Envirocare facility as the primary disposal site and NTS as the secondary disposal site.

Shipments of depleted U_3O_8 to a disposal facility are expected to begin shortly after conversion facility operations commence, currently planned for late 2006. The conversion facilities are being designed with a short-term storage capacity of 6 months' worth of depleted uranium conversion products. This storage capacity is being provided in order to accommodate potential delays in disposal activities without affecting conversion operations. If a delay was to extend beyond 6 months, DOE would evaluate possible options and conduct appropriate NEPA review for those options.

This EIS evaluates the impacts from packaging, handling, and transporting depleted U_3O_8 from the conversion facility to disposal sites that would be (1) selected in a manner consistent with DOE policies and orders and (2) authorized or licensed to receive the conversion products by DOE (in conformance with DOE orders), the U.S. Nuclear Regulatory Commission (NRC; in conformance with NRC regulations), or an NRC Agreement State agency (in conformance with state laws and regulations determined to be equivalent to NRC regulations). Assessment of the impacts and risks from on-site handling and disposal at the LLW disposal facility are deferred to the disposal site's site-specific NEPA or licensing documents. DOE plans to decide the specific disposal location(s) for the depleted U_3O_8 conversion product after additional appropriate NEPA review. Accordingly, DOE will continue to evaluate its disposal options and will consider any further information or comments relevant to that decision. DOE will give a minimum 45-day notice before making the specific disposal decision and will provide any supplemental NEPA analysis for public review and comment.

In addition, UDS believes that aqueous HF generated during conversion is a valuable commercial commodity that could be readily sold for industrial use. Thus, this EIS evaluates impacts associated with HF sale and use. To account for the possibility that uses for HF will not be identified, this EIS also evaluates a contingency for the neutralization of HF to the unreactive solid CaF_2 for sale or disposal.

1.6.2.5 Human Health and Environmental Issues

This EIS evaluates and compares the potential impacts on human health and the environment at the Portsmouth site under the alternatives and options described above. In general, this EIS emphasizes those impacts that might differ under the various alternatives and those impacts that would be of special interest to the general public (such as potential radiation effects).

This EIS includes assessments of impacts on human health and safety, air, water, soil, biota, socioeconomics, cultural resources, site waste management capabilities, resource requirements, and environmental justice. Impacts judged by DOE to be of the greatest concern or public interest and to receive more detailed analysis include impacts on human health and safety, air and water, waste management capabilities, and socioeconomics. These issues are consequently treated in greater detail in this EIS.

The process of estimating environmental impacts from the conversion of DUF_6 is subject to some uncertainty because final facility designs are not yet available. In addition, the methods used to estimate impacts have uncertainties associated with their results. This EIS impact assessment was designed to ensure — through the selection of assumptions, models, and input parameters — that impacts would not be underestimated and that relative comparisons among the alternatives would be valid and meaningful. This approach was developed by uniformly applying common assumptions to each alternative and by choosing assumptions intended to produce conservative estimates of impacts — that is, assumptions that would lead to overestimates of the expected impacts. Although uncertainty may characterize estimates of the absolute magnitude of impacts, a uniform approach to impact assessment enhances the ability to make valid comparisons among alternatives. This uniform approach was implemented in the analyses conducted for this EIS to the extent practicable.

1.6.3 Public Review of the Draft EIS

The two draft site-specific conversion facility EISs were mailed to stakeholders in late November 2003, and a notice of availability was published by the EPA in the *Federal Register* on November 28, 2003 (68 FR 66824). In addition, each EIS was also made available in its entirety on the Internet at the same time, and e-mail notification was sent to those on the project Web site mailing list. Stakeholders were encouraged to provide comments on the draft EISs during a 67-day review period, from November 28, 2003, until February 2, 2004. Comments could be submitted by calling a toll-free number, by fax, by letter, by e-mail, or through the project Web site. Comments could also be submitted at public hearings held near Portsmouth, Ohio, on January 7, 2004; Paducah, Kentucky, on January 13, 2004; and Oak Ridge, Tennessee, on January 15, 2004. The public hearings were announced on the project Web site and in local newspapers prior to the meetings.

A total of about 210 comments were received during the comment period. The comments received and DOE's responses to those comments are presented in Volume 2 of this EIS. Because of the similarities in the proposed actions and the general applicability of many of the comments to both site-specific conversion facility EISs, all comments received on the Portsmouth and Paducah EISs are included in Volume 2. In addition, all comments received were considered in the preparation of both final EISs.

Several revisions were made to the two site-specific conversion facility draft EISs on the basis of the comments received (changes are indicated by vertical lines in the right margin of the document). The vast majority of the changes were made to provide clarification and additional detail. Specific responses to each comment received on the draft EISs are presented in Volume 2 of this EIS; a summary of the most common issues raised by the reviewers and the general DOE responses to these issues are listed below.

- *Comments related to the proposed action and preferred alternative.*

  Numerous reviewers expressed support for the DOE conversion project in general and agreement with the preferred alternatives identified in the draft EISs. Reviewers stressed the importance of meeting the requirements of P.L. 107-206, as well as the consent orders that DOE has signed with each of the affected states.

  DOE appreciates support for the conversion project and is committed to complying with all applicable regulations, agreements, and orders.

- *Comments related to transportation of cylinders.*

Several reviewers raised concerns over the safe transportation of cylinders from the ETTP site. Common themes included a preference for the use of overpacks, opposition to transporting noncompliant cylinders "as-is" under a DOT exemption, a general desire that shipments be made in a manner protective of health and safety, and questions concerning the potential use of barge transportation.

DOE is committed to conducting all transportation activities in a manner protective of human health and safety and in compliance with all applicable regulations. A Transportation Plan will be developed for each shipping program related to the DUF_6 conversion facility project. Each Plan will be developed to address specific issues associated with the commodity being shipped, the origin and destination points, and concerns of jurisdictions transited by the shipments. In all cases, DOE-sponsored shipments will comply with all applicable State and Federal regulations and will be reflected in many of the operational decisions that will be made and presented in the Plan. The transportation regulations are designed to be protective of public health and safety during both accident and routine transportation conditions.

To allow flexibility in planning and future operations, the transportation analysis in each EIS evaluates a range of options for cylinder preparation and transport modes. For example, all three options for shipping noncompliant cylinders, including obtaining a DOT exemption, using overpacks, and transferring the contents from noncompliant to compliant cylinders, are evaluated in the EISs, as are both truck and rail modes. Because barge transport has not been proposed as part of the current conversion facility project and for the reasons discussed in Section 2.3.5, a detailed evaluation has not been included in the final EISs. If barge transportation was proposed in the future and considered to be a reasonable option, additional NEPA review would be conducted.

- *Comments related to removal of cylinders from the ETTP site.*

Several reviewers stressed the importance of DOE compliance with the 1999 consent order with the TDEC that requires the removal of the DUF_6 cylinders from the ETTP site or the conversion of the material by December 31, 2009.

DOE is committed to complying with the 1999 consent order. Toward that end, the DOE contract for accelerated cleanup of the ETTP site, including removal of the DUF_6 cylinders, calls for completion of this activity by the end of FY 2008.

- *Comments related to the potential for DOE to receive additional DUF_6 cylinders from other sources.*

  Several reviewers noted that DOE may receive additional DUF_6 cylinders from other sources, including continued USEC operations, the proposed American Centrifuge Facility at the Portsmouth site, and other potential commercial enrichment facilities. Some reviewers requested that DOE design the conversion facilities to accommodate such an increase.

  At the present time, there are no plans or proposals for DOE to accept DUF_6 cylinders for conversion beyond the current inventory for which it has responsibility. However, Section 2.2.7 of the Portsmouth site-specific conversion facility EIS and Section 2.2.5 of the Paducah EIS discuss a number of possible future sources of additional DUF_6 that could require conversion. The potential environmental impacts associated with expanding plant operations (by either extending operations or increasing the throughput) to accommodate processing of additional cylinders are discussed in Section 5.2.8 of the Portsmouth EIS and Section 5.2.6 of the Paducah EIS. Because of the uncertainty associated with possible future sources of DUF_6 for which DOE could assume responsibility, there is no current proposal to increase throughputs of the conversion facilities or extend the operational period.

- *Comments related to USEC's American Centrifuge Facility.*

  Several reviewers noted the January 2004 announcement by USEC that the American Centrifuge Facility would be sited at Portsmouth, and stated that the EISs should be revised accordingly, including consideration of the facility under Portsmouth cumulative impacts.

  The two site-specific conversion facility EISs have been revised to reflect that Portsmouth has been selected as the site for the USEC American Centrifuge Facility. Although Location B is the likely site for construction of the centrifuge facility, it has been retained in the final Portsmouth conversion EIS as a siting alternative. The cumulative impacts analysis included in both the draft and final Portsmouth conversion facility EIS assumed that a new USEC centrifuge enrichment facility would be constructed and operated at the Portsmouth site (see Sections S.5.16 and 5.3.2). As stated in Sections S.5.16 and 5.3.2, the analysis assumed that such a plant would be sited at Portsmouth, that the existing DOE gas centrifuge technology would be used, and that the environmental impacts of such a facility would be similar to those outlined in a 1977 EIS for Expansion of the Portsmouth Gaseous Diffusion Plant that considered a similar action that was never completed. It should be noted that the NRC licensing activities for the proposed centrifuge enrichment plant will include preparation of an EIS that must also evaluate cumulative impacts at the Portsmouth site. The centrifuge enrichment facility cumulative impacts analysis will be based on the anticipated USEC enrichment facility design, which does not currently exist, and will benefit from the detailed evaluation of conversion facility impacts presented in this EIS.

- *Comments related to current cylinder management.* Several reviewers raised questions and concerns about the current management of the cylinders at the three DOE storage sites.

  In response to these concerns, it has been emphasized that DOE's current cylinder management program provides for safe storage of the depleted DUF_6 cylinders. DOE is committed to the safe storage of the cylinders at each site through the implementation of the decision made in the ROD. DOE has an active cylinder management program designed to ensure the continued safety of cylinders until conversion is accomplished.

1.7 RELATIONSHIP TO OTHER NEPA REVIEWS

This site-specific DUF_6 Conversion EIS, along with the EIS prepared for the Paducah conversion facility (DOE 2004a), represents the second level of a tiered environmental review process being used to evaluate and implement DOE's DUF_6 Management Program. A "tiered" process refers to a process of first addressing higher-order decisions in a programmatic EIS (PEIS) and then conducting a more narrowly focused (project-level) environmental review. The project-level review incorporates, by reference, the programmatic analysis, as appropriate, as well as additional site-specific analyses. The DUF_6 PEIS (DOE 1999a), issued in April 1999, represents the first level of this tiered process.

DOE prepared, or is in the process of preparing, other NEPA reviews that are related to the management of DUF_6 or to the current DUF_6 storage sites. The DUF_6 PEIS includes an extensive list of reviews that were prepared before 1999; that list is not repeated here. The following related NEPA reviews were conducted after publication of the DUF_6 PEIS; these reviews are related to this EIS primarily because they evaluate activities occurring at Portsmouth or ETTP.

- *Supplement Analysis for Transportation of DOT Compliant Depleted Uranium Hexafluoride Cylinders from the East Tennessee Technology Park to the Portsmouth Gaseous Diffusion Plant in Fiscal Years 2003 through 2005* (DOE 2003d): The purpose of this supplement analysis is to provide a basis for determining whether the existing PEIS NEPA analysis and documentation would be sufficient to allow DOE to transport up to 1,700 full cylinders containing DUF_6 from its ETTP location to the Portsmouth site in FYs 2003 through 2005. All of these cylinders would be compliant with DOT regulatory requirements. Details of the proposed shipment campaign are presented in a transportation plan prepared by Bechtel Jacobs Company LLC (2003). Based on the Supplement Analysis, DOE issued an amended ROD to the PEIS concluding that the estimated impacts for the proposed shipment of up to 1,700 cylinders were less than or equal to those considered in the PEIS and that no further NEPA documentation was required (68 FR 53603). However, this EIS considers shipment of all DUF_6 and non-DUF_6 at ETTP to Portsmouth (proposed) and Paducah (option). No shipments were made in FY 2003; it is expected that the planned shipments would occur in FY 2004 and FY 2005.

- *Draft Environmental Assessment: Reindustrialization Program at the Portsmouth Gaseous Diffusion Plant, Piketon, Ohio* (DOE 2001b): DOE proposes to transfer real property (i.e., underutilized, surplus, or excess Portsmouth GDP land and facilities) by lease and/or disposal (e.g., sale, donation, transfer to another federal agency, exchange) via a reindustrialization program. DOE prepared this environmental assessment (EA) to give the public information on the potential impacts that could result from the proposed transfer of land and facilities and to ensure that environmental impacts are considered in the decision-making process. This EA (1) describes the existing environment at Portsmouth relevant to potential impacts associated with the proposed action and alternatives; (2) analyzes potential environmental impacts, including those from development of a range of industrial and commercial uses; (3) identifies and characterizes cumulative impacts that could result from Portsmouth reindustrialization in relation to other ongoing or proposed activities within the surrounding area; and (4) provides DOE with environmental information to use in prescribing restrictions to protect, preserve, and enhance the human environment and natural ecosystems.

- *Environmental Assessment: Winterization Activities in Preparation for Cold Standby at the Portsmouth Gaseous Diffusion Plant, Piketon, Ohio* (DOE 2001c): DOE proposes to conduct winterization activities in preparation for cold standby of facilities at DOE's Portsmouth GDP in Piketon, Ohio. Winterization of Portsmouth was deemed necessary because DOE had decided to place the plant in cold standby and because facilities and systems had to be protected from freezing after USEC was to stop enriching uranium at Portsmouth in 2001. DOE prepared this EA to give the public information on the potential impacts that could result from the proposed action and reasonable alternatives and to ensure that potential environmental impacts would be considered in the decision-making process. This EA (1) describes the existing environment at Portsmouth relevant to potential impacts of the proposed action and alternatives; (2) analyzes potential environmental impacts; (3) identifies and characterizes cumulative impacts that could result from Portsmouth in relation to other ongoing or proposed activities within the surrounding area; and (4) provides DOE with environmental information to use in prescribing restrictions to protect, preserve, and enhance the human environment and natural ecosystems.

- *Draft Environmental Assessment Addendum for the Proposed Transfer of Parcel ED-1 to the Community Reuse Organization of East Tennessee* (DOE 2002a): In January 1996, DOE executed a lease for the Community Reuse Organization of East Tennessee (CROET) to develop an industrial/business park at the 957-acre (387-ha) Parcel ED-1 of Oak Ridge Reservation (ORR). The purpose of the DOE action was to transfer excess DOE real property in order to continue and further support economic development in the region. This proposed action is being evaluated in response to a proposal from CROET to transfer fee title for the presently leased Parcel ED-1. DOE's action is needed to help offset economic losses resulting from DOE downsizing, facility closures, and workforce restructuring. DOE also recognizes that transferring excess land for economic development purposes can benefit the federal government by reducing or eliminating landlord costs. The purpose of this EA addendum is to analyze the DOE proposal to transfer title of Parcel ED-1 to CROET.

- *Final Programmatic Environmental Assessment for the U.S. Department of Energy, Oak Ridge Operations Implementation of a Comprehensive Management Program for the Storage, Transportation, and Disposition of Potentially Re-Usable Uranium Materials* (DOE 2003c): DOE proposes to implement a comprehensive management program to safely, efficiently, and effectively manage its potentially reusable low-enriched uranium, normal uranium, and depleted uranium. Uranium materials presently located at multiple sites are to be consolidated by transporting the materials to one or several locations to facilitate disposition. Management would include the storage, transport, and ultimate disposition of these materials. This programmatic EA (PEA) addresses the proposed action to implement a long-term (more than 20 years) management plan for DOE's inventory of potentially reusable low-enriched, normal, and depleted uranium. A Finding of No Significant Impact (FONSI) was approved on October 16, 2002.

- *Environmental Assessment for Transportation of Low-Level Radioactive Waste from the Oak Ridge Reservation to Off-Site Treatment or Disposal Facilities* (DOE 2001a): DOE proposes to transport LLW from ORR for treatment or disposal at various locations in the United States. This EA for the transport of LLW was prepared in accordance with CEQ and DOE regulations and DOE orders and guidance. On the basis of the findings presented in this EA, DOE has determined that the proposed transportation of legacy and operational LLW from ORR for treatment or disposal at representative DOE sites and licensed commercial facilities located in the continental United States would not constitute a major federal action that would significantly affect the quality of the human environment within the context of NEPA. DOE concluded that preparation of an EIS was not required.

- *Final Environmental Impact Statement for Treating Transuranic (TRU)/Alpha Low-Level Waste at the Oak Ridge National Laboratory* (DOE 2000b): DOE proposes to construct, operate, and decontaminate and decommission a TRU waste treatment facility in Oak Ridge, Tennessee. The four waste types that would be treated at the proposed facility would be (1) remote-handled TRU mixed waste sludge, (2) liquid LLW associated with the sludge, (3) contact-handled TRU/alpha LLW solids, and (4) remote-handled TRU/alpha LLW solids. The mixed waste sludge and some of the solid waste contain metals regulated under the Resources Conservation and Recovery Act (RCRA) and might be classified as mixed waste. This document analyzes the potential environmental impacts associated with five alternatives: no action, the low-temperature drying alternative (preferred alternative), the vitrification alternative, the cementation alternative, and the treatment and waste storage at ORNL alternative.

- *Construction and Operation of the Spallation Neutron Source Facility* (DOE 1999d): DOE proposes to construct and operate a state-of-the-art, short-pulsed spallation neutron source composed of an ion source, a linear accelerator, a proton accumulator ring, and an experiment building containing a liquid mercury target and a suite of neutron scattering instrumentation. The proposed Spallation Neutron Source would be designed to operate at a proton beam power of 1 MW. The design would accommodate future upgrades to a peak operating power of 4 MW. This document analyzes the potential environmental impacts from the proposed action and the alternatives. The analysis assumes the facility would operate at powers of 1 and 4 MW over its lifetime. The two primary alternatives analyzed in this final EIS are the proposed action (to proceed with building the Spallation Neutron Source) and the no action alternative. The no action alternative describes the expected condition of the environment if no action was taken. Four siting alternatives for the Spallation Neutron Source are evaluated: ORNL in Oak Ridge, Tennessee (preferred alternative); Argonne National Laboratory (ANL) in Argonne, Illinois; Brookhaven National Laboratory (BNL) in Upton, New York; and Los Alamos National Laboratory (LANL) in Los Alamos, New Mexico.

- *Final Waste Management Programmatic Environmental Impact Statement for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste* (DOE 1997a): This EIS (referred to herein as the WM PEIS) evaluates the impacts of different approaches to the treatment, storage, and disposal of the existing and projected DOE inventory of certain types of waste management program wastes over the next 20 years. The WM PEIS considers radioactive low-level, high-level, TRU, and mixed wastes, as well as toxic and hazardous wastes. The amounts of wastes analyzed for treatment, storage, or disposal range from thousands to millions of cubic meters and include wastes generated at the DOE sites in Paducah, Kentucky; Portsmouth, Ohio; and Oak Ridge, Tennessee. The WM PEIS does not evaluate management of DUF_6

because that material is considered a source material, not a waste. The draft WM PEIS was issued in September 1995, and the final was issued in May 1997.

The WM PEIS considers the impacts of waste management at Paducah, Portsmouth, and ORR on the basis of the existing and projected inventories of waste generated during site operations. The three sites are also considered candidate sites for regionalized waste management sites, and waste management impacts are evaluated for these scenarios as well. Cumulative impacts of current operations, waste management, and proposed future operations are also assessed for the three sites in the WM PEIS.

1.8 OTHER DOCUMENTS AND STUDIES RELATED TO DUF_6 MANAGEMENT AND CONVERSION ACTIVITIES

In addition to the related NEPA reviews described in Section 1.7, other reports that relate to managing the DUF_6 inventory (covering conversion, transportation, characterization, and disposal activities) that were completed after the DUF_6 PEIS was published were also reviewed in preparing this EIS. A list of the reports reviewed and used as a part of the preparation for this EIS is provided here.

- *Final Plan for the Conversion of Depleted Uranium Hexafluoride as Required by Public Law 105-204* (DOE 1999b): This report is the final plan for converting DOE's DUF_6 inventory, as required by P.L. 105-204. This Conversion Plan describes the steps that would allow DOE to convert the DUF_6 inventory to a more stable chemical form. It incorporates information received from the private sector in response to DOE's request for expressions of interest; ideas from members of the affected communities, Congress, and other interested stakeholders; and the results of the analyses for the final DUF_6 PEIS. The Conversion Plan describes DOE's intent to chemically process the DUF_6 to create products that would present a lower long-term storage hazard and provide a material suitable for use or disposal.

- *U.S. Department of Energy DUF_6 Materials Use Roadmap* (DOE 2000a): This report meets the commitment presented in the Conversion Plan by providing a comprehensive roadmap that DOE will use to guide any future R&D activities for the materials associated with its DUF_6 inventory. It supports the decision presented in the ROD, namely, to begin conversion of the DUF_6 inventory to uranium oxide, uranium metal, or a combination of both as soon as possible, while allowing for future uses for as much of this inventory as possible. This roadmap is intended to explore potential uses for the DUF_6 conversion products and identify areas where further development is needed. Although it focuses on potential governmental uses of DUF_6 conversion products, it also incorporates a limited analysis of private sector uses. This roadmap also addresses other surplus depleted uranium, primarily in the form of depleted uranium trioxide (UO_3) and depleted UF_4.

- *Depleted Uranium Hexafluoride Management Program: Data Compilation for the Portsmouth Site in Support of Site-Specific NEPA Requirements for Continued Cylinder Storage, Cylinder Preparation, Conversion, and Long-Term Storage Activities* (Hartmann 1999a): This report is a compilation of data and analyses for the Portsmouth site that were obtained and conducted to prepare the DUF_6 PEIS. The report describes the affected environment at the Portsmouth site and summarizes potential environmental impacts that could result from conducting the following DUF_6 activities at the site: continued cylinder storage, preparation of cylinders for shipment, conversion, and long-term storage.

- *Depleted Uranium Hexafluoride Management Program: Data Compilation for the K-25 Site in Support of Site-Specific NEPA Requirements for Continued Cylinder Storage and Cylinder Preparation Activities* (Hartmann 1999b): This report is a compilation of data and analyses for the ETTP site (formerly called the K-25 site) that were obtained and conducted to prepare the DUF_6 PEIS. The report describes the affected environment at the ETTP site and summarizes the potential environmental impacts that could result from continued cylinder storage and preparation of cylinders for shipment at the site.

- *Evaluation of UF_6-to-UO_2 Conversion Capability at Commercial Nuclear Fuel Fabrication Facilities* (Ranek and Monette 2001): This report examines the capabilities of existing commercial nuclear fuel fabrication facilities to convert DUF_6 to depleted UO_2. For domestic facilities, the information summarized includes currently operating capacity to convert DUF_6 to UO_2; transportation distances from DUF_6 storage locations near Oak Ridge, Portsmouth, and Paducah to the commercial conversion facilities; and regulatory requirements for nuclear fuel fabrication and transportation of DUF_6. The report concludes that current U.S. commercial nuclear fuel fabricators could convert 5,200 t (5,700 tons) of DUF_6 per year to UO_2 (which includes 666 t (734 tons) of DUF_6 per year of capacity that was scheduled for shutdown by the end of 2001). However, only about 300 t (330 tons) of DUF_6 per year of this capacity could be confirmed as being possibly available to DOE. The report also provides some limited descriptions of the capabilities of foreign fuel fabrication plants to convert DUF_6 to UO_2.

- *Assessment of Preferred Depleted Uranium Disposal Forms* (Croff et al. 2000a): This study assesses the acceptability of various potential depleted uranium conversion products for disposal at likely LLW disposal sites. The objective is to help DOE decide the preferred form for the depleted uranium conversion product and determine a path that will ensure reliable and efficient disposal. The study was conducted under the expectation that if worthwhile beneficial uses could not be found for the converted depleted uranium product, it would be sent to an appropriate site for disposal. The depleted uranium products are considered to be LLW under both DOE orders and NRC regulations. A wide range of issues associated with disposal are discussed in the report. The report concludes that, on balance, the four potential forms of depleted uranium (uranium metal, UF_4, UO_2, and U_3O_8) considered in the study should be acceptable, with proper controls, for near-surface disposal at sites such as NTS and Envirocare.

- *Evaluation of the Acceptability of Potential Depleted Uranium Hexafluoride Conversion Products at the Envirocare Disposal Site* (Croff et al. 2000b): With regard to the Envirocare site, the earlier report (Croff et al. 2000a), concluded that "current waste acceptance criteria suggest that the acceptability of depleted uranium hexafluoride conversion material for disposal at Envirocare of Utah is questionable. Further investigation is required before a definitive determination can be made." The purpose of this report is to document the more thorough investigation suggested in the earlier report. It concludes that an amendment to the Envirocare license issued on October 5, 2000, has reduced the uncertainties associated with disposal of the depleted uranium product at Envirocare to the point that they are now comparable with uncertainties associated with the disposal of the depleted uranium product at NTS that were discussed in the earlier report.

- *Transportation Impact Assessment for Shipment of Uranium Hexafluoride (UF_6) Cylinders from the East Tennessee Technology Park to the Portsmouth and Paducah Gaseous Diffusion Plants* (Biwer et al. 2001): This report presents a transportation impact assessment for shipping the 4,683 full cylinders of DUF_6 (containing a total of approximately 56,000 t [62,000 tons]) stored at ETTP to the Portsmouth and Paducah sites for conversion. It also considers the transport of 2,394 cylinders stored at ETTP that contain a total of 25 t (28 tons) of enriched and normal uranium or that are empty. Shipments by both truck and rail are considered, with and without cylinder overpacks. In addition, the report contains an analysis of the current and pending regulatory requirements applicable to packaging UF_6 for transport by truck or rail, and it evaluates regulatory options for meeting the packaging requirements.

- *Strategy for Characterizing Transuranics and Technetium Contamination in Depleted UF_6 Cylinders* (Hightower et al. 2000): This report summarizes the results of a study performed to develop a strategy for characterizing low levels of radioactive contaminants (Pu, Np, Am, and Tc) in DUF_6 cylinders at the ETTP, Portsmouth, and Paducah sites. The principal conclusion from this review and analysis is that even without additional sampling, the current body of knowledge is sufficient to give potential conversion vendors an adequate basis for designing facilities that can operate safely. The report also provides upper-bound estimates of Pu, Np, and Tc concentrations in DUF_6 cylinders.

- *A Peer Review of the Strategy for Characterizing Transuranics and Technetium Contamination in Depleted Uranium Hexafluoride Tails Cylinders* (Brumburgh et al. 2000): This document provides the findings from a peer review of the ORNL study (Hightower et al. 2000) that set forth a strategy for characterizing low levels of radioactive contaminants in DUF_6 cylinders at the ETTP, Portsmouth, and Paducah sites. This peer review evaluates the ORNL study in three main areas: TRU chemistry/radioactivity, statistical approach, and the uranium enrichment process. It provides both general and specific observations about the general characterization strategy and its recommendations.

1.9 ORGANIZATION OF THIS ENVIRONMENTAL IMPACT STATEMENT

This DUF_6 Conversion EIS consists of two volumes. Volume 1 contains 10 chapters and 8 appendixes. Volume 2 contains the comment response document for the review of the draft EIS. Brief summaries of the main components of the EIS follow:

Volume 1 — Main Text and Appendixes:

- Chapter 1 introduces the EIS, discussing pertinent background information, the purpose of and need for the DOE action, the scope of the assessment, related NEPA reviews, other related reports and studies, and EIS organization.

- Chapter 2 defines the alternatives and implementation options considered in the EIS, defines alternatives considered but not analyzed in detail, and presents a summary comparison of the estimated environmental impacts.

- Chapter 3 discusses the environmental setting at the Portsmouth and ETTP sites.

- Chapter 4 addresses the assumptions on which this EIS and its analyses are based, defines the approaches to and methods for environmental impact assessment used in developing this EIS, and presents background information on the human health assessment.

- Chapter 5 discusses the potential environmental impacts of the alternatives. This chapter also discusses potential cumulative impacts at the Portsmouth and ETTP sites; possible mitigation of adverse impacts that are unavoidable; irreversible commitment of resources; the relationship between short-term use of the environment and long-term productivity; pollution prevention and waste minimization; and impacts from D&D activities.

- Chapter 6 identifies the major laws, regulations, and other requirements applicable to implementing the alternatives.

- Chapter 7 is an alphabetical listing of all the references cited in the EIS. All cited references are available to the public.

- Chapter 8 lists the names, education, and experience of persons who helped prepare the EIS. Also included are the subject areas for which each preparer was responsible.

- Chapter 9 presents brief definitions of the technical terminology used in the EIS.

- Chapter 10 is a subject matter index that provides the numbers of pages where important terms and concepts are discussed.

- Appendix A presents the pertinent text of P.L. 107-206, which mandates the construction of conversion facilities at the Portsmouth and Paducah sites.

- Appendix B discusses issues associated with potential TRU and Tc contamination of a portion of the DUF_6 inventory as well as PCBs contained in some cylinder coatings and describes how such contamination was addressed in this EIS.

- Appendix C summarizes the comments received during public scoping.

- Appendix D contains the environmental synopsis prepared to support the DUF_6 conversion process.

- Appendix E discusses potential uses of HF and CaF_2, the DOE-authorized release process, and impacts associated with sale and use.

- Appendix F describes the assessment methodologies used to evaluate the potential environmental impacts.

- Appendix G contains copies of consultation letters regarding the preparation of this EIS that were sent to state agencies and recognized Native American groups.

- Appendix H contains the contractor disclosure statement.

Volume 2 — Responses to Public Comments:

- Chapter 1 provides an overview of the public participation and comment process.

- Chapter 2 provides copies of the actual letters or other documents that contain comments on the draft EIS to DOE.

- Chapter 3 lists DOE responses to all comments received.

2 DESCRIPTION AND COMPARISON OF ALTERNATIVES

> **Alternatives Considered in This EIS**
>
> ***No Action:*** NEPA regulations require evaluation of a no action alternative. In this EIS, the no action alternative is storage of DUF_6 cylinders indefinitely in yards at the Portsmouth and ETTP sites, with continued cylinder surveillance and maintenance activities.
>
> ***Proposed Action:*** Construction and operation of a conversion facility at the Portsmouth site for conversion of the Portsmouth and ETTP DUF_6 inventories into depleted uranium oxide (primarily U_3O_8) and other conversion products.
>
> ***Action Alternatives:*** Three action alternatives focus on where to construct the conversion facility within the Portsmouth site (Alternative Location A, B, or C). The preferred alternative is Location A.

Alternatives for building and operating a DUF_6 conversion facility at the Portsmouth site were evaluated for their potential impacts on the human and natural environment. This EIS considers the proposed action of building and operating a conversion facility for conversion of the Portsmouth and ETTP DUF_6 cylinder inventories and a no action alternative. Under the proposed action, three action alternatives are considered that focus on where to construct the conversion facility within the Portsmouth site. The action alternatives include the shipment of DUF_6 and non-DUF_6 cylinders currently stored at ETTP to Portsmouth. In addition, the construction of a new cylinder storage yard at Portsmouth, if required for ETTP cylinders, is considered. The no action alternative assumes that a conversion facility is not built at Portsmouth and that the cylinders would continue to be stored indefinitely at Portsmouth and ETTP in a manner consistent with current management practices. This chapter defines these alternatives and options in detail and discusses the types of activities that would be required under each. A summary of the alternatives considered in this EIS is presented in Table 2.1-1.

A separate EIS prepared for construction and operation of a conversion facility at the Paducah site (DOE 2004a) also includes a no action alternative. The no action alternative defined in the Paducah EIS includes an evaluation of the potential impacts of indefinite long-term storage of cylinders at Paducah.

In addition to describing the alternatives evaluated in this EIS, this chapter includes a discussion of alternatives considered but not analyzed in detail (Section 2.3) and a summary comparison of the potential environmental impacts from the alternatives (Section 2.4). The comparison of alternatives is based on information about the environmental setting provided in Chapter 3, descriptions of the assessment methodologies provided in Chapter 4, and the detailed assessment results presented in Chapter 5.

2.1 NO ACTION ALTERNATIVE

Under the no action alternative, it is assumed that DUF_6 cylinder storage would continue indefinitely at the Portsmouth and ETTP sites. The no action alternative assumes that DOE would continue surveillance and maintenance activities to ensure the continued

TABLE 2.1-1 Summary of Alternatives Considered

Alternative	Description	Options Considered
No Action (Section 2.1)	Continued storage of the DUF_6 cylinders indefinitely at the Portsmouth and ETTP sites, with continued cylinder surveillance and maintenance.	None.
Proposed Action (Section 2.2)	Construction and operation of a conversion facility at the Portsmouth site for conversion of the Portsmouth and ETTP DUF_6 inventories into depleted uranium oxide (primarily U_3O_8) and other conversion products. This EIS assesses the potential environmental impacts from the following proposed activities: • Construction, operation, maintenance, and D&D of the proposed DUF_6 conversion facility at the Portsmouth site; • Transportation of DUF_6 and non-DUF_6 cylinders from ETTP to Portsmouth; • Construction of a new cylinder storage yard (if required) for ETTP cylinders; • Transportation of uranium conversion products and waste materials to a disposal facility; • Transportation and sale of the HF conversion product; and • Neutralization of HF to CaF_2 and sale or disposal in the event that the HF product is not sold.	*ETTP Cylinders:* This EIS considers an option of shipping cylinders at ETTP to Paducah. *Transportation:* This EIS evaluates the shipment of cylinders and conversion products by both truck and rail. *Expanded Operations:* This EIS discusses the impacts associated with potential expansion of plant operations by extending the operational period and by increasing throughput (by efficiency improvements or by adding a fourth process line).
Alternative Location A (Preferred) (Section 2.2.1.1)	Construction of the conversion facility at Location A, an area that encompasses 26 acres (10 ha) in the west-central portion of the site.	
Alternative Location B (Section 2.2.1.2)	Construction of the conversion facility at Location B, an area that encompasses 50 acres (20 ha) in the southwest portion of the site.	
Alternative Location C (Section 2.2.1.3)	Construction of the conversion facility at Location C, an area that encompasses 78 acres (31 ha) in the southeast portion of the site.	

> **No Action Alternative**
>
> It is assumed that the DUF_6 cylinders would continue to be stored indefinitely at the Portsmouth and ETTP sites and that cylinder surveillance and maintenance would also continue. Impacts are evaluated through the year 2039; in addition, potential long-term (after 2039) impacts are evaluated.

safe storage of cylinders. Potential environmental impacts are estimated through the year 2039. The year 2039 was selected to be consistent with the DUF_6 PEIS (DOE 1999a), which evaluated a 40-year cylinder storage period (1999 through 2039). In addition, long-term impacts (i.e., occurring after 2039) from potential cylinder breaches are assessed. A similarly defined no action alternative was also evaluated in the DUF_6 PEIS. The assessment of the no action alternative in this EIS has been updated to reflect changes that have occurred since publication of the DUF_6 PEIS in 1999. Details are provided below.

Specifically, the activities assumed to occur include routine cylinder inspections, ultrasonic testing of the wall thickness of selected cylinders, painting of selected cylinders to prevent corrosion, cylinder yard surveillance and maintenance, and relocation of some cylinders. It is assumed that cylinders would be painted every 10 years. On the basis of these activities, an assessment of the potential impacts on workers, members of the public, and the environment was conducted.

Breached cylinders are cylinders that have a hole of any size at some location on the wall. The occurrence of cylinder breaches, caused by either corrosion or handling damage, is an important concern when the potential impacts of continued cylinder storage are evaluated. There is a general concern that the number of cylinder breaches at the sites could increase in the future as the cylinder inventory ages.

At the time the PEIS was published (1999), 8 breached cylinders had been identified at the three storage sites; 3 of those breaches were at Portsmouth and 4 were at ETTP.[1] Investigation of these breaches indicated that 6 of the 8 were initiated by mechanical damage during stacking; the damage was not noticed immediately, and subsequent corrosion occurred at the damaged point. It was concluded that the other 2 cylinder breaches, both at ETTP, had been caused by external corrosion due to prolonged ground contact.

For assessment purposes in this EIS, two cylinder breach cases are evaluated. In the first case, it is assumed that the planned cylinder maintenance and painting program would maintain the cylinders in a protected condition and control further corrosion. In this case, it is assumed that after initial painting, some cylinder breaches would occur from handling damage; a total of 16 breaches are estimated to occur through 2039 at the Portsmouth site and a total of 7 for the ETTP site. In the second case, it is assumed that external corrosion would not be halted by improved storage conditions, cylinder maintenance, and painting. This case is considered in order to account for uncertainties with regard to how effective painting would be in controlling

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1 An additional breach that occurred at the ETTP site in 1998 was discussed in Section B.2 of the PEIS (DOE 1999a). In the period 1998 through 2002, two additional breaches were discovered at the Paducah site. A total of 11 breaches have been identified at the Portsmouth, ETTP, and Paducah sites.

cylinder corrosion and uncertainties in the future painting schedule. In this case, the numbers of future breaches estimated through 2039 are 74 for the Portsmouth site and 213 for the ETTP site. These breach estimates were determined on the basis of historical corrosion rates when cylinders were stored under poor conditions (i.e., cylinders were stacked too close together, were stacked on wooden chocks, or came in contact with the ground). Because storage conditions have improved dramatically over the last several years as a result of cylinder yard upgrades and restacking activities, it is expected that these breach estimates based on the historical corrosion rate provide a worst case for estimating the potential impacts from continued cylinder storage. The results of this assessment were used to provide an estimate of the earliest time when continued cylinder storage could begin to raise regulatory concerns under these worst-case conditions.

The impacts to human health and safety, surface water, groundwater, soil, air quality, and ecology from uranium and HF releases from breached cylinders are assessed in this EIS. For all hypothetical cylinder breaches, it is assumed that the breach would be undetected for 4 years, which is the period between planned inspections for most of the cylinders. In practice, cylinders that show evidence of damage or heavy external corrosion are inspected annually, so it is very unlikely that a breach would be undetected for a 4-year period. For each hypothetical cylinder breach, it is further assumed that 1 lb (0.45 kg) of uranium (as UO_2F_2) and 4.4 lb (2 kg) of HF would be released from the cylinder annually for a period of 4 years.

The estimated numbers of future breaches at the Portsmouth and ETTP sites were used to estimate potential impacts that might occur during the repair of breached cylinders and impacts from releases that might occur during continued cylinder storage. Potential radiological exposures of involved workers could result from patching breached cylinders or emptying the cylinder contents into new cylinders. The impacts on groundwater and human health and safety from uranium releases were assessed by estimating the amount of uranium that could be transported from the yards in surface runoff and the amount that could migrate through the soil to the groundwater.

For this EIS, a reassessment of the no action alternative assumptions used in the PEIS was conducted. Recent cylinder surveillance and maintenance plans — including inspections and painting — were used to update the PEIS no action alternative assessment. The results of this reevaluation, together with a consideration of the changes in the on-site worker and off-site public populations at Portsmouth and ETTP, were used to determine the impacts from the no action alternative. Additional discussion and the estimated impacts from the no action alternative are presented in Section 5.1.

2.2 PROPOSED ACTION

The proposed action evaluated in this EIS is to construct and operate a conversion facility at the Portsmouth site for conversion of the Portsmouth and ETTP DUF_6 inventories into depleted uranium oxide (primarily U_3O_8) and other conversion products. Three locations within the Portsmouth site are evaluated as alternatives (see Section 2.2.1). The proposed action includes shipping the ETTP cylinders to Portsmouth and construction of a new cylinder storage yard at Portsmouth for the ETTP cylinders, if required. The conversion facility would convert DUF_6 into a stable chemical form for beneficial use/reuse and/or disposal. The off-gas from the conversion process would yield aqueous HF, which would be processed and marketed or converted to a solid for sale or disposal. To support the conversion operations, the emptied DUF_6 cylinders would be stored, handled, and processed for reuse as disposal containers to the extent practicable. The time period considered is a construction period of approximately 2 years, an operational period of 18 years, and a 3-year period for the D&D of the facility. Current plans call for construction to begin in the summer of 2004. The assessment is based on the conceptual conversion facility design proposed by the selected contractor, UDS (see text box).

Proposed Action

The proposed action in this EIS is construction and operation of a DUF_6 conversion facility at the Portsmouth site for conversion of the Portsmouth and ETTP DUF_6 inventories into depleted uranium oxide (primarily U_3O_8) and other conversion products. DUF_6 and non-DUF_6 cylinders would be transported from ETTP to Portsmouth; and a cylinder storage yard would be constructed at Portsmouth for ETTP cylinders, if required. Three alternative locations within the Portsmouth site are evaluated (Locations A, B, and C).

This EIS assesses the potential environmental impacts from the following proposed activities:

- Construction, operation, maintenance, and D&D of the proposed DUF_6 conversion facility at the Portsmouth site;
- Transportation of DUF_6 cylinders and non-DUF_6 cylinders from ETTP to Portsmouth;
- Construction of a new cylinder storage yard (if required) for ETTP cylinders;
- Transportation of uranium conversion products and waste materials to a disposal facility;
- Transportation and sale of the HF conversion product; and
- Neutralization of HF to CaF_2 and its sale or disposal in the event that the HF product is not sold.

Conversion Facility Design

The EIS is based on the conversion facility design being developed by UDS, the selected conversion contractor. At the time the draft EIS was prepared, the UDS design was in the 30% conceptual stage, with several facility design options being considered.

Following the public comment period, the draft EIS was revised on the basis of comments received and on the basis of 100% conceptual facility design. This final EIS identifies and evaluates design options to the extent possible.

In addition, an option of expanding operations by extending the conversion facility operational period or increasing throughput is discussed in this section.

2.2.1 Action Alternatives

The action alternatives focus on where to site the conversion facility within the Portsmouth site. The Portsmouth site was evaluated to identify alternative locations for a conversion facility (Shaw 2001). Potential locations were evaluated on the basis of the following criteria:

- *Current condition of the land and site preparation required.* This criterion looked at the condition of the land from a constructability viewpoint, considering factors that would increase the construction cost over the amount needed for a relatively level grassy topography.

- *Legacy environmental concerns.* This criterion looked at environmental factors that would affect construction at the site.

- *Availability of utilities.* This criterion looked at the relative difficulty of bringing services from existing plant utilities to the site.

- *Location.* This criterion looked at the advantages and disadvantages of location in relation to cylinder transport between the yards and the new facility.

- *Effect on current plant operations.* This criterion looked at how the conversion facility's location could affect existing plant operations.

- *Size.* This criterion looked at size to ensure that the required minimum amount of land would be available for construction of the conversion facility (assumed to be about 30 acres [12 ha]).

The three alternative locations identified at the Portsmouth site, denoted Locations A, B, and C, are shown in Figure 2.2-1.

2.2.1.1 Alternative Location A (Preferred Alternative)

Location A is the preferred location for the conversion facility and is located in the west-central portion of the site, encompassing 26 acres (10 ha). This location has three existing structures that were formerly used to store containerized lithium hydroxide monohydrate. These warehouses, which were originally erected in the early 1950s to support construction of the Portsmouth GDP, have 4-in. (10-cm) concrete floors. The structures are made of steel and are what is now commonly called pre-engineered steel buildings. No utilities are functional in these buildings. The open field north and east of the buildings was rough graded several times; the last time was in the late 1970s. The site was also rough graded, and storm water ditch systems were installed. Two railroad spurs existed at one time in this area. One has had the track and ties removed, and the other has fallen into disrepair. This location was identified in the RFP for conversion services as the site for which bidders were to design their proposed facilities.

2.2.1.2 Alternative Location B

Location B is in the southwest portion of the site and encompasses approximately 50 acres (20 ha). The site has two existing structures built as part of the gas centrifuge enrichment project that was begun in the early 1980s and was terminated in 1985. The first building is a two-story building (110,000 ft^2 [10,219 m^2] of floor) constructed of steel, with metal siding to house uranium material feed and withdrawal facilities. The facility was never placed in operation, has had major equipment removed, and is currently not utilized. The other structure was constructed at the same time as an ingress and egress portal for both vehicles and pedestrians to a fenced, secure area. It is currently not utilized. The open field to the east of the buildings was developed during the same time period; it was rough graded, and storm water systems were installed.

It should be noted that USEC is currently in the process of developing and demonstrating an advanced enrichment technology based on gas centrifuges. A license for a lead test facility to be operated at the Portsmouth site was issued by the NRC in February 2004. The lead facility would be located in the existing gas centrifuge buildings within Location B. In addition, USEC has announced that it plans to site its American Centrifuge Facility at Portsmouth, although an exact location was not identified. Therefore, Location B might not be available for construction of the conversion facility.

2.2.1.3 Alternative Location C

Location C is in the southeast portion of the site and has an area of about 78 acres (31 ha). This location consists of a level to very gently rolling grass field. It was graded during the construction of the Portsmouth site and has been maintained as grass fields since then.

2.2.2 Conversion Process Description

This section provides a summary description of the proposed UDS conversion process and facility. The proposed UDS conversion system is based on a proven commercial process in operation at the Framatome Advanced Nuclear Power (ANP), Inc., fuel fabrication facility in Richland, Washington. The two primary sources for the information in this section are excerpts from the UDS conversion facility conceptual design report (UDS 2003a) and the UDS NEPA data package prepared for the 100% conceptual facility design (UDS 2003b).

The UDS dry conversion is a continuous process in which DUF_6 is vaporized and converted to a mixture of uranium oxides (primarily U_3O_8) by reaction with steam and hydrogen in a fluidized-bed conversion unit. The resulting depleted U_3O_8 powder is collected and packaged for disposition. The process equipment would be arranged in parallel lines. Each line would consist of two autoclaves, two conversion units, an HF recovery system, and process off-gas scrubbers. The Portsmouth facility would have three parallel conversion lines. Equipment would also be installed to collect the HF co-product and process it into any combination of several marketable products. A backup HF acid neutralization system would be provided to convert up to 100% of the HF acid to CaF_2 for storage, sale, or disposal in the future, if necessary. Figure 2.2-2 is an overall material flow diagram for the conversion facility; Figure 2.2-3 is a conceptual facility site plan. A summary of key facility characteristics is presented in Table 2.2-1.

The conversion facility will be designed to convert 13,500 t (15,000 tons) of DUF_6 per year, requiring 18 years to convert the Portsmouth and ETTP inventories. The total footprint of the Portsmouth processing facility would be approximately 148 ft × 271 ft (45 m × 83 m). The conversion facility would occupy a total of approximately 10 acres (4 ha), with up to 65 acres (26 ha) of land disturbed during construction (including temporary construction lay-down areas and utility access). Some of the disturbed areas would be areas cleared for railroad or utility access, not adjacent to the construction area.

DUF_6 cylinders would be delivered from long-term storage to the cylinder staging yard at the conversion facility by means of cylinder handling equipment already available at the site. The staging yard would accommodate short-term storage of cylinders. Cylinders in the conversion staging yard would be transferred into the conversion building airlock by using an overhead bridge crane. The cylinders would then be moved into the vaporization room to the autoclaves by an overhead monorail crane and/or rail cart. The cylinders would be loaded into autoclaves for heating and transfer of the DUF_6 to the conversion units.

Cylinders that could not be processed through the normal process feed system would be processed through the cylinder transfer facility. If the cylinder was overfilled, the excess DUF_6 would be transferred to another cylinder. This same system would be used to transfer all of the contents from unacceptable cylinders to cylinders suitable for feeding into the conversion process.

After the emptied cylinder was removed from the autoclave, a stabilizing agent would be introduced into the cylinder to neutralize residual fluoride in the heel. The cylinders would then be moved out to the staging yard for an approximate 4-month aging period so that short-lived uranium decay products in the nonvolatile heel would decay, thereby reducing potential radiation exposure during the processing of emptied cylinders. Emptied cylinders would then be reused as disposal containers or processed and disposed of as LLW.

Major conversion system components are described further in the following subsections. The plant design includes several other supporting facilities and services, including an electrical system with backup, a communications system, a deionized water system, a control system, an air supply system, a fire protection system, and a heating, ventilation, and air-conditioning system.

2.2.2.1 Cylinder Transfer System

Some cylinders might be unacceptable for processing in the vaporization system autoclaves because of corrosion, damage, overfilling, or excessive size. A cylinder transfer

TABLE 2.2-1 Summary of Portsmouth Conversion Facility Parameters

Parameter/Characteristic	Value
Construction start	2004
Construction period	2 years
Start of operations	2006
Operational period	18 years
Facility footprint	10 acres (4 ha)
Facility throughput	13,500 t/yr (15,000 tons/yr) DUF_6 (≈1,000 cylinders/yr)
Conversion products	
Depleted U_3O_8	10,800 t/yr (11,800 tons/yr)
CaF_2	18 t/yr (20 tons/yr)
70% HF acid	2,500 t/yr (2,800 tons/yr)
49% HF acid	5,800 t/yr (6,300 tons/yr)
Steel (emptied cylinders, if not used as disposal containers)	1,177 t/yr (1,300 tons/yr)
Proposed conversion product disposition (see Table 2.2-2 for details)	
Depleted U_3O_8	Disposal; Envirocare (primary), NTS (secondary)[a]
CaF_2	Disposal; Envirocare (primary), NTS (secondary)
70% HF acid	Sale pending DOE approval
49% HF acid	Sale pending DOE approval
Steel (emptied cylinders, if not used as disposal containers)	Disposal; Envirocare (primary), NTS (secondary)

[a] DOE plans to decide the specific disposal location(s) for the depleted U_3O_8 conversion product after additional appropriate NEPA review. Accordingly, DOE will continue to evaluate its disposal options and will consider any further information or comments relevant to that decision. DOE will give a minimum 45-day notice before making the specific disposal decision and will provide any supplemental NEPA analysis for public review and comment.

Sources: UDS (2003a,b).

system would be used to transfer the contents of up to four unacceptable cylinders per week to acceptable cylinders. Cylinder transfer system equipment would include two low-temperature autoclaves, four fill positions, a "hot box" containing controls and vacuum pumps, and an oversize cylinder heating room. Fill positions would include a water spray cooling system necessary for low-temperature DUF_6 transfer. The oversize cylinder heating room would contain radiant heating enclosure controls and connections.

2.2.2.2 Vaporization System

Cylinders that met the vaporization criteria would be brought to the vaporization room and loaded into electrically heated autoclaves. Autoclaves for each process line would be used to provide continuous feed to the DUF_6 conversion units. The cylinders would be heated to feed DUF_6 vapor to the process. The design will incorporate in-line filters to provide additional assurances that TRU isotopes would not enter the conversion system. The need for in-line filters would be evaluated during operations; they might be removed if they were not needed.

The DUF_6 vapor would flow through a heated enclosure called a "hot box," which contains the equipment that would control flow to the conversion units, including vacuum pumps. The hot box has the necessary controls to achieve stable DUF_6 flow to the conversion units.

The autoclaves would be used to heat DUF_6 cylinders by internal electrical heating and to provide secondary DUF_6 containment. The selected autoclaves would be American Society of Mechanical Engineers standard pressure vessels, sufficiently designed to provide containment of DUF_6 and HF from a full, DUF_6 cylinder that had ruptured. Each autoclave system would include equipment and controls to connect to the cylinder, control DUF_6 flow, monitor DUF_6 weight, and control vaporization conditions.

Electrically heated autoclaves would provide a safety advantage over steam-heated units. If DUF_6 leaks in a steam autoclave, the DUF_6 reacts with the steam and generates HF gas, which pressurizes the autoclave and is extremely corrosive. If DUF_6 leaks in an electrically heated autoclave, however, the only moisture available is humidity in the air, which limits HF generation and subsequent pressurization and corrosion. This also makes cleanup of the autoclave much easier since the autoclave is evacuated directly to the conversion unit and does not produce wet uranium recycle and liquid wastes.

2.2.2.3 Conversion System

DUF_6 vapor would be reacted with steam and hydrogen in fluidized-bed conversion units. The hydrogen would be generated by using anhydrous ammonia (NH_3). Nitrogen is also used as an inert purging gas and is released to the atmosphere through the building stack as part of the clean off-gas stream. The oxide powder would be retained in the conversion unit by passing the process off-gas through sintered metal filters. Uranium oxide powder would be continuously withdrawn from the conversion unit to match the feed rate of DUF_6. Each conversion unit would be electrically heated and integrated with a heating/insulation jacket.

All equipment components (vessels, filters, etc.) in the conversion system would be fabricated of corrosion-resistant alloys suited to process conditions. In the event of a system failure or an unscheduled shutdown, the DUF_6 shutoff valve in the autoclave would automatically close. The DUF_6 piping would then be purged with nitrogen. In the event of power, instrument, air, or other failure, a fail-safe design would be used for valves and for the control system.

2.2.2.4 Depleted Uranium Conversion Product Handling System

Depleted U_3O_8 powder would be cooled as it was discharged from the conversion unit. An in-line water-cooled heat exchanger would cool the powder before it dropped into a vacuum transfer station enclosure. The vacuum transfer station would include connections, a vacuum transfer pickup device, a support vessel, a hopper, and a secondary enclosure to facilitate packaging the depleted U_3O_8. A package fill station would be located below each hopper. Powder fill would be controlled by weight in the fill container, and a secondary containment enclosure would be provided at the fill station. The filled packages would be lifted and conveyed by using an overhead monorail crane through an airlock and loaded into railcars for shipment to the disposal site. Each packaging station would operate on a semicontinuous basis with intermittent package removal and installation. Continuous level control would maintain the oxide hopper at 20% to 25% of capacity. Prior to package change out, the oxide discharge would be stopped.

UDS proposes to use the emptied cylinders as disposal containers to the extent practicable. An option of using bulk bags (large capacity, strong, flexible bags) as disposal containers is also being considered. After being processed (see Section 2.2.2.6), the emptied cylinders would be moved to the conversion product transfer station and refilled with depleted U_3O_8 powder. The refilled cylinders would be sealed and loaded to railcars for shipment to the disposal site. Bulk bags would be handled similarly.

The conversion facilities are being designed with a short-term storage capacity for 6 months' worth of depleted uranium conversion products. This storage capacity is being provided in order to accommodate potential delays in disposal activities without affecting conversion operations. If a delay was to extend beyond 6 months, DOE would evaluate possible options and conduct appropriate NEPA review for those options.

2.2.2.5 HF Recovery System

The fluorine component of the DUF_6 would leave the conversion unit as HF gas through sintered metal filters that would retain nearly all (greater than 99.9%) of the uranium in the conversion unit. The HF would be condensed, along with the unreacted excess steam, and the resulting HF acid would flow by gravity to receiver tanks. In addition, the off-gas would be passed through a series of two scrubbers to recover most of the uncondensed HF. In each scrubber, process off-gas would come into contact with 20% potassium hydroxide (KOH) solution. HF vapor would combine with KOH in the solution to form potassium fluoride (KF) and water (H_2O); thus HF would be removed from the process off-gas stream.

The HF acid would be automatically transferred from the receivers to interim bulk storage tanks located outside the building. An in-line uranium analyzer in each transfer line would be used as a final verification that containment of the uranium was intact. High-integrity piping and equipment made with corrosion-resistant materials would result in zero leakage of HF, either gaseous or liquid, to the environment. The HF would be stored on site at each conversion facility for approximately 2 weeks or less under normal conditions and then shipped to a vendor. The storage capacity for HF at each site is limited, and if the material could not be moved, it would be converted to CaF_2 or processing would stop.

2.2.2.6 Emptied Cylinder Processing

UDS proposes to use the emptied cylinders as disposal containers to the extent practicable. After removal of the cylinders from the autoclaves, a stabilizing agent would be introduced to the cylinders to neutralize residual fluoride in the heels. After an approximate 4-month aging period, emptied cylinders (with heel) would be transferred to the conversion product transfer stations, as described above. Alternatively, if bulk bags were used for depleted U_3O_8 disposal containers, after an approximate 4-month aging period, emptied cylinders (with heel) would be transported into the cylinder disposition facility. A forklift would be used to move the cylinders to the feed queue outside the facility airlock. Cylinders would then be brought into the disposition facility via an overhead monorail crane and placed into a compactor feed station. The plugs would be removed from the cylinder to vent the cylinder during crushing. The cylinder would then be pushed by a ram into the compactor itself, where it would be compacted radially to a maximum thickness of 8 in. (20 cm). The compacted cylinder would then be pushed to the cutting station, where it would be cut in half to reduce the length. The two pieces of metal would be picked up with an overhead crane and placed into an intermodal shipping container. Debris from these operations would then be collected in a container by a vacuum system and loaded into the intermodal container.

Secondary containment would be provided for the intermodal container loadout. In addition, small cylinders that had not been compacted, as well as valves, plugs, and facility secondary waste, might also be loaded into the intermodal containers. Cylinders that were destined for disposal at NTS would not be introduced into the facility but would instead be loaded directly onto trucks or railcars for transport.

2.2.2.7 Management of Potential Transuranic and PCB Contamination

As discussed in Section 1.2.2, as a result of enrichment of reprocessed uranium in the early years of gaseous diffusion, some of the DUF_6 inventory is contaminated with small amounts of Tc and the TRU elements Pu, Np, and Am. In addition, a portion of the cylinder inventory was originally painted with coatings containing PCBs.

TRU contamination in the cylinders would exist as fluoride compounds that would be both insoluble in liquid DUF_6 and nonvolatile but capable of being entrained from the cylinders during the vaporization and feeding of DUF_6 into the conversion process. The TRU contamination would exist primarily as (1) small particulates dispersed throughout the DUF_6 contents and (2) small quantities in the residual heels from the original feed cylinders in a relatively small but unknown number of cylinders (see Appendix B for more details). Tc contamination would exist as fluoride and oxyfluoride compounds that would be stable and partially volatile, and the contamination would be present both uniformly dispersed throughout the DUF_6 and in the heel material referred to previously.

The TRU contaminants that are dispersed throughout the DUF_6 might be entrained in the gaseous DUF_6 during the cylinder emptying operations and carried out of the cylinders. These contaminants could be captured in filters between the cylinders and the conversion units. These filters would be monitored and changed out periodically to prevent buildup of TRU. They would be disposed of as LLW.

It is also expected that the nonvolatile forms of Tc that exist in the cylinders would remain in the heels or be captured in the filters. However, because of the existence of some volatile technetium fluoride compounds, and for the purposes of analyses in this EIS, it is assumed that all of the Tc dispersed in the DUF_6 would volatilize with DUF_6 and be carried into the conversion process equipment. Any Tc compounds transferred into the conversion units would be oxidized along with the DUF_6. For this EIS, it is also assumed that the Tc in the form of oxides would partition into the U_3O_8 and HF products in the same ratio as the uranium. It is assumed that Tc left in the heels from the original feedstock would remain behind after the DUF_6 was vaporized.

If bulk bags were used for depleted U_3O_8 disposal, the emptied cylinders would be processed as described in Section 2.2.2.6. The emptied cylinders would be surveyed by using nondestructive assay techniques to determine the presence of a significant quantity of TRU isotopes. If TRU isotopes were detected, samples would be taken and analyzed. Cylinders that exceeded the disposal site limits at the Envirocare of Utah, Inc., facility would be treated to immobilize the heel (e.g., with grout) within the cylinder, compacted, and sectioned; then the cylinder/heel waste stream would be sent to NTS and disposed of as LLW.

As noted in Section 1.2.2, the paints applied to some cylinders prior to 1978 included PCBs, which were typically added as a fungicide and to increase durability and flexibility. Records of the PCB concentrations in the paints used were not kept, so it is currently unknown how many cylinders are coated with paint containing PCBs. However, paint chips from a representative sample of cylinders at the ETTP site have been analyzed for PCBs. The results indicate that up to 50% of the cylinders at ETTP may have coatings containing PCBs. Because the Portsmouth and Paducah inventories contain a large number of cylinders produced before 1978, it is reasonable to assume that a significant number of cylinders at those sites also are coated with paint containing PCBs.

For each of the three storage sites, the PCBs in cylinder paints constitute an extremely small proportion of the PCBs that were previously and are currently at the sites. For example, although the Paducah site has been working for several years to dispose of PCB-containing equipment, the site still had about 870 liquid PCB-containing items (mostly capacitors) in service at the end of 2001. The Portsmouth and ETTP sites also still have a large number of liquid PCB-containing items in service. The three sites are suspected to have had spills of PCB liquids during past operations, prior to the identification of the health and environmental hazards of PCBs.

Each of the three current DUF_6 cylinder storage sites has an existing program for managing PCB-contaminated waste under the Toxic Substances Control Act (TSCA). In addition, the environmental monitoring program at each site includes monitoring of PCB concentrations in soil, sediment, groundwater, surface water, and biota on and in the vicinity of the sites (see Sections 3.1 and 3.2). These programs would be expected to continue throughout cylinder management activities.

Under the proposed action, storage, conversion, transportation, and disposal operations will comply with applicable TSCA regulations. Additional details are provided in Appendix B.

2.2.3 Conversion Product Disposition

The conversion process would generate four conversion products that have a potential use or reuse: depleted U_3O_8, HF, CaF_2, and steel from emptied DUF_6 cylinders (if not used as disposal containers). DOE has been working with industrial and academic researchers for several years to identify potential uses for these products. Some potential uses for depleted uranium exist or are being developed, and DOE believes that a viable market exists for the HF generated during conversion. To take advantage of these to the extent possible, DOE requested in the RFP that the bidders for conversion services investigate and propose viable uses. The probable disposition paths identified by UDS for each of the conversion products are summarized in Table 2.2-2 (UDS 2003b).

According to UDS, of the four conversion products, only HF has a viable commercial market currently interested in the product. Therefore, UDS expects that the HF would be sold to a commercial vendor pending DOE approval of the residual contamination limits and the sale. Commercial-grade HF produced at the Framatome ANP, Inc. (a UDS partner), facility in Richland, Washington, is currently sold commercially under an NRC-approved license. UDS is currently working with DOE through a formal process to evaluate and establish authorized release limits for the HF. Details on this process and on HF sale and use are provided in Appendix E. Should the release of the HF not be allowed, it would be neutralized to CaF_2 for sale or disposal, creating about 2 t (2.2 tons) per 1 t (1.1 ton) of HF. UDS will seek to obtain DOE approval to sell this material as well. However, the market is not as strong as that for the HF; thus, the CaF_2 produced during normal operations might become waste.

Although the depleted U_3O_8 and emptied cylinders have the potential for use or reuse, currently none of the uses have been shown to be viable because of cost, perception, feasibility, or the need for additional study. Thus, UDS expects that most, if not all, of the uranium oxide and emptied cylinders will require disposal. These materials would be processed and may be shipped to Envirocare for disposal, as summarized in Table 2.2-2.

The EIS evaluation of conversion product disposition considers:

- Transportation of the uranium oxide conversion product and emptied cylinders by truck and rail to both Envirocare (proposed) and NTS (option) for disposal. DOE plans to decide the specific disposal location(s) for the depleted U_3O_8 conversion product after additional appropriate NEPA review. Accordingly, DOE will continue to evaluate its disposal options and will consider any further information or comments relevant to that decision.

TABLE 2.2-2 Summary of Proposed Conversion Product Treatment and Disposition

Conversion Product	Packaging/Storage	Proposed Disposition	Optional Disposition
Depleted U_3O_8	U_3O_8 would be loaded into emptied cylinders, which would be loaded onto railcars. An option of using bulk bags as disposal containers is also considered.	Disposal at Envirocare of Utah, Inc.[a]	Disposal at NTS.[a]
CaF_2	Packaged for sale or disposal.	Commercial sale pending DOE approval of authorized release limits, as appropriate.	Disposal at Envirocare of Utah, Inc.[a]
HF acid (49% and 70%)	HF produced by the dry conversion facility would be commercial grade. HF would be stored on site until loaded into rail tank cars.	Sale to commercial HF acid supplier pending DOE approval of authorized release limits, as appropriate.	Neutralization of HF to CaF_2 for use or disposal.
Steel (emptied cylinders)	Emptied cylinders would be reused as disposal containers for U_3O_8 to the extent practicable. If bulk bags were used, the emptied cylinders would have a stabilizing agent added to neutralize residual fluorine, be stored for 4 months, crushed to reduce the size, sectioned, and packaged in intermodal containers.	Disposal at Envirocare of Utah, Inc.[a]	Disposal at NTS.[a]

[a] DOE plans to decide the specific disposal location(s) for the depleted U_3O_8 conversion product after additional appropriate NEPA review. Accordingly, DOE will continue to evaluate its disposal options and will consider any further information or comments relevant to that decision. DOE will give a minimum 45-day notice before making the specific disposal decision and will provide any supplemental NEPA analysis for public review and comment.

DOE will give a minimum 45-day notice before making the specific disposal decision and will provide any supplemental NEPA analysis for public review and comment.

- Transportation and sale of the HF conversion product, and
- Neutralization of HF to CaF_2 and its sale or disposal in the event that the HF product is not sold.

Because specific destinations are unknown at this time, impacts from the shipment of HF and CaF_2 for use are based on a range of representative route distances. Additional details concerning the transportation assessment are provided in Appendix F, Section F.3.

Transportation Requirements for DUF_6 Cylinders

All shipments of UF_6 cylinders have to be made in accordance with applicable DOT regulations for the shipment of radioactive materials; specifically, the provisions of 49 CFR Part 173, Subpart I. The DOT regulations require that each UF_6 cylinder be designed, fabricated, inspected, tested, and marked in accordance with the various engineering standards that were in effect at the time the cylinder was manufactured. The DOT requirements are intended to maintain the safety of shipments during both routine and accident conditions. The following provisions are particularly important relative to DUF_6 cylinder shipments:

1. A cylinder must be filled to less than 62% of the certified volumetric capacity (the fill limit was reduced to from 64% to 62% in about 1987).

2. The pressure within a cylinder must be less than 14.8 psia (subatmospheric pressure).

3. A cylinder must be free of cracks, excessive distortion, bent or broken valves or plugs, and broken or torn stiffening rings or skirts, and it must not have a shell thickness that has decreased below a specified minimum value. (Shell thicknesses are assessed visually by a code vessel inspector, and ultrasonic testing may be specified at the discretion of the inspector to verify wall thickness, when and in areas the inspector deems necessary.)

4. A cylinder must be designed so that it will withstand (1) a hydraulic test at an internal pressure of at least 1.4 megapascals (200 psi) without leakage; (2) a free drop test onto a flat, horizontal surface from a height of 1 ft (0.3 m) to 4 ft (1.2 m), depending on the cylinder's mass, without loss or dispersal; and (3) a 30-minute thermal test equivalent to being engulfed in a hydrocarbon fuel/air fire having an average temperature of at least 800°C (1,475°F) without rupture of the containment system.

2.2.4 Preparation and Transportation of ETTP Cylinders

DOE proposes to ship cylinders stored at ETTP to Portsmouth for conversion. This EIS evaluates the preparation of DUF_6 and non-DUF_6 cylinders at ETTP and the transportation of those cylinders to Portsmouth by several different methods, as described below.

All shipments of ETTP cylinders would have to be made consistent with DOT regulations for the shipment of radioactive materials as specified in Title 49 of the CFR (see text box and Chapter 6). The cylinders could be shipped by truck or rail.

The majority of DUF_6 cylinders were designed, built, tested, and certified to meet the DOT requirements. The DOT requirements are intended to maintain the safety of shipments during both routine and accident conditions. A summary of the applicable transportation regulations for shipment of UF_6 is provided in Chapter 6 of this EIS; a detailed discussion of pertinent transportation regulations is presented in Biwer et al. (2001). Cylinders meeting the DOT requirements could be loaded directly onto specially designed truck trailers or railcars for shipment. However, after several decades in storage, some cylinders have physically deteriorated such that they no longer meet the DOT requirements.

It is unknown exactly how many DUF_6 cylinders do not meet DOT transportation requirements. As discussed in Section 1.7, it is estimated that up to 1,700 cylinders are DOT compliant, with the remainder not meeting the DOT requirements. Problems are related to the following DOT requirements that must be satisfied before shipment: (1) documentation must be available showing that each cylinder was properly designed, fabricated, inspected, and tested prior to being filled; (2) cylinders must be filled to less than 62% of the maximum capacity; (3) the pressure within cylinders must be less than atmospheric pressure; (4) cylinders must not leak or be damaged so they are unsafe; and (5) cylinders must have a specified minimum wall thickness. Cylinders not meeting these requirements are referred to as "noncompliant." Some cylinders might fail to meet more than one requirement.

Three options exist for shipping noncompliant cylinders (Biwer et al. 2001):

1. The DUF_6 contents could be transferred from noncompliant cylinders into new or compliant cylinders.

2. An exemption could be obtained from DOT that would allow the DUF_6 cylinder to be transported either "as is" or following repairs. The primary finding that DOT would have to make to justify granting an exemption is this: the proposed alternative would have to achieve a safety level that would be at least equal to the level required by the otherwise applicable regulation or, if the otherwise applicable regulation did not establish a required safety level, would be consistent with the public interest and adequately protect against the risks to life and property that are inherent when transporting hazardous materials in commerce.

3. Noncompliant cylinders could be shipped in a protective overpack. In this case, the shipper would have to obtain an exemption from DOT that would allow the existing cylinder, regardless of its condition, to be transported if it was placed in an overpack. The overpack would have to be specially designed. Furthermore, DOT would have to determine that, if the overpack was fabricated, inspected, and marked according to its design, the resulting packaging (including the cylinder and the overpack) would have a safety level at least equal to the level required for a new UF_6 cylinder.

Before shipment, each cylinder would be inspected to determine if it met DOT requirements. This inspection would include a record review to determine if the cylinder was overfilled; a visual inspection for damage or defects; a pressure check to determine if the cylinder was overpressurized; and an ultrasonic wall thickness measurement (based on a visual inspection, if necessary). If a cylinder passed the inspection, the appropriate documentation would be prepared, and the cylinder would be loaded directly for shipment. The preparation of compliant cylinders (cylinders that meet DOT requirements) would include inspection activities, unstacking, on-site transfer, and loading onto a truck trailer or railcar. The cylinders would be secured by using the appropriate tiedowns, and the shipment would be labeled in accordance with DOT requirements. Handling and support equipment and the procedures for on-site movement and for loading the cylinders would be of the same type currently used for cylinder management activities at the storage sites.

This EIS considers the three options for shipping noncompliant cylinders from ETTP. The information on these activities is based on preconceptual design data provided in the Engineering Analysis Report (Dubrin et al. 1997) prepared for the DUF_6 PEIS and the analysis of potential environmental impacts presented in Appendix E of the DUF_6 PEIS (DOE 1999a).

An overpack is a container into which a cylinder is placed for shipment. The overpack would be designed, tested, and certified to meet all DOT shipping requirements. It would be suitable for containing, transporting, and storing the cylinder contents regardless of cylinder condition. For transportation, a noncompliant cylinder would be placed into an overpack that was already on a truck trailer or railcar. The overpack would be closed and secured, and the shipment would be labeled in accordance with DOT requirements. The overpacks could be reused following shipment.

The second cylinder preparation option for transporting noncompliant cylinders considered in this EIS is the transfer of the DUF_6 from substandard cylinders to new or used cylinders that would meet all DOT requirements. This option could require the construction of a new cylinder transfer facility, for which there are no current plans. Following transfer of the DUF_6, the compliant cylinders could be shipped by placing them directly onto appropriate trucks or railcars. If a decision were made to construct a transfer facility at ETTP, additional NEPA review would be conducted.

The third option is to ship the cylinders "as-is" under a DOT exemption. As discussed above, for this to occur, it must be demonstrated that the cylinders would be shipped in a manner achieving a level of safety that would be at least equal to the level required by the regulations, which would likely require some compensatory measures.

In this EIS, transportation impacts are estimated for shipment by either truck or rail after cylinder preparation. The impacts are assessed by determining truck and rail routes between ETTP and the Portsmouth site.

2.2.5 Construction of a New Cylinder Storage Yard at Portsmouth

It might be necessary to construct an additional yard at Portsmouth for storing the ETTP cylinders, depending on when and at what rate the ETTP cylinders were shipped. DOE is currently in the process of determining if a new yard is required, or if existing storage yard space could be used for the ETTP cylinders. The potential environmental impacts from the construction of a new cylinder storage yard have been included in this EIS to account for current uncertainties.

Two possible locations for new cylinder yard construction were identified at the Portsmouth site, as shown in Figure 2.2-4 (also identified in Figure 2.2-4 is an existing concrete pad being evaluated for temporary storage of the ETTP cylinders). Both areas are adjacent to current DOE cylinder storage yards. Proposed Area 1 consists of three smaller sections with a total area of about 5.5 acres (2.2 ha). Proposed Area 2 consists of two smaller sections with a total area of about 6.3 acres (2.5 ha). New yards would be constructed of concrete and would be similar to other concrete yards constructed at the Portsmouth site. Potential environmental impacts from construction of a new yard at both locations identified are evaluated in this EIS.

2.2.6 Option of Shipping ETTP Cylinders to Paducah

As discussed above, DOE proposes to ship the DUF_6 and non-DUF_6 cylinders at ETTP to Portsmouth. However, this EIS considers shipping the ETTP cylinders to Paducah as an option. If the ETTP cylinders were shipped to Paducah, the Portsmouth conversion facility would have to operate for 14 rather than 18 years to convert the Portsmouth inventory. In Chapter 5, this EIS presents a discussion of the potential environmental impacts associated with this reduction in the operational period. Potential impacts associated with transportation of the ETTP cylinders to Paducah are evaluated in detail in the site-specific Paducah conversion facility EIS (DOE 2004a).

2.2.7 Option of Expanding Conversion Facility Operations

The conversion facility at Portsmouth is currently being designed to process the DOE DUF_6 cylinder inventory at the site over 18 years by using three process lines. There are no current plans to operate the conversion facility beyond this time period or to increase the throughput of the facility by adding a fourth process line. However, a future decision to extend conversion facility operations or increase throughput at the site could be made for several reasons. Consequently, this EIS includes an evaluation of the environmental impacts associated with expanding conversion facility operations at the site (either by increasing throughput or by extending operations beyond 18 years) in order to provide future planning flexibility (impacts are presented in Section 5.2.8). The possible reasons for expanding operations in the future are discussed below.

The DOE Office of Inspector General (OIG) issued a final audit report in March 2004 recommending that EM conduct a cost benefit analysis to determine the optimum size of the Portsmouth conversion facility and, on the basis of the results of that review, implement the most cost-effective approach (DOE 2004c). The report states that by adding an additional process line to the Portsmouth facility, the time to process the Portsmouth and ETTP inventories of DUF_6 could be shortened by 5 years at a substantial cost savings of 55 million dollars.

As stated in the DOE EM response to the OIG report (DOE 2004b), DOE is not planning to increase the number of process lines within the Portsmouth conversion facility in response to the OIG recommendations. Instead, on the basis of experience with other projects, DOE believes that higher throughput rates can be achieved by improving the efficiency of the planned equipment (DOE 2004b). The conversion contract provides significant incentives to the conversion contractor to improve efficiency. For example, the current facility designs are based on an assumption that the conversion plant would have an 84% on-line availability (percent of time system is on line and operational). However, Framatome's experience at the Richland plant indicates that the on-line availability is expected to be at least 90%. Therefore, there is additional capacity expected to be realized in the current design. Although there are no plans to increase the throughput at the Portsmouth facility by adding an additional process line, as recommended by the OIG, the potential environmental impacts associated with increasing the plant throughput, by both process improvements and the addition of a fourth process line, are discussed in Section 5.2.8 of this EIS.

A future decision to extend operations or expand throughput might also result from the fact that DOE could assume management responsibility for DUF_6 in addition to the current inventory. Two statutory provisions make this possible. First, Sections 161v. [42 USC 2201(v)] and 1311 [42 USC 2297b-10] of the AEA of 1954 [P.L. 83-703], as amended, provide that DOE may supply services in support of USEC. In the past, these provisions were used once to transfer DUF_6 cylinders from USEC to DOE for disposition in accordance with DOE orders, regulations, and policies. Second, Section 3113(a) of the USEC Privatization Act [42 USC 2297h-11(a)] requires DOE to accept LLW, including depleted uranium that has been determined to be LLW, for disposal upon request and reimbursement of costs by USEC or any other person licensed by the NRC to operate a uranium enrichment facility. This provision has not been invoked, and the form in which depleted uranium would be transferred to DOE by a uranium enrichment facility invoking this provision is not specified. However, DOE believes depleted uranium transferred under this provision in the future would most likely be in the form of DUF_6, thus adding to the inventory of material needing conversion at the DUF_6 conversion facilities and disposition.

Several possible sources of additional DUF_6 generated from uranium enrichment activities include the following:

1. USEC continues to operate the gaseous diffusion plant at the Paducah site, generating approximately 1,000 cylinders per year of DUF_6. In the past, DOE signed MOAs with USEC transferring DUF_6 cylinders to DOE (DOE and USEC 1998a,b); the latest was signed in June 2002 for DUF_6 generated from 2002 through 2005. Future MOAs are possible. Consequently, DOE may assume responsibility for additional DUF_6 cylinders at the Paducah site.

2. USEC is currently in the process of developing and demonstrating an advanced enrichment technology based on gas centrifuges. A license for a lead test facility to be operated at the Portsmouth site was issued by the NRC in February 2004. In January 2004, USEC announced that its future enrichment facility using the advanced technology would be sited at the Portsmouth site. Consequently, additional DUF_6 could be generated at this site that ultimately could be transferred to DOE.

3. New commercial uranium enrichment facilities may be built and operated in the United States by commercial companies other than USEC. Although there are no agreements for DOE to accept DUF_6 from such commercial sources, it is possible in the future.

If DOE took responsibility for additional DUF_6 in the future, it is reasonable to assume that the conversion facilities at Portsmouth and/or Paducah could be operated longer than specified in the current plans in order to convert this material or that the throughput of the facilities could be increased. The duration of extended operations or the size of a throughput increase would depend on the quantity of material transferred and the location of the transfer.

In addition, because, under the current plans, the Portsmouth facility could conclude operations approximately 7 years before the current Paducah inventory would be converted at the Paducah site, it is possible that DUF_6 cylinders could be transferred from Paducah to Portsmouth to facilitate conversion of the entire inventory, particularly if DOE assumed responsibility for additional DUF_6 at Paducah.

The potential environmental impacts associated with extended plant operations, increased facility throughput, and Paducah-to-Portsmouth cylinder shipments are discussed in Section 5.2.8.

2.3 ALTERNATIVES CONSIDERED BUT NOT ANALYZED IN DETAIL

2.3.1 Utilization of Commercial Conversion Capacity

During the scoping process for the PEIS, it was suggested that DOE consider using existing UF_6 conversion capacity at commercial nuclear fuel fabrication facilities that convert natural or enriched UF_6 to UO_2 in lieu of constructing new conversion capacity for DUF_6. Accordingly, in May 2001, DOE investigated the capabilities of existing commercial nuclear fuel fabrication facilities in the United States to determine whether this suggested approach would be a reasonable alternative. Publicly available information was reviewed, and an informal telephone survey of U.S. commercial fuel cycle facilities was conducted. The investigation report concluded that if 100% of the UF_6 conversion capacity of domestic commercial nuclear fuel fabrication facilities operating in May 2001 could be devoted to converting DOE's DUF_6 inventory, approximately 5,500 t (6,100 tons) of DUF_6 could be converted per year. On the basis of this conclusion, the investigation report estimated that it would take more than 125 years to convert DOE's DUF_6 inventory by using only existing conversion capacity. Furthermore, during the informal telephone survey, U.S. commercial fuel fabrication facilities were willing to confirm a capacity of only about 300 t (331 tons) of UF_6 per year as being possibly available to DOE. The investigation report indicated that there seems to be a general lack of interest on the part of the facility owners in committing existing operating or mothballed capacity to conversion of the DOE DUF_6 inventory (Ranek and Monette 2001).

Even though UF_6 conversion capacity at commercial nuclear fuel fabrication facilities might become available in the future, the small capacity identified in 2001 as being possibly available to DOE, coupled with the low interest level expressed at that time by facility owners, indicates that the feasibility of this suggested alternative is low. Therefore, this EIS does not analyze in detail the alternative of using existing capacity at commercial nuclear fuel fabrication facilities.

2.3.2 Other Sites

The consideration of alternative sites was limited to alternative locations within the Portsmouth site in response to Congressional direction. As discussed in detail in Section 1.1, Congress has acted twice regarding the construction and operation of DUF_6 conversion plants at Portsmouth and Paducah.

First, in July 1998, P.L. 105-204 directed DOE to make a plan consistent with NEPA for the construction and operation of conversion facilities at Portsmouth and Paducah. Consequently, DOE prepared a plan (DOE 1999b) and published an NOI in the *Federal Register* on September 18, 2001 (68 FR 48123) that identified the range of alternatives to be considered in a conversion facility EIS, including the alternative of constructing only one conversion plant.

Second, while the preparation of the conversion facility EIS was underway, Congress acted again regarding DUF_6 management by passing P.L. 107-206 in August 2002. The pertinent part of P.L. 107-206 directed DOE to award a contract for construction and operation of conversion facilities at the Portsmouth and Paducah sites and to commence construction no later than July 31, 2004. Subsequently, DOE reevaluated the appropriate approach of the NEPA review and decided to prepare two separate site-specific EISs. This change was announced in the *Federal Register* on April 28, 2003 (68 FR 22368). Consistent with the direction of P.L. 107-206, the alternatives for placing the conversion facilities were limited in each site-specific EIS to locations within the Portsmouth and Paducah sites, respectively.

2.3.3 Other Conversion Technologies

This EIS provides a detailed analysis of impacts associated with the proposed UDS conversion of DUF_6 to depleted U_3O_8. As discussed in Section 1.6.2.2, the conversion project RFP did not specify the conversion product technology or form. Three proposals submitted in response to the RFP were deemed to be in the competitive range; two of these proposals involved conversion of DUF_6 to U_3O_8 and the third involved conversion to depleted UF_4. Potential environmental impacts associated with these proposals were considered during the procurement process, including the preparation of an environmental critique and environmental synopsis, which were prepared in accordance with the requirements of 10 CFR 1021.216.

The environmental synopsis is presented in Appendix D. The environmental synopsis concluded that, on the basis of the assessment of potential environmental impacts presented in the critique, no proposal was 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. In addition, the potential environmental impacts associated with the proposals were found to be similar to, and generally less than, those presented in the DUF_6 PEIS (DOE 1999a) for representative conversion technologies.

2.3.4 Long-Term Storage and Disposal Alternatives

This EIS considers the site-specific impacts from conversion operations at the Portsmouth site, impacts from the transportation of depleted uranium conversion products to NTS and Envirocare for disposal, and impacts from the potential sale of HF and CaF_2 produced from conversion. Environmental impacts are not explicitly evaluated for the long-term storage of conversion products or for disposal.

At this time, there are no specific proposals for the long-term storage of conversion products that would warrant more detailed analysis. Long-term storage alternatives were analyzed in the PEIS, including storage as DUF_6 and storage as an oxide (either U_3O_8 or UO_2). For long-term storage of DUF_6, the options considered were storage in outdoor yards, buildings, and an underground mine. For long-term storage as an oxide, storage in buildings, underground vaults, and an underground mine were considered. The potential environmental impacts from long-term storage were evaluated for representative and generic sites. Preconceptual designs presented in the Engineering Analysis Report (Dubrin et al. 1997) were used as the basis for the analysis, and the evaluation of environmental impacts considered a 40-year period.

This EIS evaluates the impacts from packaging, handling, and transporting conversion products from the conversion facilities to a LLW disposal facility. The disposal facility would be (1) selected in a manner consistent with DOE policies and orders and (2) authorized or licensed to receive the conversion products by either DOE (in conformance with DOE orders), the NRC (in conformance with NRC regulations), or an NRC Agreement State agency (in conformance with state laws and regulations determined to be equivalent to NRC regulations). Assessment of the impacts and risks from on-site handling and disposal at the LLW disposal facility is deferred to the disposal site's site-specific NEPA or licensing documents. However, this EIS covers the impacts from transporting the DUF_6 conversion products to both Envirocare and NTS.

2.3.5 Other Transportation Modes

Transportation by air and barge were considered but not analyzed in detail. Transportation by air was deemed to not be reasonable for the types and quantities of materials that would be transported to and from the conversion site. Any transportation by air would involve only small quantities of specialty materials or items generally carried through mail delivery services.

Transportation by barge was also considered, but although it could be used to ship cylinders among the three current storage sites, it was not evaluated in detail. As explained more fully in Section 4.1 of the Engineering Analysis Report (Dubrin et al. 1997), ETTP is the only site with a nearby barge facility. Portsmouth would either have to build new facilities or use existing facilities that are located 20 to 30 mi (32 to 48 km) from the Portsmouth site. Use of existing facilities would require on-land transport by truck or rail over the 20- to 30-mi (32- to 48-km) distance, and the cylinders would have to go through one extra unloading/loading step at the end of the barge transport. Currently, there are no initiatives to build new barge facilities closer to the Portsmouth site. If barge shipment was proposed in the future and considered to be a reasonable option, additional NEPA review would be conducted.

2.3.6 One Conversion Plant Alternative

In the NOI published in the *Federal Register* on September 18, 2001, construction and operation of one conversion plant was identified as a preliminary alternative that would be considered in the conversion EIS. However, with the passage of P.L. 107-206, which mandates the award of a contract for the construction and operation of conversion facilities at both Paducah and Portsmouth, the one conversion plant alternative was considered but not analyzed in this EIS.

2.4 COMPARISON OF ALTERNATIVES

2.4.1 General

This EIS includes analyses of a no action alternative and the proposed action of building and operating a conversion facility at three alternative locations within the Portsmouth site. Listed below is a general comparison of the activities required for each alternative and the types of environmental impacts that could be expected from each. A detailed comparison of the estimated environmental impacts associated with the alternatives is provided in Section 2.4.2.

- The no action alternative would consist of the continued surveillance and maintenance of the DUF_6 inventories at the Portsmouth and ETTP sites. No conversion facility would be constructed or operated. Only minor yard reconstruction would be required, and no cylinders would be shipped off site. Cylinder breaches could occur as a result of damage during handling or external corrosion.

  Potential environmental impacts associated with the no action alternative would be primarily limited to (1) the exposure of involved workers to external radiation in the cylinder yards during surveillance and maintenance activities, (2) impacts associated with the possible release of depleted uranium and HF from breached cylinders and their dispersal in the environment (before the breaches were identified and repaired), and (3) potential accidents that could damage cylinders and result in a release of DUF_6.

- The proposed action would involve the construction and operation of a conversion facility at Portsmouth. Three alternative locations are considered. It would take the conversion facility approximately 18 years to convert the entire DUF_6 inventory to U_3O_8 at a rate of approximately 1,000 cylinders (13,500 t [15,000 tons]) per year. This includes conversion of about 4,800 DUF_6 cylinders to be transported from the ETTP site. Shipping of about

1,100 non-DUF_6 cylinders from ETTP to Portsmouth is also included; however, conversion of the contents of these cylinders is not included under the proposed action. Finally, aqueous HF could also be produced for sale during the conversion process, or the HF could be neutralized to CaF_2 for sale or disposal.

The proposed action also evaluates construction of a new cylinder storage yard at Portsmouth for the ETTP cylinders, if required. Two alternate areas for the storage yard are considered (see Figure 2.2-4).

The option of shipping approximately 5,900 cylinders (approximately 4,800 DUF_6 cylinders for conversion and about 1,100 non-DUF_6 cylinders) from ETTP to Paducah rather than to Portsmouth is also evaluated. This option would reduce the period of operation of the Portsmouth conversion facility from 18 to 14 years.

After conversion, the conversion products (U_3O_8, aqueous HF or CaF_2, and emptied cylinders, if not used as disposal containers for U_3O_8) would be shipped by truck or rail to a user or disposal facility (either NTS or Envirocare).

Potential environmental impacts associated with the proposed action alternatives would include (1) impacts to local air, water, soil, ecological, and cultural resources during storage yard and facility construction; (2) impacts to workers from conversion facility construction and operations; (3) impacts from small amounts of depleted uranium and other hazardous compounds released to the environment through normal conversion plant air effluents; (4) impacts from the shipment of cylinders, conversion products, and waste products; and (5) impacts from potential accidents involving the release of radioactive material or hazardous chemicals.

2.4.2 Summary and Comparison of Potential Environmental Impacts

This EIS includes analyses of potential impacts at the Portsmouth and ETTP sites under the no action alternative and potential impacts at Portsmouth under the proposed action alternatives. Under the no action alternative, potential impacts associated with the continued storage of DUF_6 cylinders in yards are evaluated through 2039; in addition, the long-term impacts that could result from releases of DUF_6 and HF from future cylinder breaches are evaluated. For the proposed action, potential impacts are evaluated at three alternative locations for the following:

- The conversion facility construction period of approximately 2 years;
- Construction of a new cylinder storage yard over a period of about 3 months, if necessary;

- The operational period required to convert the entire DUF_6 inventory, which would equal 18 years (14 years if the ETTP inventory was shipped to Paducah instead); and

- A facility D&D period of 3 years.

Under each alternative, potential consequences are evaluated in many areas: human health and safety (during normal operations, accidents, and transportation), air quality, noise, water, soil, socioeconomics, ecology, waste management, resource requirements, land use, cultural resources, and environmental justice. (Methodologies are discussed in Chapter 4 and Appendix F.) The assessment considers impacts that could result from the construction of necessary facilities, normal operations of facilities, accidents, preparation of cylinders for shipment, transportation of materials, and the D&D of facilities after conversion is complete. In addition, the production and sale of aqueous HF is evaluated, as is the possibility of neutralizing HF to CaF_2 for sale or disposal.

The potential environmental impacts at Portsmouth under the proposed action alternatives and at Portsmouth and ETTP under the no action alternative are presented in Table 2.4-1 (placed at the end of this chapter). To supplement the information in Table 2.4-1, each area of impact evaluated in the EIS is discussed below. Major similarities and differences among the alternatives are highlighted. This section provides a summary comparison; additional details and discussion are provided in Chapter 5 for each alternative and area of impact.

2.4.2.1 Human Health and Safety — Construction and Normal Facility Operations

Under the no action alternative and the action alternatives, it is estimated that potential exposures of workers and members of the public to radiation and chemicals would be well within applicable public health standards and regulations during normal facility operations (including 10 CFR 835, 40 CFR 61 Subpart H, and DOE Order 5400.5). The estimated doses and risks from radiation and/or chemical exposures of the general public and noninvolved workers would be very low, with zero latent cancer fatalities (LCFs) expected among these groups over the time periods considered, and with no adverse health impacts from chemical exposures expected. (Dose and risk estimates are shown in Table 2.4-1.) In general, the location of a conversion facility within the Portsmouth site would not significantly affect potential impacts to workers or the public during normal facility operations (i.e., no significant differences in impacts were identified at alternative Locations A, B, or C).

Involved workers (persons directly involved in the handling of radioactive or hazardous materials) could be exposed to low-level radiation emitted by uranium during the normal course of their work activities, and this exposure could result in a slight increase in the risk for radiation-induced LCFs to individual involved workers. (The possible presence of TRU and Tc contamination in the cylinder inventory would not contribute to exposures during normal operations.) The annual number of workers exposed could range from about 33 (under the no action alternative for Portsmouth and ETTP combined) to 163 under the action alternatives. Under all alternatives, it is estimated that radiation exposure of involved workers would be unlikely to result in additional LCFs among the entire involved worker populations (risks from radiation exposure range from a 1-in-10 chance of one additional LCF among the entire conversion facility involved worker population over the life of the project to a 1-in-5 chance of one additional LCF among the involved cylinder maintenance workers at Portsmouth under the no action alternative).

Possible radiological exposures from using groundwater potentially contaminated as a result of releases from breached cylinders or facility releases were also evaluated. In general, these exposures would be within applicable public health standards and regulations. However, the uranium concentration in groundwater could exceed 20 µg/L (the drinking water guideline used for comparison in this EIS) at some time in the future under the no action alternative if cylinder corrosion was not controlled. This scenario is highly unlikely because ongoing cylinder inspections and maintenance would prevent significant releases from occurring.

2.4.2.2 Human Health and Safety — Facility Accidents

2.4.2.2.1 Physical Hazards. Under all alternatives, workers could be injured or killed as a result of on-the-job accidents unrelated to radiation or chemical exposure. On the basis of accident statistics for similar industries, it is estimated that under the no action alternative, zero fatalities and about 70 injuries might occur through 2039 at the Portsmouth and ETTP sites (about 1 injury per year at Portsmouth, and about 0.7 injury per year at ETTP). Under the action alternatives, the risk of physical hazards would not depend on the location of the conversion facility. No fatalities are predicted, but about 11 injuries during conversion facility construction and up to 142 injuries during operations could occur at the conversion facility (about 6 injuries per year during construction and about 8 injuries per year during operations). In addition, 1 injury would be expected from construction of a new cylinder yard for ETTP cylinders. Accidental injuries and deaths are not unusual in industries that use heavy equipment to manipulate weighty objects and bulk materials.

2.4.2.2.2 Facility Accidents Involving Radiation or Chemical Releases. Under all alternatives, it is possible that accidents could release radiation or chemicals to the environment, potentially affecting both the workers and members of the public. Of all the accidents considered, those involving DUF_6 cylinders and those involving chemicals at the conversion facility would have the largest potential effects.

The DUF_6 Management Plan (DOE 1996e) outlines required cylinder maintenance activities and procedures to be undertaken in the event of a cylinder breach and/or release of DUF_6 from one or more cylinders. Under all alternatives, there is a low probability that accidents involving DUF_6 cylinders could occur at the current storage locations. If an accident occurred, DUF_6 could be released to the environment. The DUF_6 would combine with moisture in the air, forming gaseous HF and UO_2F_2, a soluble solid in the form of small particles. The depleted uranium and HF could be dispersed downwind, potentially exposing workers and members of the general public to radiation and chemical effects. The amount released would depend on the severity of the accident and the number of cylinders involved. The probability of cylinder accidents would decrease under the action alternatives as the DUF_6 was converted and the number of cylinders in storage decreased as a result.

For releases involving DUF_6 and other uranium compounds, both chemical and radiological effects could occur if the material was ingested or inhaled. The chemical effect of most concern associated with internal uranium exposure is kidney damage, and the radiological effect of concern is an increase in the probability of developing cancer. With regard to uranium, chemical effects occur at lower exposure levels than do radiological effects. Exposure to HF from accidental releases could result in a range of health effects, from eye and respiratory irritation to death, depending on the exposure level. Large anhydrous NH_3 releases could also cause severe respiratory irritation and death. (NH_3 is used to generate hydrogen, which is required for the conversion process.)

Chemical and radiological exposures to involved workers (those within 100 m [329 ft] of the release) under accident conditions would depend on how rapidly the accident developed, the exact location and response of the workers, the direction and amount of the release, the physical forces causing or caused by the accident, meteorological conditions, and the characteristics of the room or building if the accident occurred indoors. Impacts to involved workers under accident conditions would likely be dominated by physical forces from the accident itself; thus quantitative dose/effect estimates would not be meaningful. For these reasons, the impacts to involved workers during accidents are not quantified in this EIS. However, it is recognized that injuries and fatalities among involved workers would be possible if an accident did occur.

Under the no action alternative, for accidents involving cylinders that might happen at least once in 100 years (i.e., likely accidents [see Section 5.1.2.1.2]), it is estimated that the off-site concentrations of HF and uranium would be considerably below levels that would cause adverse chemical effects among members of the general public from exposure to these chemicals. However, up to 70 noninvolved workers might experience potential adverse effects from exposure to HF and uranium (mild and temporary effects, such as respiratory irritation or temporary decrease in kidney function). It is estimated that up to 3 noninvolved workers would experience potential irreversible adverse effects that are permanent in nature (such as lung damage or kidney damage); no fatalities are expected. Radiation exposures would be unlikely to result in additional LCFs among noninvolved workers or members of the general public for these types of accidents.

Cylinder accidents that are less likely to occur could be more severe, having greater consequences that could potentially affect off-site members of the general public. These types of accidents are considered extremely unlikely, expected to occur with a frequency of between once in 10,000 years and once in 1 million years of operations. Based on the expected frequency, through 2039, the probability of this type of accident was estimated to be about 1 chance in 2,500. Among all the cylinder accidents analyzed, the postulated accident that would result in the largest number of people with adverse effects (including mild and temporary as well as permanent effects) would be an accident that involves rupture of cylinders in a fire. If this type of accident occurred at the Portsmouth site, it is estimated that up to 680 members of the general public and up to 1,000 noninvolved workers might experience adverse chemical effects from HF and uranium exposure (mild and temporary effects, such as respiratory irritation or temporary decrease in kidney function).

The postulated cylinder accident that would result in the largest number of persons with irreversible adverse health effects is a corroded cylinder spill under wet conditions, with an estimated frequency of between once in 10,000 years and once in 1 million years of operations. If this accident occurred, it is estimated that 1 member of the general public and up to 140 noninvolved workers might experience irreversible adverse effects (such as lung damage or kidney damage). No fatalities are expected among members of the general public; there would be a potential for 1 fatality among noninvolved workers from chemical effects. Radiation exposures would be unlikely to result in additional LCFs among noninvolved workers (1 chance in 100) or the general public (1 chance in 30).

In addition to the cylinder accidents discussed above is a certain class of accidents that the DOE investigated; however, because of security concerns, information about such accidents is not available for public review but is presented in a classified appendix to the EIS. All classified information will be presented to state and local officials, as appropriate.

The number of persons actually experiencing adverse or irreversible adverse effects from cylinder accidents would likely be considerably fewer than those estimated for this analysis and would depend on the actual circumstances of the accident and the individual chemical sensitivities of the affected persons. For example, although exposures to releases from cylinder accidents could be life-threatening (especially with respect to immediate effects from inhalation of HF at high concentrations), the guideline exposure level of 20 parts per million (ppm) of HF used to estimate the potential for irreversible adverse effects from HF exposure is likely to result in overestimates. This is because no animal or human deaths have been known to occur as a result of acute exposures (i.e., 1 hour or less) at concentrations of less than 50 ppm; generally, if death does not occur quickly after HF exposure, recovery is complete.

Similarly, the guideline intake level of 30 mg used to estimate the potential for irreversible adverse effects from the intake of uranium in this EIS is the level suggested in NRC guidance. This level is somewhat conservative; that is, it is intended to overestimate rather than underestimate the potential number of irreversible adverse effects in the exposed population following uranium exposure. In more than 40 years of cylinder handling activities, no accidents involving releases from cylinders containing *solid* UF_6 have occurred that have caused diagnosable irreversible adverse effects among workers. In previous accidental exposure incidents involving *liquid* UF_6 in gaseous diffusion plants, some worker fatalities occurred immediately after the accident as a result of inhalation of HF generated from the UF_6. However, no fatalities occurred as a result of the toxicity of the uranium exposure. A few workers were exposed to amounts of uranium estimated to be about three times the guideline level (30 mg) used for assessing irreversible adverse effects; none of these workers, however, actually experienced such effects.

Under the action alternatives, low-probability accidents involving chemicals at the conversion facility could have large potential consequences for noninvolved workers and members of the public. At a conversion site, accidents involving chemical releases, such as NH_3

and HF, could occur. NH_3 is used to generate hydrogen for conversion, and HF can be produced as a co-product of converting DUF_6. Although the UDS proposal uses NH_3 to produce hydrogen, hydrogen can also be produced by using natural gas. In that case, the accident impacts would be much less than those discussed in this section for NH_3 accidents. (Details about potential NH_3 and other accidents are in Section 5.2.3.2 [conversion facility] and Section 5.2.5 [transportation].)

The conversion accident estimated to have the largest potential consequences is an accident involving the rupture of tanks containing either 70% HF or anhydrous NH_3. Such an accident could be caused by a large earthquake and is expected to occur with a frequency of less than once in 1 million years of operations. The probability of this type of accident occurring during the operation of a conversion facility is a function of the period of operation; over 18 years of operations, the accident probability would be less than 1 chance in 56,000.

If an aqueous HF or anhydrous NH_3 tank ruptured at the conversion facility, a maximum of up to about 2,300 members of the general public might experience adverse effects (mild and temporary effects, such as respiratory irritation or temporary decrease in kidney function) as a result of chemical exposure. A maximum of about 210 people might experience irreversible adverse effects (such as lung damage or kidney damage), with the potential for about 4 fatalities. With regard to noninvolved workers, up to about 1,400 workers might experience adverse effects (mild and temporary) as a result of chemical exposures. A maximum of about 1,400 noninvolved workers might experience irreversible adverse effects, with the potential for about 30 fatalities.

The location of the conversion facility within the Portsmouth site would affect the number of noninvolved workers and members of the general public who might experience adverse or irreversible adverse effects from an HF or anhydrous NH_3 tank rupture accident. However, the differences among the locations within each site would generally be small and within the uncertainties associated with the exact accident sequence and weather conditions at the time of the accident. An exception would be that the number of noninvolved workers impacted would be higher for Location B for both potential adverse and irreversible adverse effects.

Although such high-consequence accidents at a conversion facility are possible, they are expected to be extremely rare. The risk (defined as consequence × probability) for these accidents would be less than 1 fatality and less than 1 irreversible adverse health effect for noninvolved workers and members of the public combined. NH_3 and HF are commonly used for industrial applications in the United States, and there are well-established accident prevention and mitigative measures for HF and NH_3 storage tanks. These include storage tank siting principles, design recommendations, spill detection measures, and containment measures. These measures would be implemented, as appropriate.

Under the action alternatives, the highest consequence radiological accident is estimated to be an earthquake damaging the depleted U_3O_8 product storage building. If this accident occurred, it is estimated that about 135 lb (61 kg) of depleted U_3O_8 would be released to the atmosphere outside of the building. The maximum collective dose received by the general public and the noninvolved workers would be about 30 person-rem and 530 person-rem, respectively.

There would be about a 1-in-50 chance of an LCF among the public and a 1-in-5 chance of an LCF among the noninvolved workers. Because the accident has a probability of occurrence that is about 1 chance in 6,000, the risk posed by the accident would be essentially zero LCFs among both the public and the workers.

2.4.2.3 Human Health and Safety — Transportation

Under the no action alternative, only small amounts of the LLW and low-level radioactive mixed waste (LLMW) that would be generated during routine cylinder maintenance activities would require transportation (about one shipment per year). Only negligible impacts are expected from such shipments. No DUF_6 or non-DUF_6 cylinders would be transported between sites.

Under the action alternatives, the total number of shipments would include the following:

1. If U_3O_8 was disposed of in emptied cylinders, there would be approximately 4,200 railcar shipments of depleted U_3O_8 from the conversion facility to Envirocare (proposed) or NTS (option), or up to 21,000 truck shipments (alternative) to either Envirocare or NTS. The numbers of shipments would be about 8,800 for truck and 2,200 for railcar if bulk bags were used as disposal containers.

2. About 8,200 truck or 1,640 railcar shipments of aqueous (70% and 49%) HF could occur; alternatively, the aqueous HF could be neutralized to CaF_2, requiring a total of about 13,600 truck or 3,400 railcar shipments. Currently, the destination for these shipments is not known.

3. About 700 truck or 350 railcar shipments of anhydrous NH_3 from a supplier to the site. Currently, the origin of these shipments is not known.

4. Emptied heel cylinders to Envirocare or NTS, if bulk bags were used to dispose of the depleted U_3O_8.

5. Approximately 5,400 truck or 1,400 railcar shipments of cylinders from ETTP to Portsmouth.

During normal transportation operations, radioactive material and chemicals would be contained within their transport packages. Health impacts to crew members (i.e., workers) and members of the general public along the routes could occur if they were exposed to low-level external radiation in the vicinity of uranium material shipments. In addition, exposure to vehicle emissions (engine exhaust and fugitive dust) could potentially cause latent fatalities from inhalation.

The risk estimates for emissions are based on epidemiological data that associate mortality rates with particulate concentrations in ambient air. (Increased latent mortality rates resulting from cardiovascular and pulmonary diseases have been linked to incremental increases in particulate concentrations.) Thus, the increase in ambient air particulate concentrations caused by a transport vehicle, with its associated fugitive dust and diesel exhaust emissions, is related to such premature latent fatalities in the form of risk factors. Because of the conservatism of the assumptions made to reconcile results among independent epidemiological studies and associated uncertainties, the latent fatality risks estimated for normal vehicle emissions should be considered to be an upper bound (Biwer and Butler 1999).[2] For the transport of conversion products and co-products (depleted U_3O_8, aqueous HF, and emptied cylinders, if not used as disposal containers), it is conservatively estimated that a total of about 10 fatalities from vehicle emissions could occur if shipments were only by truck and if aqueous HF product was sold and transported 620 mi (1,000 km) from the site (about 20 fatalities are estimated if HF was neutralized to CaF_2 and transported 620 mi [1,000 km] from the site). The number of fatalities occurring from exhaust emissions if shipment was only by rail would be less than 1 if the HF was sold and about 1 if the HF was neutralized to CaF_2.

Exposure to external radiation during normal transportation operations is estimated to cause less than 1 LCF under both truck and rail options. Members of the general public living along truck and rail transportation routes would receive extremely small doses of radiation from shipments, less than 0.1 mrem over the duration of the program. This would be true even if a single person was exposed to every shipment of radioactive material during the program.

Traffic accidents could occur during the transportation of radioactive materials and chemicals. These accidents could potentially affect the health of workers (i.e., crew members) and members of the general public, either from the accident itself or from accidental releases of radioactive materials or chemicals.

The total number of traffic fatalities (unrelated to the type of cargo) was estimated on the basis of national traffic statistics on shipments by both truck and rail. If the aqueous HF was sold, about 1 traffic facility would be estimated under both transportation modes. If HF was neutralized to CaF_2, about 2 fatalities would be estimated for the truck option and 1 fatality for the rail option.

Severe transportation accidents could also result in a release of radioactive material or chemicals from a shipment. The consequences of such a release would depend on the material released, location of the accident, and atmospheric conditions at the time. Potential consequences would be greatest in urban areas because more people could be exposed. Accidents that occurred when the atmospheric conditions were very stable (typical of nighttime) would have higher potential consequences than accidents that occurred when the conditions were unstable (i.e., turbulent, typical of daytime) because the stability would determine how quickly the released material dispersed and diluted to lower concentrations as it moved downwind.

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2 For perspective, in a recently published EIS for a geologic repository at Yucca Mountain, Nevada (DOE 2002h), the same risk factors were used for vehicle emissions; however, they were adjusted to reduce the amount of conservatism in the estimated health impacts. As reported in the Yucca Mountain EIS, the adjustments resulted in a reduction in the emission risks by a factor of about 30.

A detailed discussion of the accident scenarios modeled for the action alternatives is provided in Section 5.2.5.3. For the action alternatives, the highest potential accident consequences during transportation activities would be caused by a rail accident involving anhydrous NH_3. Although anhydrous NH_3 is a hazardous gas, it has many industrial applications and is commonly safely transported by industry as a pressurized liquid in trucks and rail tank cars.

The probability of a severe anhydrous NH_3 railcar accident occurring in a highly populated urban area under stable atmospheric conditions is extremely rare. The probability of such an accident occurring if all the anhydrous NH_3 needed was transported 620 mi (1,000 km) is estimated to be less than 1 chance in 400,000. Nonetheless, if such an accident (i.e., release of anhydrous NH_3 from a railcar in a densely populated urban area under stable atmospheric conditions) occurred, up to 5,000 persons might experience irreversible adverse effects (such as lung damage), with the potential for about 100 fatalities. If the same type of NH_3 rail accident occurred in a typical rural area, which would have a smaller population density than an urban area, potential impacts would be considerably less. It is estimated that in a rural area, approximately 20 persons might experience irreversible adverse effects, with no expected fatalities. The atmospheric conditions at the time of an accident would also significantly affect the consequences of a severe NH_3 accident. The consequences of an NH_3 accident would be less severe under unstable conditions, the most likely conditions in the daytime. Unstable conditions would result in more rapid dispersion of the airborne NH_3 plume and lower downwind concentrations. Under unstable conditions in an urban area, approximately 400 persons could experience irreversible adverse effects, with the potential for about 8 fatalities. If the accident occurred in a rural area under unstable conditions, 1 person would be expected to experience an irreversible adverse effect, with zero fatalities expected. When the probability of an NH_3 accident occurring is taken into account, it is expected that no irreversible adverse effects and no fatalities would occur over the shipment period.

For perspective, anhydrous NH_3 is routinely shipped commercially in the United States for industrial and agricultural applications. On the basis of information provided in the DOT *Hazardous Material Incident System (HMIS) Database* (DOT 2003b) for 1990 through 2002, 2 fatalities and 19 major injuries to the public or to transportation or emergency response personnel have occurred as a result of anhydrous NH_3 releases during nationwide commercial truck and rail operations. These fatalities and injuries occurred during transportation or loading and unloading operations. Over that period, truck and rail NH_3 spills resulted in more than 1,000 and 6,000 evacuations, respectively. Five very large spills, more than 10,000 gal (38,000 L), have occurred; however, these spills were all en route derailments from large rail tank cars. The two largest spills, both around 20,000 gal (76,000 L), occurred in rural or lightly populated areas and resulted in 1 major injury. Over the past 30 years, the safety record for transporting anhydrous NH_3 has significantly improved. Safety measures contributing to this improved safety record include the installation of protective devices on railcars, fewer derailments, closer manufacturer supervision of container inspections, and participation of shippers in the Chemical Transportation Emergency Center.

After anhydrous NH_3, the types of accidents that are estimated to result in the second highest consequences are those involving shipment of 70% aqueous HF produced during the conversion process. The estimated numbers of irreversible adverse effects for 70% HF rail accidents are about one-third of those from the anhydrous NH_3 accidents. However, the number of estimated fatalities is about one-sixth of those from NH_3 accidents, because the percent of fatalities among the individuals experiencing irreversible adverse effects is 1% as opposed to 2% for NH_3 exposures (Policastro et al. 1997). For perspective, since 1971, the period covered by DOT records, no fatal or serious injuries to the public or to transportation or emergency response personnel have occurred as a result of anhydrous HF releases during transportation. (Most of the HF transported in the United States is anhydrous HF, which is more hazardous than aqueous HF.) Over that period, 11 releases from railcars were reported to have no evacuations or injuries associated with them. The only major release (estimated at 6,400 lb [29,000 kg] of HF) occurred in 1985 and resulted in approximately 100 minor injuries. Another minor HF release during transportation occurred in 1990. The safety record for transporting HF has improved in the past 10 years for the same reasons as those discussed above for NH_3. Transportation accidents involving the shipment of DUF_6 cylinders were also evaluated, with the estimated consequences being less than those discussed above for NH_3 and HF (see Section 5.2.5.3).

2.4.2.4 Air Quality and Noise

Under the no action alternative, air quality from construction and operations would be within national and state ambient air quality standards. If continued cylinder maintenance and painting are effective in controlling corrosion, as expected, concentrations of HF would be kept within air quality standards at the Portsmouth and ETTP sites. If cylinder corrosion is not controlled, the maximum 24-hour HF concentration at the ETTP site boundary could be about equal to the Tennessee primary standard of 2.9 $\mu g/m^3$ around the year 2020 (standards would not be exceeded at Portsmouth). However, because of the on-going cylinder maintenance program, it is not expected that this high breach rate would occur at the ETTP site.

Under the action alternatives, it was found that air quality impacts during construction would be similar for all three alternative locations. The total (modeled plus the measured background value representative of the site) concentrations due to emissions of most criteria pollutants — such as sulfur dioxide (SO_2), nitrogen oxides (NO_x), and carbon monoxide (CO) — would be well within applicable air quality standards. As is often the case for construction, the primary concern would be particulate matter (PM) released from near-ground-level sources. Total concentrations of PM_{10} and $PM_{2.5}$ (PM with a mean aerodynamic diameter of 10 µm or less and 2.5 µm or less, respectively) at the construction site boundaries would be close to or above the standards because of the high background concentrations and the proximity of the new cylinder yard and the proposed conversion facility to potentially publicly accessible areas. The background data used are the maximum values from the last 5 years of monitoring at the nearest monitoring location (operated by the OEPA) to the site, located about 20 mi (32 km) away in the town of Portsmouth. On the basis of these values, exceedance of the annual $PM_{2.5}$ standard would be unavoidable, because the background concentration already exceeds the standard (background is 24.1 $\mu g/m^3$, in comparison with the standard of 15 $\mu g/m^3$). Accordingly, construction activities should be conducted so as to minimize further impacts on ambient air quality. To mitigate impacts, water could be sprayed on disturbed areas more often, and dust suppressant or pavement could be applied to roads with frequent traffic.

During operations, it is estimated that total concentrations for all criteria pollutants except $PM_{2.5}$ would be well within standards. The background level of $PM_{2.5}$ in the area of the Portsmouth site approaches or already exceeds the standard. Again, impacts during operations were found to be similar for all three alternative locations.

Noise impacts are expected to be negligible under the no action alternative. Under the action alternatives, estimated noise levels at the nearest residence (located 0.9 km [0.6 mi] from the alternative location) would be below the U.S. Environmental Protection Agency (EPA) guideline of 55 dB(A)[3] as day-night average sound level (DNL)[4] for residential zones during construction and operations.

2.4.2.5 Water and Soil

Under the no action alternative, uranium concentrations in surface water, groundwater, and soil would remain below guidelines throughout the project duration. However, if cylinder maintenance and painting were not effective in reducing cylinder corrosion rates, the uranium concentration in groundwater could be greater than the guideline at both the Portsmouth and ETTP sites at some time in the future (no earlier than about 2100). If continued cylinder maintenance and painting were effective in controlling corrosion, as expected, groundwater uranium concentrations would remain less than the guideline.

During construction of the conversion facility, construction material spills could contaminate surface water, groundwater, or soil. However, by implementing storm water management, sediment and erosion controls (e.g., temporary and permanent seeding; mulching and matting; sediment barriers, traps, and basins; silt fences; runoff and earth diversion dikes), and good construction practices (e.g., covering chemicals with tarps to prevent interaction with rain, promptly cleaning up any spills), concentrations in soil and wastewater (and therefore surface water and groundwater) could be kept well within applicable standards or guidelines.

During operations, no appreciable impacts on surface water, groundwater, or soils would result from the conversion facility because no contaminated liquid effluents are anticipated, and because airborne emission would be at very low levels (e.g., <0.25 g/yr of uranium). Impacts would be similar for all three alternative locations.

2.4.2.6 Socioeconomics

The socioeconomic analysis evaluates the effects of construction and operation of a new cylinder yard and conversion facility on population, employment, income, regional growth,

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3 dB(A) is a unit of weighted sound-pressure level, measured by the use of the metering characteristics and the A-weighting specified in the *American National Standard Specification for Sound Level Meters*, ANSI S1.4-1983, and in Amendment S1.4A-1985 (Acoustical Society of America 1983, 1985).

4 DNL is the 24-hour average sound level, expressed in dB(A), with a 10-dB penalty artificially added to the nighttime (10 p.m.–7 a.m.) sound level to account for noise-sensitive activities (e.g., sleep) during these hours.

housing, and community resources in the region of influence (ROI) around the site. In general, socioeconomic impacts tend to be positive, creating jobs and income, with only minor impacts on housing, public finances, and employment in local public services.

The no action alternative would result in a small socioeconomic impact at both the Portsmouth and ETTP sites combined, creating a total of 130 jobs during operations (direct and indirect jobs) and generating a total of $5.3 million in personal income per operational year. No significant impacts on regional growth and housing, local finances, and public service employment in the ROI are expected.

Under the action alternatives, jobs and income would be generated during both construction and operation. Construction of the conversion facility would create 280 jobs and generate $9 million in personal income in the peak construction year (construction occurs over a 2-year period). Operation of the conversion facility would create 320 jobs and generate $13 million in income each year. Only minor impacts on regional growth and housing, local finances, and public service employment in the ROI are expected. The socioeconomic impacts would not depend on the location of the conversion facility; therefore, the impacts would be the same for alternative Locations A, B, and C.

2.4.2.7 Ecology

Under the no action alternative, continued cylinder maintenance and surveillance activities would have negligible impacts on ecological resources (i.e., vegetation, wildlife, wetlands, and threatened and endangered species). No yard reconstruction is planned for either the Portsmouth or ETTP sites. It is estimated that potential concentrations of contaminants in the environment from future cylinder breaches would be below levels harmful to biota. However, there is a potential for impacts to aquatic biota from cylinder yard runoff during painting activities.

Under the action alternatives, the total area disturbed during conversion facility construction would be 65 acres (26 ha). Vegetation communities would be impacted in this area from a loss of habitat. However, for all three alternative locations, impacts could be minimized, depending on exactly where the facility was placed within each location. These habitat losses would constitute less than 1% of available land at the site. It was found that concentrations of contaminants in the environment during operations would be below harmful levels. Impacts to vegetation and wildlife would be negligible at all three locations.

Wetlands at or near Locations A, B, and C could be adversely affected at the Portsmouth site. Impacts to wetlands could be minimized depending on where exactly the facility was placed within each location. Unavoidable impacts to wetlands that are within the jurisdiction of the U.S. Army Corps of Engineers (USACE) may require a Clean Water Act (CWA) Section 404 Permit, which would trigger the requirement for a CWA 401 water quality certification from Ohio. Impacts at Location A may potentially be avoided by an alternative routing of the entrance road, or mitigation may be developed in coordination with the appropriate regulatory agency. A mitigation plan might be required prior to the initiation of construction.

Construction of the conversion facility should not directly affect federal- or state-listed species. However, impacts on deciduous forest might occur. Impacts to forested areas could be avoided if temporary construction areas were placed in previously disturbed locations. Trees with exfoliating bark, such as shagbark hickory, or dead trees with loose bark can be used by the Indiana bat (federal- and state-listed as endangered) as roosting trees during the summer. There is a potential that such trees could be disturbed during construction at Locations A or C at Portsmouth. If either live or dead trees with exfoliating bark are encountered on construction areas, they should be saved if possible. If cutting of such trees is necessary, it should be performed before April 15 or after September 15.

2.4.2.8 Waste Management

Under the no action alternative, LLW, LLMW, and PCB-containing waste could be generated from cylinder scraping and painting activities. The amount of wastes generated would represent an increase of less than 1% in the loads of these wastes at the Portsmouth and ETTP sites, representing negligible impacts on waste management operations at both sites.

Under the action alternatives, waste management impacts would not be dependent on the location of the facility within the site and would be the same for alternative Locations A, B, and C. Waste generated during construction and operations would have negligible impacts on the Portsmouth site waste management operations, with the exception of possible impacts from disposal of CaF_2. Industrial experience indicates that HF, if produced, would contain only trace amounts of depleted uranium (less than 1 ppm). It is expected that HF would be sold for use. If sold for use, the sale would be subject to review and approval by DOE in coordination with the NRC, depending on the specific use (as discussed in Appendix E).

The U_3O_8 produced from conversion would generate about 4,700 yd^3 (3,570 m^3)/yr of LLW. This is 5% of Portsmouth's annual projected volume and would have a low impact on site LLW management.

If the HF was not sold but instead neutralized to CaF_2, it is currently unknown whether (1) the CaF_2 could be sold, (2) the low uranium content would allow the CaF_2 to be disposed of as nonhazardous solid waste, or (3) disposal as LLW would be required. The low level of uranium contamination expected (i.e., less than 1 ppm) suggests that sale or disposal as nonhazardous solid waste would be most likely. If sold for use, the sale would be subject to review and approval by DOE in coordination with the NRC, depending on the specific use. Waste management for disposal as nonhazardous waste could be handled through appropriate planning and design of the facilities. If the CaF_2 had to be disposed of as LLW, it could represent a potentially large impact on waste management operations.

A small quantity of TRU could be entrained in the gaseous DUF_6 during the cylinder emptying operations. These contaminants would be captured in the filters between the cylinders and the conversion equipment. The filters would be monitored and replaced routinely to maintain concentrations below regulatory limits for TRU waste. The spent filters would be disposed of as LLW, generating up to 25 drums of LLW over the life of the project.

Current UDS plans are to leave the heels in the emptied cylinders, add a stabilizer, and use the cylinders as disposal containers for the U_3O_8 product to the extent practicable. An alternative is to process the empty cylinders and dispose of them directly as LLW. Either one of these approaches is expected to meet the waste acceptance criteria of the disposal facilities and minimize the potential for generating TRU waste through washing of the cylinders to remove the heels. Although cylinder washing is not considered a foreseeable option at this time, for completeness, an analysis of the maximum potential quantities of TRU waste that could be generated from cylinder washing is included in Appendix B, as is a discussion of PCBs contained in some cylinder coatings.

2.4.2.9 Resource Requirements

Resource requirements include construction materials, fuel, electricity, process chemicals, and containers. In general, all alternatives would have a negligible effect on the local or national availability of these resources.

2.4.2.10 Land Use

Under the no action alternative, all activities would occur in areas previously used for conducting similar activities; therefore, no land use impacts are expected. Under the action alternatives, a total of 65 acres (26 ha) could be disturbed for the conversion facility, with some areas cleared for railroad or utility access and not adjacent to the construction site. Up to 6.3 additional acres (2.5 ha) could also be disturbed for construction of a new cylinder yard. All three alternative locations are within an already industrialized facility, and impacts to land use would be similar for the three locations. The permanently altered areas would represent less than 1% of available land already developed for industrial purposes. Negligible impacts on land use are thus expected.

2.4.2.11 Cultural Resources

Under the no action alternative, impacts on cultural resources at the current storage locations would be unlikely because all activities would occur in areas already dedicated to cylinder storage. Under the action alternatives, impacts on cultural resources could be possible at all three alternative locations. Archaeological and architectural surveys have not been finalized for the candidate locations and must be completed prior to initiation of the action alternatives. If archaeological resources were encountered, or historical or traditional cultural properties were identified, a mitigation plan would be required.

2.4.2.12 Environmental Justice

No disproportionately high and adverse human health or environmental impacts are expected to minority or low-income populations during normal facility operations under the action alternatives. Although the consequences of facility accidents could be high if severe accidents occurred, the risk of irreversible adverse effects (including fatalities) among members of the general public from these accidents (taking into account the consequences and probability of the accidents) would be less than 1. Furthermore, transportation accidents with high and adverse impacts are unlikely; their locations cannot be projected, and the types of persons who would be involved cannot be reliably predicted. Thus, there is no reason to expect that minority and low-income populations would be affected disproportionately by high and adverse impacts.

2.4.2.13 Impacts from Cylinder Preparation at ETTP

The cylinders at ETTP would have to be prepared to be shipped by either truck or rail. Approximately 5,900 cylinders (4,800 DUF_6 cylinders for conversion and about 1,100 non-DUF_6 cylinders) would require preparation for shipment at ETTP. As discussed in Chapter 5, three cylinder preparation options are considered for the shipment of noncompliant cylinders.

In general, the use of cylinder overpacks would result in small potential impacts. Overpacking operations would be similar to current cylinder handling operations, and impacts would be limited to involved workers. No LCFs among involved workers from radiation exposure are expected. Impacts would be similar if noncompliant cylinders were shipped "as-is" under a DOT exemption, with appropriate compensatory measures.

The use of a cylinder transfer facility would likely require the construction of a new facility at ETTP; there are no current plans to build such a facility. Operational impacts would generally be small and limited primarily to external radiation exposure of involved workers, with no LCFs expected. Transfer facility operations would generate a large number of emptied cylinders requiring disposition. If a decision were made to construct and operate a transfer facility at ETTP, additional NEPA review would be conducted.

If ETTP cylinders were transported to Paducah for conversion, the operational period at Portsmouth would be reduced by 4 years. Annual impacts would be the same as discussed for each technical discipline. No significant decrease in overall impacts would be expected.

2.4.2.14 Impacts Associated with Conversion Product Sale and Use

The conversion of the DUF_6 inventory produces products having some potential for reuse (no large-scale market exists for depleted U_3O_8). These products include HF and CaF_2, which are commonly used as commercial materials. An investigation of the potential reuse of HF and CaF_2 is included as part of this EIS (Chapter 5 and Appendix E). Areas examined include the characteristics of these materials as produced within the conversion process, the current markets for these products, and the potential socioeconomic impacts should these products be provided to the commercial sector. Because there would be some residual radioactivity associated with these materials, the DOE process for authorizing release of materials for unrestricted use (referred to as "free release") and an estimate of the potential human health effects of such free release are also considered in this investigation. The results of the analysis of HF and CaF_2 use are included in Table 2.4-1.

If the products were to be released for restricted use (e.g., in the nuclear industry for the manufacture of nuclear fuel), the impacts would be less than those for unrestricted release.

Conservative estimates of the amount of uranium and technetium that might transfer into the HF and CaF_2 were used to evaluate the maximum expected dose to workers using the material if it was released for commercial use or the general public. On the basis of very conservative assumptions concerning use, the maximum dose to workers was estimated to be less than 1 mrem/yr, much less than the regulatory limit of 100 mrem/yr specified for members of the general public. Doses to the general public would be even lower.

Socioeconomic impact analyses were conducted to evaluate the impacts of the introduction of the conversion-produced HF or CaF_2 into the commercial marketplace. A potential market for the aqueous HF has been identified as the current aqueous HF acid producers. The impact of HF sales on the local economy in which the existing producers are located and on the U.S. economy as a whole is likely to be minimal. No market for the CaF_2 that might be produced in the conversion facility has been identified. Should such a market be found, the impact of CaF_2 sales on the U.S. economy is also predicted to be minimal.

2.4.2.15 Impacts from D&D Activities

D&D would involve the disassembly and removal of all radioactive and hazardous components, equipment, and structures. For the purposes of analysis in this EIS, it was also assumed that the various buildings would be dismantled and "greenfield" (unrestricted use) conditions would be achieved. The "clean" waste will be sent to a landfill that accepts construction debris. Low-level waste will be sent to a licensed or DOE disposal facility, where it will likely be buried in accordance with the waste acceptance criteria and other requirements in effect at that time. Hazardous and mixed waste will be disposed of in a licensed facility in accordance with applicable regulatory requirements. D&D impacts to involved workers would be primarily from external radiation; expected exposures would be a small fraction of operational doses; no LCFs would be expected. It is estimated that no fatalities and up to 5 injuries would result from occupational accidents. Impacts from waste management would include total generation of about 275 yd^3 (210 m^3) of LLW, 157 yd^3 (120 m^3) of LLMW, and 157 yd^3 (120 m^3) of hazardous waste; these volumes would result in low impacts in comparison with projected site annual generation volumes.

2.4.2.16 Cumulative Impacts

The CEQ guidelines for implementing NEPA define cumulative effects as the impacts on the environment resulting from the incremental impact of an action under consideration when added to other past, present, and reasonably foreseeable future actions (40 CFR 1508.7) Activities considered for cumulative analysis include those in the vicinity of the Portsmouth site that might affect environmental conditions at or near that locality under both the no action alternative and the action alternatives. Activities considered also include those at the ETTP site associated with transporting cylinders to Portsmouth (under the proposed action) and continued long-term storage of DUF_6 (under the no action alternative).

One action considered reasonably foreseeable under cumulative impacts is the development of a uranium enrichment facility at the Portsmouth site. An agreement between USEC and DOE on June 17, 2002, established the possibility of constructing an enrichment plant at either site. In January 2004, USEC announced that it planned to site its American Centrifuge Facility at the Portsmouth site. This EIS assumes that such an enrichment facility would employ the existing gas centrifuge technology and would generate impacts similar to those outlined in a 1977 analysis of environmental consequences that considered such an action. (The facility proposed in 1977 was never completed or operated.)

Other actions planned at the Portsmouth site include continued waste management activities, waste disposal activities, environmental restoration activities, industrial reuse of sections of the site, and the DUF_6 management activities considered in this EIS. Activities involving gaseous diffusion uranium enrichment at Portsmouth were discontinued early in 2002. Cumulative impacts at the Portsmouth site and vicinity would be as follows for the no action alternative and the proposed action alternatives:

- The cumulative radiological exposure to the off-site population would be considerably below the maximum DOE dose limit of 100 mrem per year to the off-site maximally exposed individual (MEI) and below the limit of 25 mrem/yr specified in 40 CFR 190 for uranium fuel cycle facilities. Annual individual doses to involved workers would be monitored to maintain exposure below the regulatory limit of 5 rem per year.

- Under the no action alternative cumulative impacts assessment, although less than one shipment per year of radioactive wastes is expected from cylinder management activities; up to 3,500 rail shipments and 4,500 truck shipments would be associated with existing and planned actions. Under the action alternatives, up to 6,800 rail shipments and 12,300 truck shipments of radioactive material could occur. The cumulative maximum dose to the MEI along the transportation route near the site entrance would be less than 1 mrem/yr for all transportation options considered.

- The Portsmouth site is located in an attainment region. However, the background annual average $PM_{2.5}$ concentration exceeds the standard. Cumulative impacts would not affect the attainment status.

- Data from the 2000 annual groundwater monitoring showed that five pollutants exceeded primary drinking water regulation levels in groundwater at the Portsmouth site. Alpha and beta activity were also detected. Good engineering and construction practices should ensure that indirect impacts associated with the conversion facility would be minimal.

- Cumulative ecological impacts should be negligible, with little change to intact ecosystems contributed by any alternative considered in this EIS in conjunction with the effects of other activities.

- Impacts on land use similarly would be minimal, with DUF_6 conversion activities confined to the Portsmouth site, which is already heavily developed for such activities.

- It is unlikely that any noteworthy cumulative impacts on cultural resources would occur under any alternative, and any such impacts would be adequately mitigated before activities for the chosen action would start.

- Given the absence of high and adverse cumulative impacts for any impact area considered in this EIS, no environmental justice cumulative impacts are anticipated for the Portsmouth site, despite the presence of disproportionately high percentages of low-income populations in the vicinity.

- Socioeconomic impacts under all the alternatives considered are anticipated to be generally positive, often temporary, and relatively small.

Actions planned at the ETTP site include continued waste management activities, reindustrialization of the ETTP site, environmental restoration activities, possibly other DOE programs involving the disposition of enriched uranium, and the DUF_6 management activities considered in this EIS. Cumulative impacts at the ETTP site and vicinity would not be large under either the no action or the action alternatives.

2.4.2.17 Potential Impacts Associated with the Option of Expanding Conversion Facility Operations

As discussed in Section 2.2.7, several reasonably foreseeable activities could result in a future decision to increase the conversion facility throughput (such as by adding a fourth process line) or to extend the operational period at one or both of the conversion facility sites, although there are no current plans to do so. To account for these future possibilities and provide future planning flexibility, Section 5.2.8 includes an evaluation of the environmental impacts associated with expanding conversion facility operations at Portsmouth, either by increasing throughput or by extending operations.

The throughput of the Portsmouth facility could be increased either by making process efficiency improvements or by adding an additional (fourth) process line. As described in Section 5.2.8, a throughput increase through process improvements would not be expected to significantly change the overall environmental impacts when compared with the current plant design (three process lines). Efficiency improvements are generally on the order of 10%, which is within the uncertainty that is inherent in the impact estimate calculations. Slight variations in plant throughput are not unusual from year to year because of operational factors (e.g., equipment maintenance or replacement) and are generally accounted for by the conservative nature of the impact calculations.

In contrast to process efficiency improvements, the addition of a fourth process line at the Portsmouth facility would require the installation of additional plant equipment and would result in a nominal 33% increase in throughput compared with the current base design. The plant capacity would be similar to the capacity planned for the Paducah site (evaluated in DOE/EIS-0359). This throughput increase would reduce the time necessary to convert the Portsmouth and ETTP DUF_6 inventories by about 5 years. The construction impacts presented above and summarized in Table 2.4-1 for three process lines would be the same if a fourth line was added, because a fourth line would fit within the process building.

In general, a 33% increase in throughput (e.g., by the addition of a fourth line) would not result in significantly greater environmental impacts during operations than those discussed above and summarized in Table 2.4-1 for three process lines (impacts associated with expanded operations are shown in brackets in Table 2.4-1 where they would differ from those presented for the proposed design). Although annual impacts in certain areas might increase up to 33% (proportional to the throughput increase), the estimated annual impacts during operations would remain well within applicable guidelines and regulations, with collective and cumulative impacts being quite low.

One exception is the $PM_{2.5}$ concentration during construction, which could exceed standards because of the regionally high background level under both three- and four-process-line cases. The background data used are the maximum values from the last 5 years of monitoring at the monitoring location nearest to the site (operated by the OEPA), located about 20 mi (32 km) away in the town of Portsmouth. On the basis of these values, exceedance of the annual $PM_{2.5}$ standard would be unavoidable, because the background concentration already exceeds the standard (background is 24.1 $\mu g/m^3$, in comparison with the standard of 15 $\mu g/m^3$).

Because a 33% increase in throughput would reduce the operational period of the facility by approximately 5 years, positive socioeconomic impacts associated with employment of the conversion facility workforce would last approximately 13 years, compared with 18 years under the base design.

The conversion facility operations could also be expanded by operating the facility longer than the currently anticipated 18 years. There are no current plans to operate the conversion facilities beyond this period. However, with routine facility and equipment maintenance and periodic equipment replacements or upgrades, it is believed the conversion facility could be operated safely beyond this time period to process any additional DUF_6 for which DOE might assume responsibility. As discussed in Section 5.2.8, if operations were extended beyond 18 years and if the operational characteristics (e.g., estimated releases of contaminants to air and water) of the facility remained unchanged, it is expected that the annual impacts would be essentially the same as those presented above and summarized in Table 2.4-1. The estimated annual impacts during operations are generally within applicable guidelines and regulations, with collective and cumulative impacts being quite low. This would also be expected during extended operations. The overall cumulative impacts from the operation of the facility would increase proportionately with the increased life of the facility.

2.5 PREFERRED ALTERNATIVE

DOE's preferred alternative is to construct and operate the proposed DUF_6 conversion facility at alternative Location A, which is located in the west-central portion of the Portsmouth site.

3 AFFECTED ENVIRONMENT

This EIS considers the proposed action of building and operating a conversion facility at the Portsmouth site for conversion of the Portsmouth and ETTP DUF_6 cylinder inventories. Section 3.1 presents a detailed description of the affected environment for the Portsmouth site. Because the option of shipping cylinders from the ETTP site in Oak Ridge, Tennessee, to the Portsmouth site for conversion is part of the proposed action, a detailed description of the affected environment for the ETTP site is provided in Section 3.2.

3.1 PORTSMOUTH SITE

The Portsmouth site is located in Pike County, Ohio, approximately 22 mi (35 km) north of the Ohio River and 3 mi (5 km) southeast of the town of Piketon (Figure 3.1-1). The two largest cities in the vicinity are Chillicothe, located 26 mi (42 km) north of the site, and Portsmouth, 22 mi (35 km) south.

The Portsmouth site includes the Portsmouth Gaseous Diffusion Plant (PORTS), a gaseous diffusion plant previously operated first by DOE and then by USEC. Uranium enrichment operations at PORTS were discontinued in May 2001, and the plant has been placed in cold standby, a nonoperational condition in which the plant retains the ability to resume operations within 18 to 24 months (DOE 2001c).

The Portsmouth site occupies 3,714 acres (1,500 ha) of land, with an 800-acre (320-ha) fenced core area that contains the former production facilities. The 2,914 acres (1,180 ha) outside the core area includes restricted buffers, waste management areas, plant management and administrative facilities, gaseous diffusion plant support facilities, and vacant land (Martin Marietta Energy Systems, Inc. [MMES] 1992b). Wayne National Forest borders the plant site on the east and southeast, and Brush Creek State Forest is located to the southwest, slightly more than 1 mi (1.6 km) from the site boundaries.

The Portsmouth site is not listed on the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) National Priorities List. Investigation and cleanup of hazardous substances (as defined in CERCLA) and hazardous wastes (as defined in the RCRA) that have been released to air, surface water, groundwater, soils, and solid waste management units as a result of past operational activities at the Portsmouth site are being conducted under the provisions of the following administrative edicts, which have been issued pursuant to RCRA, CERCLA, and/or Ohio state law:

- State of Ohio v. U.S. Department of Energy, Divested Atomic Corporation, et al., Consent Decree. Civil Action C2-89-732. August 31, 1989 (referred to as the 1989 Ohio Consent Decree). The 1989 Ohio Consent Decree addresses certain hazardous waste compliance issues at the Portsmouth site and requires the performance of corrective actions in addition to other requirements.

- In the Matter of United States Department of Energy: Portsmouth Gaseous Diffusion Plant, Administrative Consent Order. U.S. Environmental Protection Agency (EPA) Administrative Docket No. OH7 890 008 983. August 12, 1997 (agreement between DOE, U.S. EPA, and Ohio EPA) (referred to as the 1997 Three-Party Administrative Consent Order). The 1997 Three-Party Administrative Consent Order replaced a prior U.S. EPA Administrative Consent Order, which was issued during 1989 and amended in 1994, and defines oversight roles at the Portsmouth site for the Ohio EPA and U.S. EPA with respect to corrective action/response action activities. It also defines certain cleanup performance obligations for DOE.

- In the Matter of United States Department of Energy and Bechtel Jacobs Company LLC, Director's Final Findings and Orders. March 17, 1999 (referred to as the 1999 Ohio Integration Order). The 1999 Ohio Integration Order integrates the closure requirements for specified units at the Portsmouth site as established under the 1989 Ohio Consent Decree, the Ohio Administrative Code, and the 1997 Three-Party Administrative Consent Order. The purpose of this integration is to avoid duplication of effort, and efficiently perform site-wide groundwater monitoring and surveillance and maintenance activities at the Portsmouth site.

3.1.1 Cylinder Yards

The Portsmouth site has a total of 16,109 DOE-managed cylinders containing DUF_6 (Table 3.1-1). The cylinders are located in two storage yards that have concrete bases (Figure 3.1-2). The cylinders are stacked two high to comply with DNFSB requirements. All 10- and 14-ton (9- and 12-t) cylinders stored in these yards have been or are being inspected and repositioned. They have been placed on new concrete saddles with sufficient room between cylinders and cylinder rows to permit adequate visual inspection of cylinders.

TABLE 3.1-1 DOE-Managed DUF_6 Cylinders at the Portsmouth Site

Cylinder Type	No. of Cylinders
Full	16,018
Partially full	42
Heel	49
Total	16,109

Source: Hightower (2004).

3.1.2 Site Infrastructure

The Portsmouth site has direct access to major highway and rail systems, a nearby regional airport, and barge terminals on the Ohio River. Use of the Ohio River barge terminals requires transportation by public road from the Portsmouth site.

The Portsmouth site obtains its water supply from an on-site water treatment plant that draws water from off-site supply wells on the Scioto River. In 2001, total groundwater production from this system averaged 6.6 million gal/d (25 million L/d) for the site, including USEC activities (DOE 2002d).

The Ohio Valley Electric Corporation supplies the site with electrical power. The current electrical consumption is about 20 to 40 MW; the maximum electrical design capacity is 2,260 MW.

3.1.3 Climate, Air Quality, and Noise

3.1.3.1 Climate

The Portsmouth site is located in the humid continental climatic zone and has weather conditions that vary greatly throughout the year (DOE 2001c). For the 1961 through 1990 period in Waverly, about 10 mi (16 km) north of the site, the annual average temperature was 52.9°F (11.6°C), with the highest monthly average temperature of 74.1°F (23.4°C) in July and the lowest of 28.8°F (−1.8°C) in January (National Oceanic and Atmospheric Administration [NOAA] 2000). Record extreme maximum and minimum temperatures are 102°F (39°C) and −24°F (−31°C). Annual precipitation averages about 39.7 in. (100.7 cm). Precipitation is relatively evenly distributed throughout the year but is somewhat higher in spring and summer than in winter and fall. Snowfall in Portsmouth averages 17.3 in. (43.9 cm) per year, occurring from November to April. Annual average relative humidity in Columbus, Dayton, and Cincinnati was more than 70% (Wood 1996).

Surface meteorological data, including wind data, have been collected at the on-site meteorological tower at the 10-, 30-, and 60-m (33-, 98-, and 197-ft) levels. The tower is in the southern part of the site. A comparison of annual wind roses for the period 1995 through 2001 indicates that wind patterns at the 10-m (33-ft) level are different from those at the 30-m and 60-m (98- and 197-ft) levels. Winds at the 10-m (33-ft) level appear to be influenced by local topographical and/or vegetative features. Accordingly, wind data at the 30-m (98-ft) level, believed to be representative of the site, are presented in Figure 3.1-3, which was prepared on the basis of hourly surface data from the on-site tower (Takacs 2002). More than 40% of the time, wind blew from the southwest quadrant, with the prevailing wind being from the south. Average wind speed was about 6.2 mph (2.8 m/s). Directional wind speed was highest, at 7.4 mph (3.3 m/s), from the northwest, and it was lowest, at 4.0 mph (1.8 m/s), from the east.

Tornadoes are rare in the area surrounding the Portsmouth site, and those that do occur are less destructive in this region than those occurring in other parts of the Midwest. For the 1950 through 1995 period, 656 tornadoes were reported in Ohio, with an average of 14 tornadoes per year (Storm Prediction Center 2002). For the same period, 3 tornadoes were reported in Pike County, but most of those were relatively weak — at most, F2 of the Fujita tornado scale.

3.1.3.2 Existing Air Emissions

Nonradiological air emissions from USEC are predominant sources in Pike County (EPA 2003b). Currently, USEC has three OEPA operating permits. The Title V permit for USEC

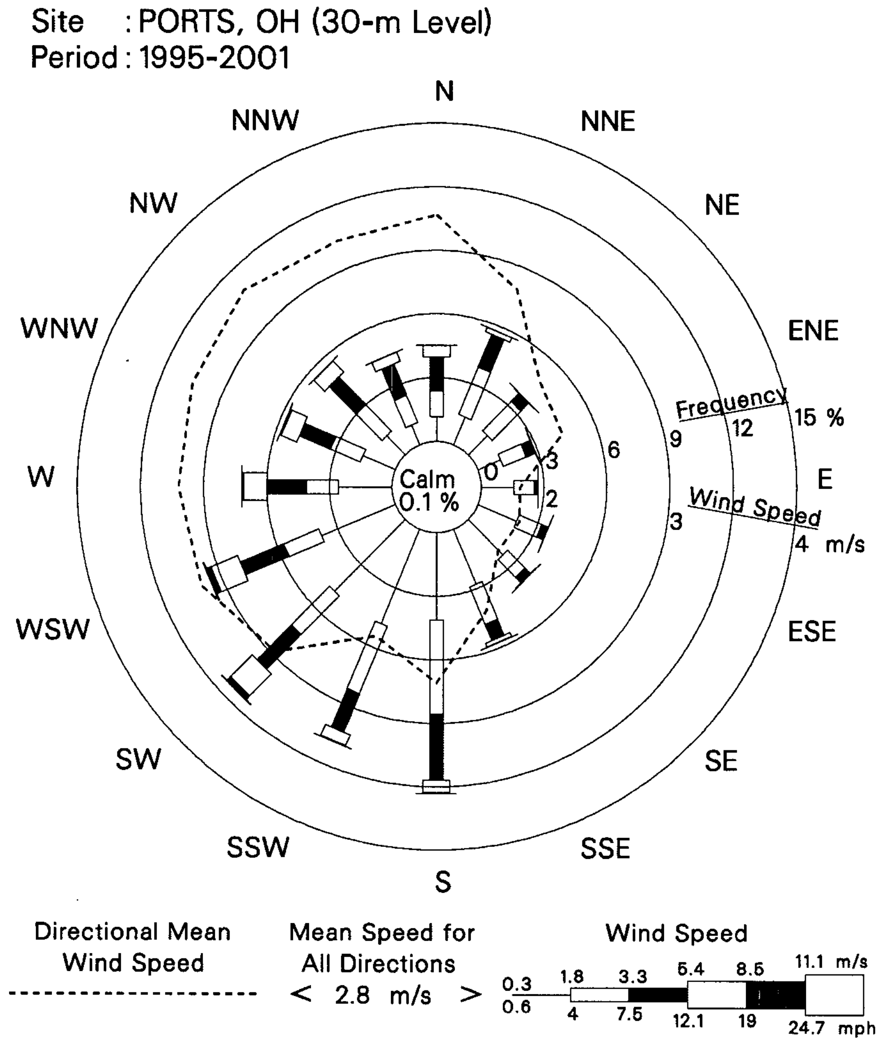

FIGURE 3.1-3 Wind Rose for the Portsmouth Site (30-m level), 1995–2001 (Source: Takacs 2002)

operations has been issued and was effective August 21, 2003, which is a sitewide, federally enforceable operating permit to cover emissions of all regulated air pollutants at the facility. In submissions to the OEPA, USEC reported the following criteria pollutant emissions for the year 2001 (see Table 3.1-2): 59.86 tons (54.30 t) of particulate matter with a mean diameter of 10 μm or less (PM_{10}), 1.42 tons (1.29 t) of volatile organic compounds (VOCs), 2,627.64 tons (2,473.57 t) of SO_2, and 362.05 tons (328.45 t) of NO_x. These emissions are associated with the boilers at the X-600 steam plant (which provides steam for the Portsmouth reservation), a boiler at the X-611 water treatment plant, an emergency generator, and a trash pump (DOE 2002d). DOE operates numerous small sources that release criteria pollutants and VOCs. At the end of 2001, DOE had eight permitted and seven registered air emission sources (Richmond 2003). In November 2001, DOE began operation of the X-6002 recirculating hot water plant to provide heat for the DOE facilities that were formerly heated by hot water from the gaseous diffusion

TABLE 3.1-2 Annual Criteria Pollutant and Volatile Organic Compound Emissions from USEC and DOE Sources at the Portsmouth Site in 2001

	Emission Rate (tons/yr)					
Major Emission Source	SO_2	NO_x	CO	VOCs	PM_{10}	$PM_{2.5}$
USEC facilities[a]	2,627.64	362.05	NA[b]	1.42	59.86	NA
DOE facilities[c]	21.5	93.6	58.5	5.7	5.3	NA

[a] Source: DOE (2002d).

[b] NA = not available.

[c] Proposed maximum annual emissions based on the assumption that two boilers would operate full time.

Source: Richmond (2003).

process. Proposed maximum annual emissions from plant operations account for most of the DOE emissions (Richmond 2003) (see Table 3.1-2). Other emission sources at DOE, which include two landfill venting systems, two glove boxes (not used in 2001), two aboveground storage tanks in the X-6002A fuel oil storage facility, and two groundwater treatment facilities, emit less than 1 ton per year of conventional air pollutants (on an individual basis).

Airborne discharges of radionuclides from the Portsmouth site are regulated under the CAA, 40 CFR 61, Subpart H, National Emission Standards for Hazardous Air Pollutants (NESHAPs). Currently, USEC is responsible for most of the sources that emit radionuclides because DOE leased the production facilities to USEC. In 2001, USEC and DOE reported emissions of 0.2 and 0.00063 Ci from their radionuclide emission sources, respectively. These values were used to estimate doses to members of the general public (DOE 2002d).

3.1.3.3 Air Quality

The Ohio State Ambient Air Quality Standards (SAAQS) for six criteria pollutants — SO_2, nitrogen dioxide (NO_2), CO, ozone (O_3), PM (PM_{10} and $PM_{2.5}$), and lead (Pb) — are the same as the National Ambient Air Quality Standards (NAAQS)[1] (OEPA 2002), as shown in Table 3.1-3.

The Portsmouth site is located in the Wilmington-Chillicothe-Logan Intrastate Air Quality Control Region (AQCR), which covers the south-central part of Ohio. Currently, Pike county is designated as being in attainment for all criteria pollutants (40 CFR 81.336). Ambient concentration data for criteria pollutants around the site are not available. On the basis of

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1 The EPA promulgated new O_3 8-hour and $PM_{2.5}$ standards in July 1997.

1997 through 2002 monitoring data, the highest concentration levels for SO_2, NO_2, CO, PM_{10}, and Pb representative of the Portsmouth site are less than 64% of their respective NAAQS, as listed in Table 3.1-3 (EPA 2003b). However, the highest O_3 and $PM_{2.5}$ concentrations are approaching or somewhat higher than the applicable NAAQS. These high ozone concentrations of regional concern are associated with high precursor emissions from the Ohio Valley region and long-range transport from southern states.

Ambient air monitoring stations in and around the site consist of a network of 15 air samplers that primarily collect data on radionuclides released from the site. These data are used to assess whether air emissions from the Portsmouth site would affect air quality in the surrounding area. If a person lived close to a monitoring station, the net dose calculated was 0.00019 mrem/yr, which is well below the 10-mrem/yr NESHAPs limit applicable to Portsmouth (see Section 3.1.7.1). In addition to the radionuclides, samples for fluoride were collected weekly from 15 ambient monitoring stations in and around PORTS. In 2001, the average ambient concentrations were similar to or less than those collected at the background station, except for a station that is within the process area immediately east of the X-326 building.

Prevention of significant deterioration (PSD) regulations (40 CFR 52.21) limit the maximum allowable incremental increases in ambient concentrations of SO_2, NO_2, and PM_{10} above established baseline levels, as shown in Table 3.1-3. The PSD regulations, which are designed to protect ambient air quality in Class I and Class II attainment areas, apply to major new sources and major modifications to existing sources. The nearest Class I PSD areas are Otter Creek Wilderness Area in West Virginia, about 177 mi (285 km) east of the Portsmouth site; Dolly Sods Wilderness Area in West Virginia, about 193 mi (311 km) east of the site; and Mammoth Cave National Park in Kentucky, about 200 mi (322 km) southwest of the site. These Class I areas are not located downwind of prevailing winds at the Portsmouth site (see Figure 3.1-3).

3.1.3.4 Existing Noise Environment

The Noise Control Act of 1972, along with its subsequent amendments (Quiet Communities Act of 1978; 42 USC 4901–4918), delegates authority to the states to regulate environmental noise and directs government agencies to comply with local community noise statutes and regulations. The State of Ohio and Pike County, where the Portsmouth site is located, have no quantitative noise-limit regulations.

The EPA has recommended a maximum noise level of 55 dB(A) as the DNL to protect against outdoor activity interference and annoyance (EPA 1974a). This level is not a regulatory goal but is "intentionally conservative to protect the most sensitive portion of the American population" with "an additional margin of safety." For protection against hearing loss in the general population from nonimpulsive noise, the EPA guideline recommends an L_{eq}(24 h) of 70 dB(A) or less.[2]

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[2] L_{eq} is the equivalent steady sound level that, if continuous during a specific time period, would contain the same total energy as the actual time-varying sound. For example, L_{eq}(24 h) is the 24-hour equivalent sound level.

The noise-producing activities within the Portsmouth site are associated with processing and construction activities and local traffic, similar to those at any other typical industrial site. During site operations, noise levels near the cooling towers are relatively high, but most noise sources are enclosed in the buildings. Currently, the site is in cold standby mode, so no major noise-producing activities exist on site. Another noise source is associated with rail traffic in and out of the Portsmouth site. In particular, train whistle noise, at a typical noise level of 95 to 115 dB(A), is high at public grade crossings. Currently, rail traffic noise is not a factor in the local noise environment because of infrequent traffic (one train per week).

The Portsmouth site is in a rural setting, and no residences or other sensitive receptor locations (e.g., schools, hospitals) exist in the immediate vicinity of any noisy on-site operations. (The nearest sensitive receptor is located about 1 mi (2 km) from Location A for the proposed conversion facility.) Ambient sound level measurements around the site are not currently available; the ambient noise level around the site is relatively low, however, except for infrequent vehicular noise. In general, the background environment is typical of rural areas; day-night average sound level (DNL) from the population density in Pike County is estimated to be about 40 dB(A) (EPA 1974b).

3.1.4 Geology and Soil

3.1.4.1 Topography, Structure, and Seismic Risk

The topography of the Portsmouth site area consists of steep hills and narrow valleys, except where major rivers have formed broad floodplains. The site is underlain by bedrock composed of shale and sandstone.

The Portsmouth site is situated within the Appalachian Plateau Physiographic Province of the Appalachian Highland region near its northwestern terminus at the Central Lowlands Province. The Appalachian Plateau is characterized by deeply dissected valleys and nearly accordant ridge tops. The summits of the main ridges just east of the Scioto River rise to an altitude of more than 1,100 ft (355 m) above mean sea level, with relief of up to 500 ft (150 m) from the bottom of the valleys.

Portsmouth is located within the Portsmouth paleoriver valley. Surface and near-surface geology at the site have been heavily influenced by glaciation and the resultant ice damming and drainage reversals. The site is located in an abandoned river valley that was filled with lacustrine (lake) sediments deposited during the existence of prehistoric Lake Tight (Rogers et al. 1988). The sedimentary units of interest at the site are, in ascending order, Ohio Shale, Bedford Shale, Berea Sandstone, Sunbury Shale, Cuyahoga Shale, Gallia Sand, and Minford Clay.

The Ohio Shale is 300 to 400 ft (90 to 120 m) thick at the site. It is black and thinly bedded and may contain oil. The Bedford Shale consists of interbedded thin sandstone and shale. The Berea Sandstone has a larger sand content than the Bedford Shale but is otherwise similar. At the site, the Berea Sandstone forms an aquifer that has an average thickness of about 30 ft (9 m). The Sunbury Shale is a black carbonaceous shale. This unit thins from east to west and may be completely absent in western portions of the site (ANL 1991b). The Teays Formation overlies the Sunbury Shale and is made up of Gallia Sand (unconsolidated Quaternary deposit) and Minford Clay (unconsolidated Quaternary deposit), in ascending order. These unconsolidated deposits have a fluvial origin and occupy paleochannels of the Teays River System. The Gallia Sand member is a silty to clayey, coarse to fine-grained sand with a pebble base. The Minford Clay member contains interbedded silts and clays and is divided into two zones: an upper zone of clay and a lower zone of silty clay.

The Portsmouth site is within 60 mi (96 km) of the Bryand Station-Hickman Creek Fault (ANL 1991b). No correlation has been made between this fault and historical seismicity. Seismic Source Zone 60 is a north-northeast-trending zone in central and eastern Ohio and includes the Portsmouth site.

The largest recorded seismic event in this zone was the Sharpsburg, Kentucky, earthquake of July 1980. That earthquake registered a magnitude of 5.3 and a Modified Mercalli intensity of VII. For this site, the evaluation-basis earthquake (EBE) was designated by DOE to have a return period of 250 years. A detailed analysis indicated that the peak ground motion for the EBE was approximately 0.06 times the acceleration of gravity (LMES 1997c). The estimated mean value of peak ground acceleration for a 1,000-year return period is 0.11 times the acceleration of gravity (ANL 1991b). Ground motion from such an earthquake would be equivalent to a Class VI or VII earthquake.

3.1.4.2 Soils

A majority of the soils at Portsmouth are formed on alluvial and lacustrine deposits. Other important soil-forming materials are parent material, colluvium, and loess (windblown material) (ANL 1991b). Approximately 1,500 acres (600 ha) of the site consists of moderately drained soils of the Urban Land-Omulga silt loam complex. The Omulga soil at the site is a dark grayish brown silt loam about 10-in. (25-cm) thick. Beneath this layer is about 54 in. (137 cm) of yellowish-brown subsoil. This material is characterized by a friable silt loam, a silty clay fragipan (low-permeability layer), and, near the bottom, a friable silt loam. Within the fragipan, the subsoil has slow permeability. Other soils of Portsmouth include the Clifty and Wilbur silt loams, which occur in stream valleys. The uplands areas contain a mixture of Coolville, Blairton, Latham, Princeton, Shelocta, and Wyatt soils. A description of these soils is provided in Hendershot et al. (1990).

The substances in soil that might be associated with cylinder management activities at the Portsmouth site are uranium and fluoride compounds, which could be released if breached cylinders or faulty valves were present. In 2001, soil was sampled for radioactive parameters, including uranium, at 24 on-site, 18 off-site, and 4 background locations (DOE 2002c). Analytical results for all off-site and most on-site sampling locations were similar to background values. Concentrations of uranium ranged from 2.1 to 23.3 μg/g, with the maximum at sampling location RIS-19, adjacent to the X-705 decontamination building (DOE 2002c). This area is known to be contaminated from historical small spills; the source of uranium was not considered to be the cylinder storage yards. Fluoride has not been analyzed in soil samples, but it occurs naturally in soils and is low in toxicity.

After a March 1978 cylinder handling accident, soil samples were collected to determine whether the X-745-C and X-745-B yards were contaminated (Geraghty & Miller, Inc. 1994a). Total uranium concentrations in the X-745-C yard did not appear to be elevated; they ranged from 2.2 to 4.4 µg/g. VOCs, semivolatile organic compounds (SVOCs), and PCBs were detected in shallow soil samples at maximum concentrations up to about 3 µg/g (for polycyclic aromatic hydrocarbons [PAHs]). Although a few VOCs were detected at low concentrations in groundwater from one well, the source is unlikely to be the X-745-C yard (Geraghty & Miller, Inc. 1994a).

Contaminant concentrations in the X-745-B yard were elevated in some soil samples, ranging from 2.7 to 352 µg/g (for the PAH phenanthrene). However, no uranium, VOCs, SVOCs, or PCBs were detected in groundwater associated with the X-745-B yard. The contamination was confined to shallow soils and limited to the immediate proximity of the unit (Geraghty & Miller, Inc. 1994b).

An investigation of Location A soils was conducted in 2000 (Tetra Tech, Inc. 2000). Six surface soil samples (collected from depths of 0 to 1 ft [0 to 35 cm]) were obtained, and 23 subsurface soil samples were collected from soil borings at the same locations as those where the surface soil samples were collected. Samples were analyzed for VOCs, SVOCs, PCBs, and radionuclides. No organic compounds or PCBs were detected in surface or subsurface soil samples. In one soil boring location, alpha activity was detected at a concentration slightly greater than background in both the surface and subsurface samples (i.e., 5.2 pCi/g in a surface and subsurface soil sample versus 4.8 pCi/g background). Overall, the characterization data did not indicate soil contamination at Location A.

No characterization of soils in Locations B and C has been conducted. There is no known past or current source of contamination at either of these locations.

3.1.5 Water Resources

The affected environment for water resources consists of surface water within and in the vicinity of the site boundary and groundwater beneath the site. Analyses of surface water, stream sediment, and groundwater samples indicated the presence of some contamination resulting from previous gaseous diffusion plant operations.

3.1.5.1 Surface Water

The Portsmouth site is within the Scioto River drainage basin. Both surface water and groundwater drain from the plant via a network of tributaries to the Scioto River (Rogers et al. 1988). The average flow in the Scioto River measured at Higby by the U.S. Geological Survey

(USGS) between 1930 and 1973 was 2.1×10^6 gal/min (133 m^3/s). The 10-year low-flow discharge at Higby is 1.4×10^5 gal/min (8.58 m^3/s).

The Portsmouth site is drained by several small tributaries of the Scioto River (Figure 3.1-4). The largest stream on the plant property is Little Beaver Creek, which drains the northern and northeastern portions of the site before discharging into Big Beaver Creek. Upstream of the plant, Little Beaver Creek flows intermittently during the year. On site, it receives treated process wastewater from a holding pond (via the east drainage ditch) and storm water runoff from the northwestern and northern sections of the plant via several storm sewers, water courses, and the north holding pond. The average release to Little Beaver Creek for 1993 was 940 gal/min (0.06 m^3/s).

Storm sewers H, F, and G on the southern end of the plant site discharge to the south holding pond. This pond overflows to Big Run Creek, another intermittent stream that discharges into the Scioto River. A small unnamed intermittent watercourse drains the southwest corner of the site via the southwest holding pond. Farther north on the property, there is another intermittent watercourse that receives runoff from the central and western portions of the site via the west drainage ditch. All of these streams flow directly to the Scioto River and carry only storm water runoff.

At the Portsmouth site, DOE is responsible for 6 National Pollutant Discharge Elimination System (NPDES) outfalls, and USEC is responsible for 11 NPDES outfalls (DOE 2002d). Total uranium discharge in 2001 from DOE outfalls was estimated as 1.2 kg (2.7 lb); total uranium discharge in 2001 from USEC outfalls was estimated as 16.2 kg (35.8 lb).

In addition to NPDES outfall monitoring, surface waters are monitored for radioactive contamination at 14 locations, including locations upstream and downstream from the Portsmouth site. The surface water monitoring results for 2001 indicated that the measured radioactive contamination was consistently less than the applicable drinking water standards (DOE 2002c,d). Uranium concentrations were detected at levels similar to those that occurred naturally in the Scioto River surface water sampling locations in 2000. Tc-99 was detected at 43 pCi/L in a sample collected downstream of Little Beaver Creek; this level is well below the DOE derived concentration guide of 100,000 pCi/L (DOE 2002d). In addition, in 2001, surface water samples were collected monthly from five locations at the DOE cylinder storage yards and analyzed for total uranium, uranium isotopes, TRU, and Tc-99. The maximum detected concentration of uranium in these samples was 14 μg/L; the maximum Tc-99 concentration was 10 pCi/L.

Sediment samples are also collected at the same locations where USEC surface water samples are collected, and at the NPDES outfalls on the east and west sides of the Portsmouth site (DOE 2002d). In 2001, the maximum uranium concentration in sediment was 5.6 μg/g, at background sampling location RM-10W. The maximum Tc-99 concentration was 16 pCi/g, at location RM-7 downstream on Little Beaver Creek. Several inorganic substances and PCBs were also monitored; results of the monitoring indicate no major difference between upstream and downstream concentrations. PCBs were not detected in sediments.

3.1.5.2 Groundwater

Five hydrogeological units are important for groundwater flow and contaminant migration beneath Portsmouth. These units are, in descending order, Minford Clay, Gallia Sand, Sunbury Shale, Berea Sandstone, and Bedford Shale. The upper two units form an aquifer in unconsolidated Quaternary deposits; the lower three units form a Mississippian bedrock aquifer. At the site, the hydraulic conductivities of all of the units are very low (Geraghty & Miller, Inc. 1989a). The most conductive unit is Gallia Sand. It has a mean hydraulic conductivity of 3.4 ft/d (1 m/d) and a range of 0.11 to 150 ft/d (0.03 to 46 m/d). It acts as the principal conduit for contaminant transport. The next most permeable unit is Berea Sandstone. It has a mean hydraulic conductivity of 0.16 ft/d (0.05 m/d) and a range of 0.0045 to 15 ft/d (0.0013 to 4.6 m/d). The average conductivity of Minford Clay, the shallowest unit, is estimated to be 0.00023 ft/d (7.0×10^{-5}) in the upper zone, while the conductivity of the lower zone is about 0.0042 ft/d (0.0013 m/d).

Within the upper portion of the bedrock aquifer, permeability is primarily produced by fractures. As depth increases, the presence of fractures decreases, and permeability depends more on porosity, grain size and shape, and packing arrangement (MMES 1993). At greater depth, the Berea Sandstone is probably more permeable than the shale units, which act as confining layers. The direction of groundwater flow beneath the site is controlled by a complex interaction between the Gallia and Berea units (Geraghty & Miller, Inc. 1989a). The flow patterns are also affected by the presence of storm sewer drains and by the reduction in recharge caused by the presence of buildings and paved areas. Groundwater flow patterns in both the Gallia and Berea units are characterized by an east-west-trending groundwater divide. The direction of groundwater flow is generally to the south in the southern sections of the Portsmouth site and to the north in the northern sections.

In the vertical direction, almost all wells exhibit a downward gradient from the Gallia to the Berea unit. The extent of the gradient is influenced by the thickness of the Sunbury Shale. Where the Sunbury Shale is thick, the gradient is large. In places where the Sunbury Shale is absent, upward vertical gradients are observed. Three main discharge areas exist for the groundwater system beneath Portsmouth: Little Beaver Creek to the north and east, Big Run Creek to the south, and two unnamed drainages to the west (Geraghty & Miller, Inc. 1989a).

Although Portsmouth has the ability to use Scioto River water, all water is currently supplied by three off-site water supply well fields completed in the Scioto River alluvium located just east of the Scioto River. Recharge of the aquifers is from river and stream flow as well as precipitation (annual average rainfall is 40.7 in. [103 cm]). In 2001, total groundwater production from this system averaged 6.6 million gal/d (2.5 million L/d) for the site, including USEC activities (DOE 2002d).

On-site groundwater at and around the Portsmouth site is monitored for radioactive and nonradioactive constituents at more than 400 wells. On site, five areas of groundwater contamination have been identified that contain contaminants. The main contaminants are VOCs (mostly trichloroethylene [TCE]) and radionuclides (e.g., uranium, Tc-99) (DOE 2002d).

Data from the 2000 annual groundwater monitoring showed that five contaminants exceeded their primary drinking water standards at the Portsmouth site: beryllium, chloroethane, americium, TCE, and uranium. Alpha and beta activity also exceeded the standards (DOE 2001d,e). The concentration of contaminants and the lateral extent of the plume did not significantly increase in 2001 (DOE 2002d).

Two phytoremediation projects to clean up TCE-contaminated groundwater are currently underway at the Portsmouth site. The phytoremediation projects involve the planting of hybrid poplar trees about 5 ft (2 m) apart in areas of contamination. The tree roots take up 50 to 350 gal (190 to 1,325 L) of water per day per tree and also provide nutrients to the soil, which accelerates bacterial breakdown of contaminants in the soil. One phytoremediation project, which started in 1999, is located on a small area of about 3 acres (1 ha) that is just northeast of Location A and borders part of the proposed new cylinder storage yard Area 2. The other project, started in 2001, is located on about 28 acres (11 ha) at the southern end of the Portsmouth site, to the south and southeast of Location B.

3.1.6 Biotic Resources

3.1.6.1 Vegetation

The most common type of vegetation on the Portsmouth site is managed grassland, which makes up 30% of the site (about 1,100 acres [445 ha]) (DOE 2001c). Grasses are the dominant species in these communities, and they are maintained by periodic mowing. Oak-hickory forest (covering 17% of the site) occurs on well-drained upland areas, and old-field communities (11%) occur in disturbed areas. Upland mixed hardwood forest also covers 11% of the site (400 acres [162 ha]). Black walnut, black locust, honey locust, black cherry, and persimmon are the dominant species in these mesic to dry upland communities. Riparian forest occurs in low, periodically flooded areas near streams; it makes up 4% of the site (153 acres [62 ha]). The dominant species in riparian forest communities are cottonwood, sycamore, willows, silver maple, and black walnut. Within the area surrounded by Perimeter Road, the Portsmouth site consists primarily of open grassland (including areas maintained as lawns) and developed areas consisting of buildings, paved areas, and storage yards.

Location A is approximately 26 acres (11 ha) in size and includes previously disturbed as well as undisturbed areas. Except for the northern portion, Location A is relatively level and has been graded. The northeastern portion of Location A and the area directly north of Building X-744-T support an old-field habitat, composed primarily of grasses such as fescue and broom-sedge, with crown vetch, wild carrot, and small scattered trees and shrubs. A drainage ditch bordering an old railroad bed in the east area supports sapling sycamore and black locust trees as well as mature black locust. Vegetation near the buildings is a managed grassland community and includes fescue, ox-eye daisy, and hop clover. Bulrush occurs in shallow drainage ditches. The area immediately adjacent to the buildings is infrequently mowed. At the northern boundary of Location A, the land surface slopes down to a small stream that runs along the northern margin of the location, approximately 100 ft (30 m) from the location boundary. This stream is bordered by a riparian woodland community of willow, mature sycamore, black locust, and maple. This woodland community is classified as riparian forest; however, the tree canopy is fairly open and narrow (less than 100 ft [30 m]) in width. Small woodland areas lie north of Building X-744-U and northwest of Building X-744-T; they are continuous with the riparian woodland community bordering the stream to the north. These wooded areas are composed primarily of mature black locust trees, along with honeysuckle, sumac, and sweet clover.

Location B is approximately 50 acres (20 ha) in size. It has been disturbed by grading and construction activities and has a level ground surface. The vegetation at this location is composed entirely of a managed grassland community and generally remains unmowed. The dominant species are fescue, broom-sedge, hop clover, and birdfoot trefoil.

Location C is approximately 78 acres (32 ha) in size and has been disturbed by grading activities. This location is relatively level to gently sloping throughout and supports an open, managed grassland vegetation community that generally remains unmowed. The dominant species is fescue, with yarrow and ox-eye daisy. Two drainages in the southwest portion of this location are bordered by narrow deciduous woodland communities (approximately 60 ft [18 m] in width) with open tree canopies. These woodland communities are classified as upland mixed hardwood forest community.

3.1.6.2 Wildlife

Habitats on the Portsmouth site support a relatively high diversity of terrestrial and aquatic wildlife species. Species observed on the site include 27 mammal species, 114 bird species, 11 reptile species, and 6 amphibian species. Ground-nesting species include bobwhite and eastern box turtle. Various species of reptiles and amphibians are associated with streams and other surface water on the site. Migrating waterfowl use site retention ponds (ANL 1991b). Additional information on wildlife resources is available in DOE (2001c), MMES (1993), and ANL (1991b).

Fish communities in Little Beaver Creek range from good to exceptional downstream of the Portsmouth outfall, and are fair upstream (OEPA 1998). Aquatic habitat quality in Little Beaver Creek is lower upstream of the Portsmouth outfall, where stream flow is intermittent. Upstream macroinvertebrate communities are poor, while downstream communities range from poor to exceptional. The fish community in West Ditch, which is downstream of Location A is marginally good, while the macroinvertebrate community is fair (OEPA 1993).

The habitats within Locations A, B, and C support wildlife species typical of similar habitats in the vicinity. Species occurring in open grassland areas like those that are common in the three locations include eastern cottontail, meadow vole, and eastern meadowlark. Small wooded areas, such as those at Locations A and B, support numerous woodland and forest edge species such as raccoon, gray squirrel, red-headed woodpecker, cardinal, white-breasted nuthatch, and yellow-rumped warbler.

3.1.6.3 Wetlands

A wetland survey of the Portsmouth site was conducted in 1995. Approximately 34 acres (14 ha) of wetlands occur on the site, excluding retention ponds. Forty-one wetlands meet the criteria for jurisdictional wetlands, while four wetlands are nonjurisdictional (Chandler 1996). Wetlands on the site primarily support emergent vegetation that includes cattail, great bulrush, and rush. Palustrine forested wetlands occur on the site along Little Beaver Creek (ANL 1991b). The Ohio State Division of Natural Areas and Preserves has listed two wetland areas near the site as significant wetland communities: (1) a palustrine forested wetland, about 5 mi (8 km) east of the site, and (2) Givens Marsh, a palustrine wetland with persistent emergent vegetation, about 2.5 mi (4 km) northeast of the site. The 100-year floodplains in the vicinity of the Portsmouth site include Big Beaver Creek and Little Beaver Creek. Both of these floodplains lie outside the area surrounded by Perimeter Road.

The drainage channel in the east portion of Location A supports a palustrine emergent wetland community of fox sedge, green bulrush, drooping bulrush, narrow-leaf cattail, and rush that is 0.08 acre (0.03 ha) in size; however, only 0.05 acre (0.02 ha) of this wetland lies within the boundary of Location A (Figure 3.1-5). The steep slopes of the channel are vegetated with upland species. The drainage channel conveys surface water runoff to an intermittent stream that borders the north margin of Location A and likely also receives groundwater discharge. The stream, which lies in a low floodplain, supports a riparian woodland community of willow, maple, sycamore, and black locust. The stream and adjacent riparian area lie outside the boundary of Location A. Another small stream originates near the southwest corner of this location and enters a small holding pond west of Perimeter Road, a short distance above the confluence with the northern stream.

Wetlands do not occur at Location B. However, a number of wetlands occur in the vicinity of Location B in areas previously disturbed by industrial development. These wetlands receive surface runoff from the surrounding landscape; also, as a result of previous grading activities, soils are poorly drained. A large palustrine emergent wetland (3.2 acres [1.3 ha]), composed primarily of cattails, lies immediately to the south of the east portion of the area; it receives runoff from portions of Location B. Another small wetland (0.3 acre [0.12 ha]) lies just outside the southeast corner boundary of Location B. Several additional wetland areas are located within the open area to the south of Location B. Streams receiving drainage from Location B lie to the south and southwest and support riparian forest communities. Drainage flows into a holding pond southwest of Perimeter Road.

Although no wetlands are identified at Location C, two small drainages in the southwest portion of the area direct surface water flows from Location C to Big Run Creek. The upper segment of the X-230K holding pond is located downstream, immediately west of this location. Also, a drainage ditch along the south margin of the parking area in the northwest portion of Location C directs surface flows into a small wetland area to the west, beyond the location boundary. Finally, a drainage ditch exiting this wetland joins the upper segment of the holding pond.

3.1.6.4 Threatened and Endangered Species

Federal- and state-listed species in the vicinity of the Portsmouth site are listed in Table 3.1-4. No occurrence of federal-listed plant or animal species on the Portsmouth site has been documented. The Indiana bat, both federal- and state-listed as endangered, has been reported in the vicinity of the Portsmouth site and may occur on the site during spring or summer; however, no Indiana bats were collected during surveys in 1994 and 1996 (DOE 1997c). Roosting and nursery sites may include forested areas with loose barked trees (such as shagbark hickory) and standing dead trees. Potential summer habitat for the Indiana bat was identified within the corridors along Little Beaver Creek, the Northwest Tributary stream, and a wooded area east of the X-100 facility. However, most of the Portsmouth site was found to have poor summer habitat because of the small size, isolation, and insufficient maturity of the few woodlands on the site.

The sharp-shinned hawk, listed by the State of Ohio as endangered, and the rough green snake, a species of special interest in Ohio, have been observed on the Portsmouth site (DOE 2001c). Both of these species inhabit moist woods. The timber rattlesnake, listed by the State of Ohio as endangered, occurs in the vicinity of the Portsmouth site but has not been found on the site. Habitat for the timber rattlesnake is found on and near high, dry ridges. Two state-protected plant species that occur on the Portsmouth site are Carolina yellow-eyed grass, listed as endangered, and Virginia meadow-beauty, listed as potentially threatened (DOE 2001c).

TABLE 3.1-4 Federal- and State-Listed Endangered, Potentially Threatened, and Special Concern Species near the Portsmouth Site

Category and Scientific Name	Common Name	Status[a]	
		Federal	State
Mammals			
Myotis sodalis	Indiana bat	E	E
Birds			
Accipiter striatus	Sharp-shinned hawk		E
Reptiles			
Crotalus horridus	Timber rattlesnake		E
Opheodrys aestivus	Rough green snake		S
Plants			
Rhexia virginica	Virginia meadow-beauty		P
Xyris difformis	Carolina yellow-eyed grass		E

[a] E = endangered; P = potentially threatened; S = special concern.

Source: DOE (2001c).

These species occur in Quadrant IV, northeast of the area bounded by Perimeter Road. A population of long-beaked arrowhead, a wetland plant listed by the state as threatened, occurs just north of the site.

No federal- or state-listed species have been found to occur at Location A, B, or C. These locations do not support suitable habitat for the Indiana bat. Although Locations A and C contain small wooded areas, the proximity to paved roads and the small size and insufficient maturity of these areas would probably provide poor habitat for Indiana bats. These characteristics also limit the habitat suitability of these small wooded areas for the sharp-shinned hawk and rough green snake. Habitat for the timber rattlesnake does not occur on or near any of the three locations. The nearest populations of Carolina yellow-eyed grass and Virginia meadow-beauty are approximately 1.5 mi (2.4 km) north of Location A. The highly disturbed conditions at the three locations do not provide suitable habitat for these species.

3.1.7 Public and Occupational Safety and Health

3.1.7.1 Radiation Environment

Operations at the Portsmouth site result in radiation exposures of on-site workers and members of the off-site general public (Table 3.1-5). The maximum radiation dose to an off-site member of the public as a result of on-site facility operations is estimated to be 2.0 mrem/yr, which is less than 3% of the average dose of 78 mrem/yr from natural background radiation around the Portsmouth site (DOE 2002d). The DOE dose limit for the general public is 100 mrem/yr (DOE 1990). The maximum dose was estimated by using the largest environmental media concentrations monitored at different off-site locations, emission data, and conservative exposure parameters. In reality, the actual dose received by the general public would be much lower than the maximum value estimated.

Radiation exposures of the cylinder yard workers include exposures from activities performed outside the cylinder yards. The average dose in 2001 was 64 mrem/yr, obtained from monitoring data (DOE 2002d). That dose is considerably below the maximum dose limit of 5,000 mrem/yr set for radiation workers (10 CFR Part 835). The average dose in 2001 for all monitored DOE/Portsmouth employees and subcontractors was 1.85 mrem/yr.

3.1.7.2 Chemical Environment

Estimated hazard quotients for members of the general public under existing environmental conditions near the Portsmouth site are presented in Table 3.1-6. The hazard quotient represents a comparison of estimated maximum potential human intake levels with intake levels below which adverse effects are very unlikely to occur (see Appendix F for further details). The estimated hazard quotients indicate that exposures to uranium and fluoride for members of the general public near the Portsmouth site are much lower than those that might be associated with adverse health effects.

The Occupational Safety and Health Administration (OSHA) has proposed permissible exposure limits (PELs) for uranium compounds and HF in the workplace (29 CFR Part 1910, Subpart Z, as of February 2003) as follows: 0.05 mg/m^3 for soluble uranium compounds, 0.25 mg/m^3 for insoluble uranium compounds, and 2.5 mg/m^3 for HF. Portsmouth worker exposures are kept below those limits.

3.1.8 Socioeconomics

Socioeconomic data for the Portsmouth site focus on an ROI of four counties in Ohio: Jackson, Pike, Ross, and Scioto. The counties included in the ROI were selected on the basis of the current residential locations of government workers directly connected to Portsmouth activities. It encompasses the area in which these workers spend most of their salaries. More than 90% of Portsmouth workers currently reside in these counties (Takacs 2002). In the following sections, data are presented for each of the counties in the ROI. However, because the majority of Portsmouth workers live in Scioto and Pike Counties and in the City of Portsmouth, it is expected that the majority of impacts from Portsmouth activities would occur in these locations. Therefore, more emphasis is placed on these areas.

3.1.8.1 Population

The population of the ROI in 2000 was 212,876 people (U.S. Bureau of the Census 2002a) and was projected to reach 215,700 by 2003 (Table 3.1-7). In 2000, 79,195 people (37% of the ROI total) resided in Scioto County, with 20,909 of them residing in the City of Portsmouth itself (U.S. Bureau of the Census 2002a). During the 1990s, with the exception of Scioto County, each of the counties in the ROI experienced a small increase in population, with an ROI average increase of 0.4%, while Portsmouth itself experienced a decline of –0.8%. Over the same period, the population of Ohio grew at a rate of 0.5%.

3.1.8.2 Employment

Total employment in Scioto County was 18,691 in 2000 and was projected to reach 19,200 by 2003. The economy of the county is dominated by the trade and service sectors; employment in these sectors currently contributes more than 73% of all employment in the county (see Table 3.1-8). Employment growth in the highest growth sector, services, was 5.7% during the 1990s, compared with 1.0% in the county for all sectors as a whole (U.S. Bureau of the Census 1992, 2002b).

In 2000, total employment in Pike County was 10,739, and it was expected to reach 12,400 by 2003. The economy of the county is dominated by the manufacturing and service industries; employment in these activities currently contributes more than 78% of all employment in the county (see Table 3.1-9). Employment growth in the highest growth sector (services) was 9.5% during the 1990s, compared with 4.8% in the county for all sectors as a whole (U.S. Bureau of the Census 1992, 2002b).

TABLE 3.1-7 Population in the Portsmouth Region of Influence and Ohio in 1990, 2000, and 2003

Location	1990	2000	Growth Rate (%), 1990–2000[a]	2003[b] (Projected)
City of Portsmouth	22,676	20,909	-0.8	20,400
Scioto County	80,327	79,195	-0.1	78,900
Pike County	24,249	27,695	1.3	28,800
Jackson County	30,230	32,641	0.8	33,400
Ross County	69,330	73,345	0.6	74,600
ROI total	204,136	212,876	0.4	215,700
Ohio	10,847,115	11,353,140	0.5	11,510,000

[a] Average annual rate.

[b] ANL projections, as detailed in Appendix F.

Source: U.S. Bureau of the Census (2002a), except as noted.

TABLE 3.1-8 Employment in Scioto County by Industry in 1990 and 2000

Sector	No. of People Employed in 1990[a]	Percentage of County Total	No. of People Employed in 2000[b]	Percentage of County Total	Growth Rate (%), 1990–2000
Agriculture	921[c]	5.4	567[d]	3.0	-4.7[e]
Mining	50	0.3	10	0.1	-14.9
Construction	795	4.7	1,159	6.2	3.8
Manufacturing	2,237	13.2	2,257	12.1	0.1
Transportation and public utilities	664	3.9	316	1.7	-7.2
Trade	6,039	35.5	4,168	22.3	-3.6
Finance, insurance, and real estate	772	4.5	825	4.4	0.7
Services	5,455	32.1	9,498	50.8	5.7
Total	16,991		18,691		1.0

[a] U.S. Bureau of the Census (1992).

[b] U.S. Bureau of the Census (2002b).

[c] These agricultural data are from 1992 and are taken from U.S. Department of Agriculture (USDA) (1994).

[d] These agricultural data are from 1999 and are taken from USDA (1999).

[e] Agricultural data are for 1992 and 1997.

TABLE 3.1-9 Employment in Pike County by Industry in 1990 and 2000

Sector	No. of People Employed in 1990[a]	Percentage of County Total	No. of People Employed in 2000[b]	Percentage of County Total	Growth Rate (%), 1990–2000
Agriculture	206[c]	3.1	167[d]	1.6	-2.1[e]
Mining	60	0.9	76	0.7	2.4
Construction	183	2.7	342	3.2	6.5
Manufacturing	3,601	53.4	5,874	54.7	5.0
Transportation and public utilities	182	2.7	164	1.5	-1.0
Trade	1,269	18.8	1,361	12.7	0.7
Finance, insurance, and real estate	187	2.8	265	2.5	3.6
Services	1,018	15.1	2,517	23.4	9.5
Total	6,738		10,739		4.8

[a] U.S. Bureau of the Census (1992).

[b] U.S. Bureau of the Census (2002b).

[c] These agricultural data are from 1992 and are taken from USDA (1994).

[d] These agricultural data are from 1999 and are taken from USDA (1999).

[e] Agricultural data are for 1992 and 1997.

In 2000, total employment in the ROI was 63,044, and it was projected to reach 67,900 by 2003. The economy of the ROI is dominated by the manufacturing and service industries; employment in these activities currently contributes more than 66% of all employment in the ROI (see Table 3.1-10). Employment growth in the highest growth sector (services) was almost 6.6% during the 1990s, compared with 2.5% in the ROI for all sectors as a whole (U.S. Bureau of the Census 1992, 2002b). Employment at the Portsmouth site currently stands at 1,727 (Takacs 2002).

Unemployment in the ROI has remained persistently high despite falling rates during the 1990s. In Scioto County, the rate steadily declined during the 1990s from a peak rate of 11.5% in 1992 to the December 2002 rate of 7.3% (Table 3.1-11) (Bureau of Labor Statistics [BLS] 2002). In Pike County, rates also fell, from a peak of 11.7% in 1992 to the current rate of 8.9%. The December 2002 unemployment in the ROI was 7.2% compared with 5.0% for the state.

3.1.8.3 Personal Income

Personal income in Scioto County was about $1.6 billion in 2000 (in 2002 dollars), and it was projected to reach almost $1.9 billion by 2003, with an annual average rate of growth of 1.5% over the period 1990 through 2000 (Table 3.1-12). County per capita income also rose in the 1990s, and it was projected to reach $23,600 in 2003, compared with $17,631 at the beginning of the period.

TABLE 3.1-10 Employment in the Portsmouth Region of Influence by Industry in 1990 and 2000

Sector	No. of People Employed in 1990[a]	Percentage of ROI Total	No. of People Employed in 2000[b]	Percentage of ROI Total	Growth Rate (%), 1990–2000
Agriculture	2,568[c]	5.2	2,121[d]	3.4	-1.9[e]
Mining	274	0.6	299	0.5	0.9
Construction	1,922	3.9	2,671	4.2	3.4
Manufacturing	12,955	26.3	16,515	26.2	2.5
Transportation and public utilities	1,818	3.7	1,293	2.1	-3.6
Trade	14,388	29.2	11,689	18.5	-2.1
Finance, insurance, and real estate	1,813	3.7	3,308	5.2	6.2
Services	13,388	27.2	25,334	40.2	6.6
Total	49,254		63,044		2.5

[a] U.S. Bureau of the Census (1992).

[b] U.S. Bureau of the Census (2002b).

[c] These agricultural data are from 1992 and are taken from USDA (1994).

[d] These agricultural data are from 1999 and are taken from USDA (1999).

[c] Agricultural data are for 1992 and 1997.

In Pike County, personal income totaled almost $0.6 billion in 2000 (in 2002 dollars), and it was projected to reach almost $0.7 billion in 2003, with an annual average rate of growth of 3.4% over the period 1990 through 2000 (Table 3.1-12). County per capita income also rose in the 1990s, and it was projected to reach $23,700 in 2003, compared with $16,944 at the beginning of the period.

Growth rates in total personal income were higher in the ROI as a whole than for Scioto County, but lower than those for Pike County. Total personal income grew at a rate of 2.2% in the ROI over the period 1990 through 2000, and it was projected to reach $5.3 billion by 2003. ROI per capita income was projected to grow from $18,109 in 1990 to $24,500 in 2003, an average annual growth rate of 1.8%.

TABLE 3.1-11 Unemployment Rates in Scioto and Pike Counties, the Portsmouth Region of Influence, and Ohio

Location and Period	Rate (%)
Scioto County	
1992–2002 average	9.4
Dec. 2002 (current rate)	7.3
Pike County	
1992–2002 average	9.5
Dec. 2002 (current rate)	8.9
ROI	
1992–2002 average	8.0
Dec. 2002 (current rate)	7.2
Ohio	
1992–2002 average	5.1
Dec. 2002 (current rate)	5.0

Source: BLS (2002).

TABLE 3.1-12 Personal Income in Scioto and Pike Counties and the Portsmouth Region of Influence in 1990, 2000, and 2003

Location and Type of Income	1990	2000	Growth Rate (%), 1990–2000	2003 (Projected)[a]
Scioto County				
Total personal income (millions of 2002 $)	1,416	1,624	1.5	1,900
Personal per capita income (2002 $)	17,631	20,501	1.7	23,600
Pike County				
Total personal income (millions of 2002 $)	411	556	3.4	690
Personal per capita income (2002 $)	16,944	20,061	1.9	23,700
Total ROI				
Total personal income (millions of 2002 $)	3,697	4,509	2.2	5,300
Personal per capita income (2002 $)	18,109	21,180	1.8	24,500

[a] ANL projections, as detailed in Appendix F.

Source: U.S. Department of Commerce (2002).

3.1.8.4 Housing

Housing stock in Scioto County grew at an annual rate of 0.5% over the period 1990 through 2000 (Table 3.1-13) (U.S. Bureau of the Census 2002a), with total housing units projected to remain at 34,600 by 2003, reflecting the declining growth in county population. Housing in the City of Portsmouth declined during this period by –0.5%, with total housing units expected to fall to 10,100 in 2003. About 1,600 new units were added to the existing housing stock in the county during the 1990s, but there were 500 fewer units in the City of Portsmouth in 2000. Vacancy rates in 2000 stood at 11.0% in the city and 9.3% in the county as a whole for all types of housing. On the basis of annual population growth rates, 3,400 vacant housing units were expected in the county in 2003, of which about 1,000 were expected to be rental units available to incoming construction workers at the proposed facility.

TABLE 3.1-13 Housing Characteristics in the City of Portsmouth, Scioto and Pike Counties, and the Region of Influence in 1990 and 2000

Location and Type of Unit	No. of Units 1990	2000
City of Portsmouth		
Owner-occupied	5,478	4,853
Rental	4,189	4,267
Total unoccupied	1,091	1,128
Total	10,758	10,248
Scioto County		
Owner-occupied	20,774	21,646
Rental	9,012	9,225
Total unoccupied	2,622	3,183
Total	32,408	34,054
Pike County		
Owner-occupied	6,113	7,314
Rental	2,692	3,130
Total unoccupied	917	1,158
Total	9,722	11,602
ROI Total		
Owner-occupied	52,302	58,246
Rental	21,874	22,824
Total unoccupied	6,579	7,956
Total	80,755	89,026

Source: U.S. Bureau of the Census (2002a).

Housing stock in Pike County grew at an annual rate of 1.8% over the period 1990 through 2000 (Table 3.1-13) (U.S. Bureau of the Census 2002b), with total housing units expected to reach 12,200 in 2003, reflecting moderate growth in county population. Almost 1,900 new units were added to the existing housing stock in the county during the 1990s. Vacancy rates in 2000 stood at 10% in the county as a whole for all types of housing. On the basis of annual population growth rates, 1,200 vacant housing units were projected in the county in 2003. About 360 of these were expected to be rental units available to incoming construction workers.

In the ROI as a whole, housing grew at a faster rate than in Scioto County or the City of Portsmouth during the 1990s, with an overall growth rate of 1.0%. Total housing units were expected to reach 91,700 by 2003, with more than 8,300 housing units added in the 1990s. On the basis of vacancy rates in 2000, which stood at 8.9%, more than 2,300 rental units were expected to be available to incoming construction workers.

3.1.8.5 Community Resources

3.1.8.5.1 Community Fiscal Conditions. Revenues and expenditures for local government jurisdictions, including counties, cities, and school districts, constitute community fiscal conditions. Revenues would come primarily from state and local sales tax revenues associated with employee spending during construction and operation and would be used to support additional local community services currently provided by each jurisdiction. Tables 1 and 2 in Allison (2002) present information on revenues and expenditures by the various local government jurisdictions in the ROI.

3.1.8.5.2 Community Public Services. Construction and operation of the proposed facility would increase demand for community services in the counties, cities, and school districts likely to host relocating construction workers and operations employees. Additional demands would also be placed on local medical facilities and physician services. Tables 3.1-14 and 3.1-15 present data on employment and levels of service (number of employees per 1,000 population) for public safety, general local government services, and physicians. Tables 3.1.8-16 and 3.1.8-17 provide staffing data for school districts and hospitals.

3.1.9 Waste Management

The Portsmouth site generates several categories of waste, including wastewater; solid LLW; solid and liquid mixed hazardous and radiological waste; nonradioactive hazardous waste;

TABLE 3.1-14 Public Service Employment in the City of Portsmouth, Scioto and Pike Counties, and Ohio in 2002

	City of Portsmouth		Scioto County		Pike County		Ohio[b]
Employment Category	No. of Workers	Level of Service[a]	No. of Workers	Level of Service[a]	No. of Workers	Level of Service[a]	Level of Service[a]
Police	44	2.1	90	1.5	10	0.4	2.3
Fire[c]	44	2.1	0	0	0	0	1.4
General	212	10.1	730	12.5	294	12.6	34.6
Total	300	14.3	820	14.1	304	13.1	52.4

[a] Level of service represents the number of employees per 1,000 persons in each jurisdiction (U.S. Bureau of the Census 2002a).

[b] 2000 data.

[c] Does not include volunteers.

Sources: City of Portsmouth: Doyle (2002); Scioto County: Massey (2002); Pike County: Jones (2002); Ohio: U.S. Bureau of the Census (2002c).

TABLE 3.1-15 Number of Physicians in Scioto and Pike Counties and Ohio in 1997

	Scioto County		Pike County		Ohio
Employment Category	Number	Level of Service[a]	Number	Level of Service[a]	Level of Service[a]
Physicians	106	1.3	25	0.9	2.4

[a] Level of service represents the number of physicians per 1,000 persons in each jurisdiction.

Source: American Medical Association (1999).

TABLE 3.1-16 School District Data for Scioto and Pike Counties and Ohio in 2001

	Scioto County		Pike County		Ohio
Employment Category	No.	Student-to-Teacher Ratio[a]	No.	Student-to-Teacher Ratio[a]	Student-to-Teacher Ratio[a]
Teachers	732	17.9	287	19.0	10.8

[a] The number of students per teacher in each school district.

Source: Ohio Department of Education (2002).

TABLE 3.1-17 Medical Facility Data for Scioto and Pike Counties in 1998

Hospital	No. of Staffed Beds	Occupancy Rate (%)[a]
Scioto County		
Southern Ohio Medical Center	281	56
Pike County		
Pike Community Hospital	40	NA[b]

[a] Percentage of staffed beds occupied.

[b] NA = not available.

Source: Healthcare InfoSource, Inc. (1998).

and nonradioactive, nonhazardous solid waste. Disposal of waste generated from ongoing management of the DOE-generated DUF_6 cylinders currently in storage is managed by DOE. USEC is responsible for wastes generated from ongoing operations that are leased from DOE, except for "legacy wastes," which contain constituents such as asbestos and PCBs. The cylinder storage yards at Portsmouth currently generate only a very small amount of waste compared with the volume of waste generated from ongoing plant operations. Cylinder yard waste consists of small amounts of metal, scrapings from cylinder maintenance operations, potentially contaminated soil, and miscellaneous items.

The site has an active program to minimize the generation of solid LLW, hazardous waste, and LLMW. Radioactive waste minimization efforts include segregating radioactive waste from nonradioactive waste; reducing radiologically controlled areas, thereby reducing the volume of personal protective equipment; and improving the segregation and handling of laboratory waste. Hazardous and mixed waste minimization actions include sorting burnable waste from radioactively contaminated materials, reducing the use of absorbent cloths to clean up PCB spills, reducing floor sweeping waste, and substituting materials containing nonhazardous components. Solid waste minimization actions include recycling corrugated cardboard, office paper, fluorescent light bulbs, batteries, and aluminum.

Table 3.1-18 lists the Portsmouth site waste loads assumed for the analysis of impacts of projected activities.

TABLE 3.1-18 Projected Waste Generation Volumes for the Portsmouth Site[a]

Waste Category	Waste Treatment Volume (m^3/yr)
LLW	73,000
LLMW	5,600
TRU	0
Hazardous waste	110
Nonhazardous waste[b]	
Solids	3,200
Wastewater	145,000

[a] Volumes include operational and environmental restoration wastes projected from FY 2002 to FY 2025.

[b] Volumes include sanitary and industrial wastes.

Source: Cain (2002c).

3.1.9.1 Wastewater

Wastewater at Portsmouth consists of nonradioactive sanitary and process-related wastewater streams, cooling water blowdown, radioactive process-related liquid effluent, discharges from groundwater treatment systems, and storm water runoff from plant areas, including runoff from the coal pile. Wastewater is processed at several on-site treatment facilities and then discharged to either the Scioto River or its immediate tributaries, including Little Beaver Creek, through several permitted outfalls. Treatment facilities include an activated sludge sewage treatment plant; several facilities that employ waste-specific pretreatment technologies (e.g., pH adjustment, activated carbon adsorption, metals removal, denitrification, and ion absorption); and numerous settling basins designed to facilitate solids settling, oil collection, and chlorine dissipation. The site wastewater facilities have a capacity of approximately 5.3 million gal/d (20 million L/d) (DOE 1996a).

3.1.9.2 Solid Nonhazardous, Nonradioactive Waste

Solid waste — including sanitary refuse, cafeteria waste, industrial waste, disinfected medical waste (excluding drugs), and construction and demolition waste — is collected and disposed of off site at a state-permitted sanitary landfill. Disposal is in shallow trenches covered with earthen fill.

3.1.9.3 Nonradioactive Hazardous and Toxic Waste

Nonradioactive waste that is considered hazardous waste according to RCRA, or that contains PCBs defined under the Toxic Substances Control Act (TSCA), requires special handling, storage, and disposal. The Portsmouth site generates waste, including spent solvents, heavy-metal-contaminated waste, and PCB-contaminated toxic waste. Portsmouth provides long-term on-site storage for hazardous waste at the X-7725 and X-326 RCRA storage areas. Several additional 90-day satellite storage areas are available for temporary storage of hazardous waste. Hazardous waste is sent to permitted off-site contractors for final treatment and/or disposal.

3.1.9.4 Low-Level Radioactive Waste

LLW generated at the Portsmouth site is stored on site pending shipment to off-site treatment/disposal facilities. Solid LLW generated at the site includes refuse, sludge, and debris contaminated with radionuclides, primarily uranium and Tc-99.

3.1.9.5 Low-Level Radioactive Mixed Waste

LLW that contains PCBs or RCRA hazardous components is considered to be LLMW. All of the LLMW inventory at Portsmouth is subject to RCRA land disposal restrictions. LLMW is currently stored on site pending shipment to off-site disposal facilities.

3.1.10 Land Use

The Portsmouth site is located in south-central Ohio, in the southern portion of rural Pike County about 22 mi (35 km) north of the Ohio River and about 1 mi (1.6 km) east of the Scioto River. On the basis of an analysis of Landsat satellite imagery from 1992, dominant land cover categories in Pike County include deciduous forest (64.6%), pasture/hay (21.6%), and row crops (10.3%) (Figure 3.1-6). The 1997 agricultural census recorded 435 farms in Pike County in 1997, covering more than 78,300 acres (31,687 ha) (USDA 1999). Human settlement is sparse throughout most of Pike County; the largest communities (Piketon and Waverly) are located near the Scioto River north of the Portsmouth site. Apart from the two communities just mentioned and the villages of Jasper northwest of the site and Wakefield south of the site, the portion of Pike County containing the Portsmouth site is dominated by forest, pasture, and row crops.

The Portsmouth site covers 3,714 acres (1,500 ha); the uranium enrichment facilities are located on an 800-acre (320-ha) fenced core area within the larger site. The site is heavily developed and includes about 150 buildings, trailers, and sheds. The areas between structures consist primarily of mowed grassy areas and pasture, while the area immediately surrounding the Portsmouth site generally features a combination of deciduous forest and pasture.

3.1.11 Cultural Resources

Southern Ohio contains evidence from most of the major prehistoric periods for Eastern North America. The earliest period, Paleoindian, is very poorly represented in southern Ohio; however, numerous sites dating to the Archaic Period (9,000 B.C.–900 B.C.) have been found in close proximity to Portsmouth. The Woodland Period (900 B.C.–A.D. 900) is also well-represented, as evidenced by the mound complexes that appear in southern Ohio. The final prehistoric period represented in southern Ohio is the Fort Ancient culture (A.D. 900–A.D. 1600). During the early historic period, the Shawnee inhabited southern Ohio, including the Scioto Valley where Portsmouth is located. No federally recognized tribe has land claims in Pike County; however, the county is in the traditional range of the Shawnee Indians. Consultations with the Shawnee and the Ohio State Historic Preservation Officer (SHPO) have been initiated (see Appendix E for consultation letters). However, no religious or sacred sites, burial sites, or resources significant to Native Americans have been identified at the Portsmouth site to date.

The first permanent non-native settlement in the region was in 1801. The economy was almost entirely based on agriculture. The populations in the Portsmouth region grew slowly. The primary impetus for growth in the Scioto Valley was the expansion of transportation routes. During the 19th and early 20th centuries, several canals, roads, and, finally, railroads were constructed in the Scioto Valley region.

In 1951, the Scioto Valley was chosen by the AEC as the location for the third gaseous uranium diffusion facility within the nation's Cold War nuclear complex, to complement the facilities at Oak Ridge, Tennessee, and Paducah, Kentucky. Construction of the Portsmouth GDP began in 1952. The plant first became operational in 1954 and was completed in 1956. The facility provided enriched uranium-235 to fuel power reactors and nuclear-powered submarines and ships. The Portsmouth facility scaled back production for many years, suspending the production of highly enriched uranium in 1991, after the end of the Cold War.

Portsmouth and its surrounding area have the potential to yield both prehistoric and historic cultural resources. Archaeological and architectural surveys were undertaken at Portsmouth in 1996; however, neither report has been finalized. Discussions between Portsmouth and the Ohio SHPO are ongoing. The proposed construction sites at Portsmouth have been previously disturbed, and preservation of archaeological sites is unlikely. Cold War era structures do exist at Locations A and B, but their significance has yet to be determined.

3.1.12 Environmental Justice

3.1.12.1 Minority Populations

This EIS uses data from the most recent decennial census in 2000 to evaluate environmental justice implications of the proposed action and all alternatives with respect to minority populations. The CEQ guidelines on environmental justice recommend that "minority" be defined as members of American Indian or Alaska Native, Asian or Pacific Islander, Black non-Hispanic, and Hispanic populations (CEQ 1997). The earliest release of 2000 census data that included information necessary to identify minority populations identified individuals both according to race and Hispanic origin (U.S. Bureau of the Census 2001). It also identified individuals claiming multiple racial identities (up to six races). To remain consistent with the CEQ guidelines, the phrase "minority population" in this document refers to persons who identified themselves as partially or totally Black (including Black or Negro, African American, Afro-American, Black Puerto Rican, Jamaican, Nigerian, West Indian, or Haitian), American Indian or Alaska Native, Asian, Native Hawaiian or other Pacific Islander, or "Other Race." The minority category also includes White individuals of Hispanic origin, although the latter is technically an ethnic category. To avoid double counting, tabulations included only White Hispanics; the above racial groups already account for non-White Hispanics. In sum, then, the minority population considered under environmental justice consisted of all non-White persons (including those of multiple racial affiliations) plus White persons of Hispanic origin.

To identify census tracts with disproportionately high minority populations, this EIS uses the percentage of minorities in each state containing a given tract as a reference point. Using the individual states to identify disproportionality acknowledges that minority distributions in the state can differ from those found in the nation as a whole. In 2000, of the 206 census tracts within 50 mi (80 km) of the proposed conversion facility at Portsmouth, 12 had minority populations in excess of state-specified thresholds — a total of 7,735 minority persons in all (Figure 3.1-7). In Pike County, 3.7% of the 2000 population was minority (U.S. Bureau of the Census 2002d).

3.1.12.2 Low-Income Populations

As recommended by the CEQ guidelines, the environmental justice analysis identifies low-income populations as those falling below the statistical poverty level identified annually by the U.S. Bureau of the Census in its Series P-60 reports on income and poverty. The Census Bureau defines poverty levels on the basis of a statistical threshold that considers for each family both overall family size and the number of related children younger than 18 years old. For example, in 1999, the poverty threshold annual income for a family of three with one related child younger than 18 was $13,410, while the poverty threshold for a family of five with one related child younger than 18 was $21,024 (see U.S. Bureau of the Census 2000). The 2000 census used 1999 thresholds because 1999 was the most recent year for which annual income data were available when the census was conducted. If a family fell below the poverty line for its particular composition, the census considered all individuals in that family to be below the poverty line.

To identify census tracts with disproportionately high low-income populations, this EIS uses the percentage of low-income persons in each state containing a given tract as a reference point. In 1999, of the 206 census tracts within 50 mi (80 km) of the proposed conversion facility at Portsmouth, 142 had low-income populations in excess of state-specified thresholds — a total of 133,303 low-income persons in all (Figure 3.1-8). In Pike County, 18.6% of the individuals for whom poverty status was known in 1999 were low-income (U.S. Bureau of the Census 2002d).

3.2 EAST TENNESSEE TECHNOLOGY PARK

ETTP is located in eastern Roane County about 25 mi (40 km) west of Knoxville, Tennessee (Figure 3.2-1). ETTP is part of the ORR in the City of Oak Ridge, Tennessee. The site was established in 1940 with initiation of construction of the Oak Ridge Gaseous Diffusion Plant. Uranium enrichment was the site's mission until the mid-1980s, when gaseous diffusion operations ceased. In 1990, the site was renamed as the K-25 Site, and it was renamed again in 1997 as the ETTP. Previous missions were waste management and restoration; the current mission is to "reindustrialize and reuse site assets through leasing of vacated facilities and incorporation of commercial industrial organizations as partners in the ongoing environmental restoration, D&D, waste treatment and disposal, and diffusion technology development activities" (DOE 2001f).

3.2.1 Cylinder Yards

There are 4,822 DUF_6 storage cylinders located in ETTP site cylinder yards (Table 3.2-1; Figure 3.2-2). Cylinders are stacked two high to conserve space. About 30% of the cylinders are stored in yard K-1066-E (constructed with a concrete base), and 30% are stored in yard K-1066-K (constructed with a gravel base). The other cylinders are stored in four smaller yards.

TABLE 3.2-1 DOE-Managed DUF_6 Cylinders at the ETTP Site

Cylinder Type	No. of Cylinders
Full	4,719
Partially full	83
Heel	20
Total	4,822

Source: Hightower (2004).

In storage at ETTP, in addition to the cylinders that contain DUF_6, are a number of cylinders in various sizes that contain enriched UF_6 or normal UF_6 or are empty. The non-DUF_6 cylinders total 1,102 and contain a total of about 26 t (29 tons) of UF_6 (7 t [8 tons] of enriched UF_6 plus 19 t [21 tons] of normal UF_6) (Hightower 2004). About 20 cylinders are empty. Of the 881 non-DUF_6 cylinders that contain enriched uranium, fewer than 30 contain uranium enriched to greater than 5% uranium-235, and all of these are small, sample cylinders containing less than 3 lb (1.4 kg) of UF_6 each.

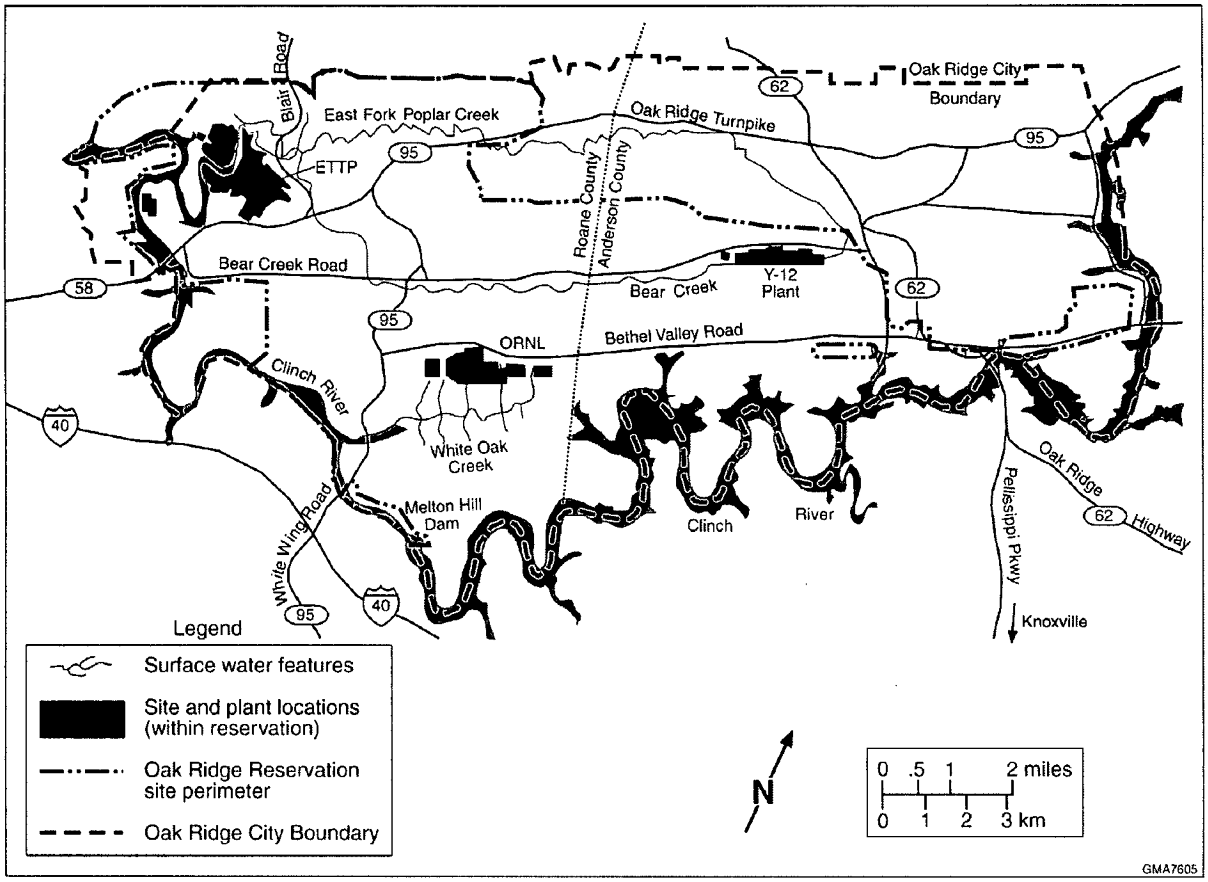

FIGURE 3.2-1 Regional Map of the ETTP Vicinity

Over 98% of the enriched UF_6 in cylinders at ETTP contains less than 5% uranium-235. It is assumed that the natural and enriched UF_6 would be put to beneficial uses; therefore, conversion of the contents of the non-DUF_6 cylinders is not considered in this EIS. This EIS does, however, include these cylinders in its evaluation of an alternative that considers the transportation of cylinders from ETTP to Portsmouth for conversion.

It is expected that many of the full DUF_6 cylinders at the ETTP site would not meet DOT transportation requirements because of damage and corrosion from poor historical storage conditions. It was estimated in the PEIS that a range of one-half to all of the full DUF_6 cylinders would not meet DOT transportation requirements (DOE 1999a). More recent estimates indicate that 1,700 cylinders are DOT compliant, with the remainder not meeting DOT requirements (see Section 1.7). No similar estimate of the condition of the non-DUF_6 cylinders at ETTP is available.

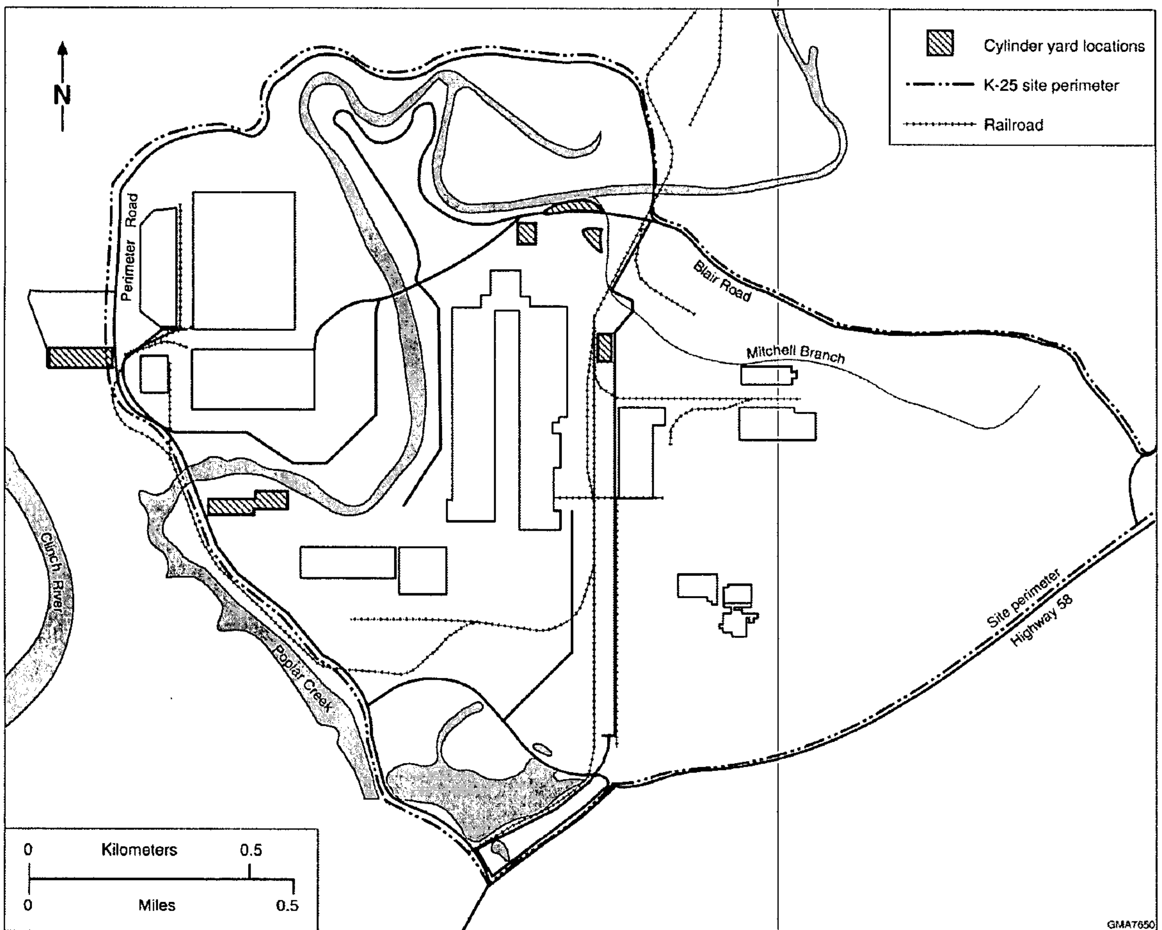

FIGURE 3.2-2 Locations of Storage Yards at ETTP That Are Used to Store DOE-Managed Cylinders

3.2.2 Site Infrastructure

The ETTP site is located in an area with a well-established transportation network. The site is near two interstate highways, several U.S. and state highways, two major rail lines, and a regional airport (Figure 3.2-1).

The ETTP water supply is pumped from Clinch River. The water is treated and stored in two storage tanks. This system, with a capacity of 4 million gal/d (15 million L/d), provides water to the Transportation Safeguards Facility and the ETTP site.

Electric power is supplied by the Tennessee Valley Authority (TVA). The distribution of power is managed through the ETTP Power Operations Department. The average demand for electricity by all of the DOE facilities at Oak Ridge, including the ETTP site, is approximately 100 MVA. The maximum capacity of the system is 920 MVA (DOE 1995). Natural gas is supplied by the East Tennessee Natural Gas Company; the daily capacity of 7,600 decatherms can be increased, if necessary. The average daily usage in 1994 was 3,600 decatherms (DOE 1995).

3.2.3 Climate, Air Quality, and Noise

3.2.3.1 Climate

The climate of the region, including the ETTP site, may be broadly classified as humid continental. The region is located in a broad valley between the Cumberland Mountains to the northwest and the Great Smoky Mountains to the southeast, which influence meteorological patterns over the region (Wood 1996). During the summer, tropical air masses from the south provide warm and humid conditions that often produce thunderstorms. In winter, the Cumberland Mountains have a moderating influence on local climate by shielding the region from cold air masses from the north and west.

For the 1961 through 1990 period, the annual average temperature was 13.7°C (56.6°F), with the highest monthly average temperature of 24.3°C (75.8°F) occurring in July and the lowest of 1.7°C (35.0°F) occurring in January (Wood 1996). Annual precipitation averages about 137 cm (53.8 in.), including about 25 cm (9.8 in.) of snowfall. Precipitation is evenly distributed throughout the season, with the highest occurring in spring.

Winds in the region are controlled in large part by the valley-and-ridge topography. Prevailing wind directions are from the northeast and southwest, reflecting the channeling of winds parallel to the ridges and valleys in the area. The average wind speed at Oak Ridge is about 2.0 m/s (4.4 mph); the dominant wind direction is from the southwest (Wood 1996). For 2001, the average wind speed at the 10-m (33-ft) level of the ETTP K1209 meteorological tower was 1.5 m/s (3.4 mph), as shown in Figure 3.2-3 (ORNL 2002). The dominant wind direction at the tower was southwest, with secondary peaks from the south-southwest and the east. These lower wind speeds at the ETTP tower and in the region reflect the air stagnation relatively common in eastern Tennessee.

Tornadoes rarely occur in the valley surrounding the ETTP site between the Cumberlands and the Great Smokies, and they historically have been less destructive than those in the Midwest. For the period 1950 through 1995, 541 tornadoes were reported in Tennessee, with an average of 12 tornadoes per year (Storm Prediction Center 2002). For the same period, 3 tornadoes were reported in Anderson and Roane Counties each, but these tornadoes were relatively weak, being F3 of the Fujita tornado scale, at most.

3.2.3.2 Existing Air Emissions

At the end of calendar year 2001, there were 88 active air emission sources under DOE control at ETTP (DOE 2002e). Of these 88 sources, ETTP operated 30; these were covered under eight major air emission sources subject to rules in the Tennessee Title V Major Source Operating Permit Program under an application shield granted by the TDEC Division of Air Pollution Control. All remaining active air emission sources are exempt from permitting requirements.

Major sources for criteria pollutants and VOCs in Anderson and Roane Counties in Tennessee include TVA steam plants and DOE operations, including the Y-12, ORNL, and ETTP sites. Annual emissions from major sources and total county emissions are presented in Table 3.2-2. The SO_2 and NO_x emissions from ETTP operations are negligible compared with those from the two TVA steam plants in Anderson and Roane Counties. However, VOC emissions account for about 39% of the Roane County emission total, and PM (PM_{10} and $PM_{2.5}$) emissions account for about 8% of the Roane County emission total. The amount of actual emissions from the ETTP site is much less than the amount of allowable emissions presented in Table 3.2-2 (DOE 2002e).

The State of Tennessee and the EPA regulate airborne emissions of radionuclides from DOE facilities under 40 CFR 61, Subpart H, NESHAPs regulations (DOE 2002e). The three ETTP major sources that operated during 2000 were the TSCA incinerator and two stacks in the K-33 building operated by British Nuclear Fuels, Ltd. Emissions from these exhaust stacks are controlled by a particulate filtration system, and continuous sampling for radionuclides emissions is conducted at these stacks to assess the dose to the public.

TABLE 3.2-2 Annual Criteria Pollutant and Volatile Organic Compound Emissions from Selected Major Point Sources around the ETTP Site in 1999

	Emission Rate (tons/yr)					
Major Emission Source	SO_2	NO_x	CO	VOC	PM_{10}	$PM_{2.5}$
TVA Bull Run Steam Plant, Clinton	38,179	13,528	420	50	529	267
Y-12 Plant (DOE)	13,375	1,672	38	19	61	21
Anderson County, Tenn., total	51,555	15,237	460	405	731	365
TVA Kingston Steam Plant, Kingston	109,194	26,055	995	122	95	98
ORNL (DOE)	361	25	53	14	363	267
ETTP (formerly K-25) (DOE)	222 (0.20%, 0.14%)[a]	60 (0.23%, 0.14%)	29 (2.5%, 1.8%)	86 (39%, 14%)	41 (8.2%, 3.2%)	34 (8.5%, 4.5%)
Roane County, Tenn., total	109,777	26,149	1,157	222	498	399

[a] First and second values in parentheses are ETTP emissions as percentages of Roane County emissions total and combined Anderson and Roane Counties emissions total, respectively.

Source: EPA (2003b).

3.2.3.3 Air Quality

The Tennessee SAAQS for six criteria pollutants — SO_2, NO_2, CO, O_3, PM (PM_{10} and $PM_{2.5}$), and Pb — are almost the same as the NAAQS (Waynick 2002), as shown in Table 3.2-3. In addition, the state has adopted standards for gaseous fluorides (expressed as HF), as presented in Table 3.2-4.

The ETTP site in Roane County is located in the Eastern Tennessee-Southwestern Virginia Interstate AQCR. Currently, the county is designated as being in attainment for all criteria pollutants (40 CFR 81.343).

Although uranium enrichment activities at ETTP were discontinued in 1985, ambient air monitoring for radionuclides, criteria pollutants (PM_{10} and Pb),[3] and several metals has continued at on-site and off-site locations (DOE 2002e). Monitoring indicates that no standards were exceeded, and there was no statistically significant elevation of pollutant concentrations associated with site operations. On the basis of modeling radionuclide emissions from all major and minor point sources, the effective dose equivalent to the most exposed member of the public was 0.8 mrem/yr in 2001, well below the NESHAPs dose limit of 10 mrem/yr (DOE 2002e). Also, the airborne dose from all ETTP radionuclide emissions was still less than the ORR maximum. The highest concentration levels for SO_2, NO_2, CO, PM_{10}, 24-hour $PM_{2.5}$, and Pb around and within the ETTP site are less than or equal to 78% of their respective NAAQS in Table 3.2-3 (EPA 2003b; DOE 2002e). However, the highest O_3 and annual $PM_{2.5}$ concentrations that are of regional concern are approaching or somewhat higher than the applicable NAAQS.

PSD regulations (40 CFR 52.21) limit the maximum allowable incremental increases in ambient concentrations of SO_2, NO_2, and PM_{10} above established baseline levels, as shown in Table 3.2-3. The PSD regulations, which are designed to protect ambient air quality in Class I and Class II attainment areas, apply to major new sources and major modifications to existing sources. The nearest Class I PSD is the Great Smoky Mountains National Park, about 55 km (34 mi) southeast of ETTP. The Joyce Kilmer-Slickrock Wilderness Area just south of the western end of Great Smoky Mountains National Park is also a Class I area. These Class I areas are not located downwind of prevailing winds at ETTP (see Figure 3.2-3).

3.2.3.4 Existing Noise Environment

The Noise Control Act of 1972, along with its subsequent amendments (Quiet Communities Act of 1978, 42 USC Parts 4901–4918), delegates to the states the authority to regulate environmental noise and directs government agencies to comply with local community noise statutes and regulations. Anderson County has quantitative noise-limit regulations, as shown in Table 3.2-5 (Anderson County 2002), although the State of Tennessee and Roane County do not.

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[3] At the end of 2001, all PM_{10} sampling was discontinued after a review of PM_{10} data over a 10-year period (1991 through 2000) in which all concentrations were below the ambient air quality standards.

TABLE 3.2-4 Additional Tennessee Ambient Air Quality Standards[a]

Pollutant	Averaging Time	Primary Standard	Secondary Standard
Gaseous fluorides (as HF)	12 hours	–[b]	3.7 µg/m^3(4.5 ppb)[c]
	24 hours	–	2.9 µg/m^3 (3.5 ppb)[c]
	7 days	–	1.6 µg/m^3 (2.0 ppb)[c]
	30 days	–	1.2 µg/m^3 (1.5 ppb)[c]
Gaseous fluorides (as HF)[d]	30 days	–	0.5 µg/m^3 (0.6 ppb)[c]

[a] These standards are in addition to the Tennessee's SAAQS listed in Table 3.2-3.

[b] A dash indicates that no standard exists.

[c] This average is not to be exceeded more than once per year.

[d] Applied in the vicinity of primary aluminum reduction plants in operation on or before December 31, 1973.

Source: TDEC (1999).

TABLE 3.2-5 Allowable Noise Level by Zoning District in Anderson County, Tennessee

Zoning		Allowable Noise Level (dBA)	
District	Abbreviation	7 a.m.–10 p.m.	10 p.m.–7 a.m.
Suburban-residential	R-1	60	55
Rural-residential	A-2	65	60
Agriculture-forest	A-1	65	60
General commercial	C-1	70	65
Light industrial	I-1	70	70
Heavy industrial	I-2	80	80
Floodway	F-1	80	80

Source: Anderson County (2002).

The EPA has recommended a maximum noise level of 55 dB(A) as DNL to protect against outdoor activity interference and annoyance (EPA 1974a). This level is not a regulatory goal but is "intentionally conservative to protect the most sensitive portion of the American population" with "an additional margin of safety." For protection against hearing loss in the general population from nonimpulsive noise, the EPA guideline recommends an L_{eq}(24 h) of 70 dB(A) or less over a 40-year period.

The noise-producing activities within the ETTP site are associated with the DUF_6 cylinder project and local traffic similar to that at any other industrial site. Major noise sources within the ETTP site consist of heavy equipment, forklift, and crane operations associated with cylinder handling, steel grit blasting operations, welding/burning/hotwork activities during breach repairs, etc. (Cain 2002a).

ETTP is in a rural setting, and no residences and sensitive receptors (e.g., schools, hospitals) are located in the immediate vicinity. As part of hearing protection for workers, industrial hygiene measurements of noise associated with the DUF_6 cylinder project have been made since 1998. Ambient noise levels around the site are relatively low. Measurements taken at the nearby residence along Popular Creek Road (off Blair Road) to the north of the site on June 1991 at 8:30 a.m. indicated about 39 dB(A), typical of a rural environment (ANL 1991b). At three residences on Blair Road nearest the site, noises from the K-25 activities were not distinguishable from background noise. To date, there have been no complaints about noise from neighboring communities.

3.2.4 Geology and Soil

3.2.4.1 Topography, Structure, and Seismic Risk

The topography of the Oak Ridge site is varied; the maximum change in elevation across the site is about 420 ft (130 m). The site is underlain by sedimentary rocks composed of limestone and dolomite. Sinkholes, large springs, and other karst features can occur in the limestone formations adjacent to the site (DOE 1995).

The ETTP site is situated in the Valley and Ridge Subregion of the Appalachian Highlands Province near the boundary with the Cumberland Plateau (DOE 1995). This subregion consists of a series of northeast-southwest trending ridges bounded by the Cumberland Escarpment on the west and by the Blue Ridge Front on the east.

The major stratigraphic units underlying the site and its confining ridges are the Rome Formation (silty shale and shale), the Conasauga Group (calcareous shale interbedded with limestone and siltstone), the Knox Group (silty dolomite), and the Chickamauga Limestone (interbedded with layers of bentonite). These units range in age from Lower Cambrian (Rome Formation) to Middle Ordovician (Chickamauga Limestone). Contacts between the members are gradational and discontinuous. Sinkholes, large springs, and other karst features are common in the Knox Group, and areas underlain with limestone or dolomites are, for the most part, classified as karst terrains (DOE 1995).

The most important structural feature near the site is a fault system consisting of the Whiteoak Mountain Fault, which runs through the southeastern corner of the Oak Ridge facility; the Kingston Fault, a parallel fault that occurs north of Poplar Creek; and the Copper Creek Fault, located in Melton Valley. A branch of the Whiteoak Mountain Fault originates just south of the facility and runs due north through its center. None of these faults appear to have any topographic expression, and it is assumed that displacement took place prior to the development of the present surface of erosion (DOE 1979). These faults can probably be considered inactive; no seismic events have been associated with these faults near the site, and no surface movement has been reported along the faults.

3.2.4.2 Soils

The typical soil types of the Valley and Ridge Province at ETTP are red-yellow podsols, reddish-brown laterites, or lithosols (DOE 1979). They are usually strongly leached and acidic and have a low organic content. The thickness of alluvium beneath the site ranges from nearly 0 to 60 ft (0 to 18 m). Soils developed on the Chickamauga Formation, which underlies most of the site, are typically yellow to yellow-brown montmorillonites. The Conasauga Shale, which underlies the southeastern corner of the site, develops a silty brown, tan, greenish, and maroon clay that is micaceous and contains fragments of unweathered parent rock. In upland areas around the site, the Fullerton Soil Series is dominant. This soil has moderate infiltration rates and is moderately drained to well drained. The Nolichucky and Talbott Series soils are the most abundant valley and terrace soils within the site proper. The Nolichucky and Talbott Series soils are similar to the Fullerton Series soils (Geraghty & Miller, Inc. 1989b).

Soil and groundwater data have been collected to determine whether contamination is associated with the Oak Ridge cylinder yards (DOE 1994a). Substances in soil possibly associated with cylinder management activities are uranium and fluoride compounds, which could be released to soil if breached cylinders or faulty valves were present. In 1991, 122 systematic soil samples were collected at the K-yard; these samples had maximum concentrations of 0.14 mg/kg of uranium-235 and 13 mg/kg of uranium-238. Soil samples collected in March 1992 at the K-yard had a maximum uranium concentration of 36 ±2 mg/kg.

In 1994, 200 systematic and 28 biased soil samples were collected in areas surrounding the cylinder yards; the maximum concentrations detected in these samples were 0.83 mg/kg of uranium-235 at the K-1066-F yard (F-yard) and 75 mg/kg of uranium-238 at the E-yard. Groundwater concentrations of total uranium (measured as gross alpha and gross beta) for upgradient and downgradient wells indicate that although some elevated levels of uranium have been detected in cylinder yard soil, no migration to groundwater has occurred (DOE 1994a).

Soil samples collected as part of general site monitoring in the immediate surrounding area in 1994 had the following maximum concentrations: uranium, 6.7 mg/kg; Aroclor® 1254 (a PCB), 0.16 mg/kg; cadmium, 0.34 mg/kg; mercury, 0.15 mg/kg; and nickel, 33 mg/kg (LMES 1996c). Fluoride was not analyzed in the soil samples but is naturally occurring and of low toxicity. Concentrations of uranium in 1995 and 1996 soil monitoring were lower than the previous results (LMES 1996b, 1997b).

As part of ongoing Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA)/RCRA investigations, several areas of soil at the ETTP site have been identified as contaminated with radionuclides and/or chemicals. Remediation of this contamination is being implemented as a part of ongoing CERCLA/RCRA activities at the site.

3.2.5 Water Resources

The affected environment for water resources consists of surface water within and in the vicinity of the site boundary and groundwater beneath the site. Analyses of surface water, stream sediment, and groundwater samples have indicated the presence of some contamination resulting from previous gaseous diffusion plant operations. Although several contaminants are present in the water, only small amounts of uranium and fluoride compounds are related to releases from the cylinders.

3.2.5.1 Surface Water

The ETTP site is located near the confluence of the Clinch River (a tributary of the Tennessee River) and Poplar Creek (Figure 3.2-4). Effluent discharge points are located on both Poplar Creek and the Clinch River, and two water withdrawal points are on the Clinch River (DOE 1979).

All waters that drain the ETTP site eventually reach the Tennessee-Ohio-Mississippi water system. The Clinch River provides the most immediate destination for waters discharged from the site and flows southwest into the Tennessee River near Kingston, Tennessee (Geraghty & Miller, Inc. 1989b). A dam constructed in 1963 at River Mile 23.1 created the Melton Hill Reservoir, which establishes the eastern and southeastern boundaries of the Oak Ridge facility. Before this dam was constructed, flows were regulated by Watts Bar Dam, which is located about 38 mi [61 km] downstream from the mouth of the Clinch River. Because of the presence of Melton Hill and Watts Bar dams, the hydrology of the Clinch River-Poplar Creek system is very complex. Average flows in Melton Branch, Whiteoak Creek, and the East Fork of Poplar Creek were 1,120, 4,320, and 21,680 gal/min (4,240, 16,350, and 82,060 L/min), respectively, for a period of record circa 1960. The average daily discharge below Melton Hill Dam was 2 million gal/min (129 m^3/s) for a 39-year period of record (Geraghty & Miller, Inc. 1989b).

The ETTP site contains a series of limited drainage basins through which small streams traverse and ultimately join with the Clinch River (DOE 1979). Poplar Creek (Figure 3.2-4) is one such stream; it receives drainage from an area of 136 mi^2 (352 km^2), including the northwestern sector of the site. The headwaters of the East Fork are collected in the vicinity of Y-12, where they receive treated wastewater in the form of cooling tower blowdown, waste stream condensate, and process cooling water. In the uplands around the site, surface runoff is

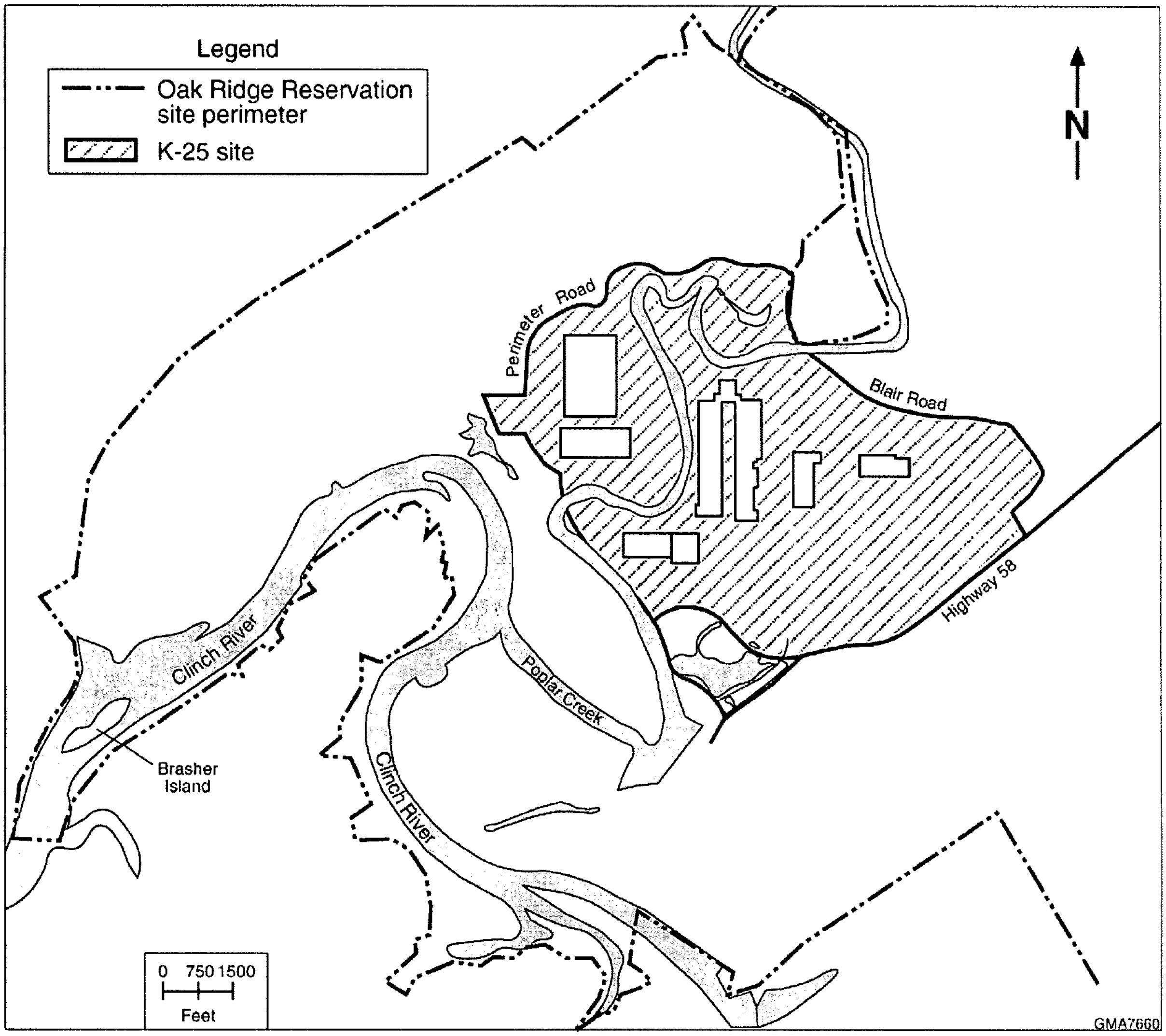

FIGURE 3.2-4 Surface Water Features in the Vicinity of ETTP

largely controlled by soil cover. Within the site, runoff is largely controlled by subsurface drains and diversion ditches. Annual precipitation is 54.8 in. (139 cm). In the vicinity of ETTP, most of the facilities are free from flood hazards for both the 100-year and 500-year maximum probable floods in Poplar Creek (Rothschild et al. 1984).

The ORR site takes water from the Clinch River for makeup cooling water for its reactors at a rate of approximately 20 million gal/d (76 million L/d). An additional 4 million gal/d (15 million L/d) is withdrawn for other process water. These withdrawals occur at Clinch River Miles 11.5 and 14.4. About 25% of this water is returned to the river as treated effluent or blowdown water. Average water consumption for ETTP in 1994 was 1,324 gal/min (5,011 L/min), equaling about 700 million gal (2.6 billion L) per year.

As of 2000, surface water was being monitored at seven locations at ETTP (DOE 2002e). In the last quarter of 1999, sampling at most monitoring stations was scaled back to a semiannual frequency. Uranium levels were well within permitted levels based on radiological standards. In most instances, results for nonradiological parameters were well within their applicable Tennessee water quality standards. Heavy metals were detected, but they were always well within applicable standards. In general, analytical results for samples collected upstream of ETTP were chemically similar to those collected downstream of the site, indicating that the site has little effect on chemical concentrations in surface water.

Sediment samples have also been collected at points that coincided with the ORR water sampling locations. The sediment samples were analyzed for uranium and other parameters. For 1994, the following maximum concentrations were measured: uranium, 43 mg/kg; mercury, 6 mg/kg; nickel, 89 mg/kg; and Aroclor 1254, 10 mg/kg (LMES 1996c).

3.2.5.2 Groundwater

Groundwater occurs in a surficial aquifer and in bedrock aquifers in the vicinity of ETTP. The surficial aquifer consists of man-made fill, alluvium, and the residuum of weathered bedrock (Geraghty & Miller, Inc. 1989b). The depth to unweathered bedrock varies from less than 10 to more than 50 ft (<3 to >15 m), depending on the characteristics of the underlying rocks.

Bedrock aquifers in the area are composed of Cambrian to Ordovician sandstones, siltstones, shales, dolostones, and limestones. The uppermost bedrock aquifer occurs in the Chickamauga Group. This formation disconformably overlies the Knox Dolostone and is the most extensive bedrock unit underlying the site. Shale beds restrict groundwater flow in the aquifer, resulting in concentrated flow along the limestone-shale contact, with resultant solution cavities.

The next-lower aquifer occurs in the Knox Group. It is composed of dolostone with interbeds of limestone. Solution features such as sinkholes and caverns are common and are an important route for groundwater flow. This unit is the principal aquifer on the site (Rothschild et al. 1984); the mean yield of wells and springs is about 268 gal/min (1,014 L/min).

As in the Knox Group, solution cavities in the Conasauga Group are an important controlling influence for groundwater flow. Because shale beds within the group are generally less transmissive, groundwater flow is concentrated in the limestone strata. In addition to solution features, folds and faults can also control flow in this unit (Rothschild et al. 1984). The oldest units in the area are the Shady Dolomite and Rome Formation. Groundwater in these units is largely controlled by fractures and vugs (Geraghty & Miller, Inc. 1989b).

During the late spring and summer of 1981, a series of tests to determine properties of the bedrock aquifers directly across the Clinch River from site K-770 were conducted (Geraghty & Miller, Inc. 1989b). Transmissivity values for the bedrock aquifers (Upper Rome Formation, Chickamauga and Knox Groups) ranged from 22 to 15,000 gal/d per foot (270 to 185,000 L/d per meter), with most values ranging from 22 to 6,000 gal/d per foot

(270 to 73,600 L/d per meter). Slug tests performed in the unconsolidated surficial aquifer indicated that the hydraulic conductivity ranged from 1×10^{-7} to 0.01 cm/s. Bedrock values ranged from 1×10^{-6} to 1×10^{-3} cm/s.

On May 29 and 30, 1991, water-level measurements were collected from 185 of 191 monitoring wells at the ETTP site (Geraghty & Miller, Inc. 1991). Inferred directions of groundwater flow are to the south and southwest toward Poplar Creek. Recharge to the groundwater system occurs from surface water bodies and precipitation.

Groundwater contamination is a significant problem on the site (Rothschild et al. 1984). The problem is compounded by use of land underlain by shallow groundwater (found in most of the valleys on the reservation) and by the presence of direct conduits to groundwater (e.g., solution features and fractures), which are common. Contamination is associated with waste disposal activities, buried pipelines, and accidental spills.

In 1994 and 1995, groundwater samples were collected from a network of between 200 and 225 monitoring wells at the site (LMES 1996b,c). The number of wells monitored was greatly decreased in 1996 as a result of the reorganization of the site into six watersheds and reduced monitoring requirements (LMES 1997b). In the 1994 and 1995 sampling conducted for the larger network of monitoring wells, the following substances were detected at levels exceeding their associated primary drinking water standards: antimony, arsenic, barium, cadmium, chromium (up to 0.741 mg/L), fluoride (only at two wells), lead, nickel (up to 0.626 mg/L), thallium (up to 0.021 mg/L), benzene (up to 6 μg/L), carbon tetrachloride, 1,1-dichloroethene (greater than 1,000 μg/L), chloroform, 1,2 dichloroethene (greater than 1,000 μg/L), methylene chloride, toluene (greater than 1,000 μg/L), 1,1,2-trichloro-1,2,2-trifluoroethane (greater than 1,000 μg/L), TCE (up to 11,000 μg/L), 1,1,1-trichloroethane (up to 140,000 μg/L), 1,1,2-trichloroethane, tetrachloroethene (up to 17 μg/L), vinyl chloride, gross alpha activity (up to 43 pCi/L), and gross beta activity (up to 6,770 pCi/L) (LMES 1996b,c). Aluminum, iron, and manganese also consistently exceeded secondary, non-health-based standards because of the natural geochemical nature of the groundwater underlying the site (LMES 1996b).

Data from the 2000 annual groundwater monitoring program showed that aluminum and lead exceeded maximum contaminant levels for groundwater at ETTP (DOE 2001f). Copper, iron, and zinc were also found at elevated concentrations, but maximum concentration limits (MCLs) are not available for these analytes.

Exit-pathway groundwater surveillance monitoring was conducted in 1994 and 1995 at convergence points where shallow groundwater flows from relatively large areas of the site and converges before discharging to surface water locations (LMES 1996b,c). The exit-pathway monitoring data are representative of maximum groundwater contamination levels at locations where the general public might possibly have access in the future. For 1994, monitoring indicated that thallium, bis(2-ethylhexyl)phthalate, and TCE were present in at least one exit-pathway well sample at concentrations exceeding primary drinking water standards (LMES 1996c). The following average concentrations of these constituents were measured: thallium, 0.007 mg/L; bis(2-ethylhexyl)phthalate, 0.169 mg/L; and TCE, 0.008 mg/L. Alpha activity and fluoride levels were also measured but did not exceed reference levels (average concentration was 4.4 pCi/L for alpha activity and 0.4 mg/L for fluoride). For 1995, monitoring indicated that no inorganic or organic substances exceeded primary drinking water standards; however, alpha activity exceeded the reference level in one well during the spring sampling event (level of 17 pCi/L) (LMES 1996b).

3.2.6 Biotic Resources

3.2.6.1 Vegetation

About 65% of the land within a 5-mi (8-km) radius of the ETTP site is forested, although most of the ETTP site consists of mowed grasses. Oak-hickory forest is the predominant community on ridges and dry slopes. Mixed pine forests or pine plantations, many of which are managed, have replaced former agricultural fields. Selective logging occurred over much of the site before 1986. Cedar barrens are small communities, primarily on shallow limestone soils, that support drought-tolerant species such as little bluestem, dropseed, eastern red cedar, and stunted oak. A cedar barrens across the Clinch River from the ETTP site may be the best example of this habitat in the state and has been designated as a State Natural Area.

3.2.6.2 Wildlife

The high diversity of habitats in the area supports many wildlife species. Ground-nesting species commonly occurring on the ETTP site include red fox, ruffed grouse, and eastern box turtle. Canada geese are also common in the ETTP area, and most are probably residents (ANL 1991a). Waterfowl, wading birds, and shorebirds are numerous along the Clinch River, in its backwaters, and in ponds. Two great blue heron rookeries are located north of the ETTP site on Poplar Creek (ANL 1991a). Species commonly associated with streams and ponds include muskrat, beaver, and several species of turtles and frogs.

The aquatic communities within the Clinch River and Poplar Creek support a high diversity of fish species and other aquatic fauna. Mitchell Branch supports fewer fish species, although the diversity of fish species has increased downstream of most ETTP discharges since 1990 (DOE 2002e; LMES 1996b).

3.2.6.3 Wetlands

Numerous wetlands occur in the vicinity of ETTP, including three small wetlands along Mitchell Branch (ANL 1991a). Extensive forested wetlands occur along Poplar Creek, East Fork Poplar Creek, Bear Creek, and their tributaries. Shallow water embayments of Melton Hill Reservoir and Watts Bar Reservoir support large areas of palustrine emergent wetlands with persistent vegetation. Forested wetlands occur along these marshy areas and extend into tributaries (DOE 1995).

3.2.6.4 Threatened and Endangered Species

No occurrence of state- or federal-listed threatened or endangered species on the ETTP site has been documented. State- and federal-listed species that occur on the ORR are presented in Table 3.2-6. Gray bats, which are federal and state listed as endangered, have been observed on ORR as transient individuals (DOE 2002e). The bald eagle, federal listed as threatened, is a winter visitor on the reservation (DOE 2001f). Bachman's sparrow, state listed as endangered, may be present on ORR, although it has not been observed recently (DOE 2002e). Suitable nesting habitat on the reservation includes open pine woods with shrubs and dense ground cover (ANL 1991a).

3.2.7 Public and Occupational Safety and Health

3.2.7.1 Radiation Environment

Radiation doses to the ETTP cylinder yard workers and to off-site members of the general public are summarized in Table 3.2-7. Exposure to airborne emissions from ETTP operations is approximately 13% of that from operations of the entire ORR. Radiation exposure of the general public MEI is estimated to be 6.7 mrem/yr. This dose is about 7% of the maximum dose limit of 100 mrem/yr set for the general public (DOE 1990) and much smaller than the average dose from natural background radiation in the State of Tennessee. The estimated dose of 6.7 mrem/yr for the MEI was based on the assumption that the off-site public would stay far away from the cylinder yards, which is the case under normal conditions. However, potential external exposure could occur and reach 100 mrem/yr if an off-site individual would spend more than 90 hours in a year immediately at the cylinder yard fence line.

Between 1991 and 1995, the average annual dose to cylinder yard workers ranged from 32 to 92 mrem/yr, which is less than 2% of the maximum radiation dose limit of 5,000 mrem/yr set for radiation workers (10 CFR Part 835). In 1998, 400 cylinders were repainted; the maximum worker exposure was 107 mrem/yr (Cain 2002b).

3.2.7.2 Chemical Environment

Table 3.2-8 gives the estimated hazard quotients for members of the general public under existing environmental conditions near the ETTP site. The hazard quotient represents a comparison of the estimated human intake level of a contaminant with an intake level below which adverse effects are very unlikely to occur. The estimated hazard quotients indicate that exposures to DUF_6-related contaminants in environmental media near the ETTP site are generally a small fraction of those that might be associated with adverse health effects. An exception is groundwater, for which the hazard quotient for fluoride could exceed the threshold of 1. However, it is highly unlikely that this groundwater would be used as a drinking water source.

OSHA has proposed PELs for uranium compounds and HF in the workplace (29 CFR Part 1910, Subpart Z, as of February 2003) as follows: 0.05 mg/m^3 for soluble uranium compounds, 0.25 mg/m^3 for insoluble uranium compounds, and 2.5 mg/m^3 for HF. ETTP worker exposures are kept below these limits.

3.2.8 Socioeconomics

Socioeconomic data for the ETTP site focus on an ROI comprising four Tennessee counties surrounding the site: Anderson, Knox, Loudon, and Roane. The counties included in the ROI were selected on the basis of the current residential locations of government workers directly involved in ETTP activities. The ROI is defined on the basis of the current residential locations of government workers directly connected to ETTP site activities and includes the area in which these workers spend much of their salaries. More than 90% of ETTP workers currently reside in these counties (Cain 2002b). Because the majority of ETTP workers live in Anderson and Knox Counties and in the City of Knoxville, the majority of impacts from ETTP would be expected to occur in these locations; therefore, the following discussions emphasize those areas.

3.2.8.1 Population

The population of the ROI in 2000 was 544,358 people (U.S. Bureau of the Census 2002a) and was expected to reach 565,000 by 2003 (Table 3.2-9). In 2000, 382,032 people (70% of the ROI total) resided in Knox County, 71,330 people resided in Anderson County, and 173,890 people resided in the city of Knoxville itself (U.S. Bureau of the Census 2002a). During

TABLE 3.2-9 Population in the ETTP Region of Influence and Tennessee in 1990, 2000, and 2003

Location	1990	2000	Growth Rate (%), 1990–2000[a]	2003[b] (Projected)
City of Knoxville	165,121	173,890	0.5	176,600
Knox County	335,749	382,032	1.3	397,100
Anderson County	68,250	71,330	0.4	72,300
Loudon County	31,255	39,086	2.3	41,800
Roane County	47,227	51,910	1.0	53,400
ROI total	482,481	544,358	1.2	564,600
Tennessee	4,877,185	5,689,283	1.6	5,958,000

[a] Average annual rate.

[b] ANL projections, as detailed in Appendix F.

Source: U.S. Bureau of the Census (2002a), except as noted.

the 1990s, each of the counties in the ROI and the city of Knoxville experienced moderate increases in population, with an ROI average growth of 1.2%. A slightly higher growth rate was experienced in Loudon County (2.3%), which had the smallest population in the ROI. Over the same period, the population in Tennessee grew at a rate of 1.6%.

3.2.8.2 Employment

Total employment in Knox County was 188,114 in 2000; it was projected to reach 199,400 by 2003. The economy of the county is dominated by the trade and service sectors; employment in those sectors currently contributes more than 75% of all employment in the county (Table 3.2-10). Employment growth in the highest growth sector, the service sector, was 7.1% during the 1990s, compared with 2.0% in the county for all sectors as a whole (U.S. Bureau of the Census 1992, 2002b).

Total employment in Anderson County was 39,797 in 2000; it was projected to reach 42,000 by 2003. The economy of the county is dominated by the manufacturing and service sectors, with employment in those sectors currently contributing more than 82% of all employment in the county (Table 3.2-11). Employment growth in the highest growth sector,

TABLE 3.2-10 Employment in Knox County by Industry in 1990 and 2000

Sector	No. of People Employed in 1990[a]	Percentage of County Total	No. of People Employed in 2000[b]	Percentage of County Total	Growth Rate (%), 1990–2000
Agriculture	2,010[c]	1.3	951[d]	0.5	-7.2[e]
Mining	775	0.5	315	0.2	-8.6
Construction	9,817	6.3	12,225	6.5	2.2
Manufacturing	22,720	14.7	16,912	9.0	-2.9
Transportation and public utilities	9,823	6.3	5,272	2.8	-6.0
Trade	52,258	33.7	41,951	22.3	-2.2
Finance, insurance, and real estate	7,228	4.7	10,668	5.7	4.0
Services	50,032	32.3	99,707	53.0	7.1
Total	154,968		188,114		2.0

[a] U.S. Bureau of the Census (1992).

[b] U.S. Bureau of the Census (2002b).

[c] These agricultural data are for 1992 and are taken from USDA (1994).

[d] These agricultural data are for 1997 and are taken from USDA (1999).

[e] Agricultural data are for 1992 and 1997.

TABLE 3.2-11 Employment in Anderson County by Industry in 1990 and 2000

Sector	No. of People Employed in 1990[a]	Percentage of County Total	No. of People Employed in 2000[b]	Percentage of County Total	Growth Rate (%), 1990–2000
Agriculture	577[c]	1.7	243[d]	0.6	-8.3[e]
Mining	293	0.9	60	0.2	-14.7
Construction	857	2.6	1,175	3.0	3.2
Manufacturing	11,634	34.9	10,523	26.4	-1.0
Transportation and public utilities	801	2.4	218	0.5	-12.2
Trade	5,236	15.7	4,200	10.6	-2.2
Finance, insurance, and real estate	829	2.5	1,058	2.7	2.5
Services	13,016	39.1	22,273	56.0	5.5
Total	33,299		39,797		1.8

a U.S. Bureau of the Census (1992).

b U.S. Bureau of the Census (2002b).

c These agricultural data are for 1992 and are taken from USDA (1994).

d These agricultural data are for 1997 and are taken from USDA (1999).

e Agricultural data are for 1992 and 1997.

services, was 5.5% during the 1990s, compared with 1.8% in the county for all sectors as a whole (U.S. Bureau of the Census 1992, 2002b).

Total employment in the ROI was 248,003 in 2000; it was projected to reach 262,600 by 2003. The economy of the ROI is dominated by the trade and service sectors; combined, they contribute 72% of all employment in the ROI (see Table 3.2-12). Employment growth in the highest growth sector, services, was almost 6.8% during the 1990s, compared with 1.9% in the ROI for all sectors as a whole (U.S. Bureau of the Census 1992, 2002b). Employment at the ETTP site currently stands at 1,740 (Cain 2002b).

Unemployment in the Knoxville Metropolitan Statistical Area was 2.8% in December 2002, slightly lower than the average rate during the 1990s (Table 3.2-13). Unemployment for the state was 4.1% in December 2002, which is also slightly lower than the average rates for the last 10 years.

TABLE 3.2-12 Employment in the ETTP Region of Influence by Industry in 1990 and 2000

Sector	No. of People Employed in 1990[a]	Percentage of ROI Total	No. of People Employed in 2000[b]	Percentage of ROI Total	Growth Rate (%), 1990–2000
Agriculture	4,528[c]	2.2	2,545[d]	1.0	-5.6[e]
Mining	1,138	0.6	407	0.2	-9.8
Construction	11,185	5.5	14,416	5.8	2.6
Manufacturing	39,633	19.3	32,706	13.2	-1.9
Transportation and public utilities	11,322	5.5	6,682	2.7	-5.1
Trade	61,583	30.1	50,387	20.3	-2.0
Finance, insurance, and real estate	8,851	4.3	12,357	5.0	3.4
Services	66,279	32.3	128,299	51.7	6.8
Total	204,922		248,003		1.9

[a] U.S. Bureau of the Census (1992).

[b] U.S. Bureau of the Census (2002b).

[c] These agricultural data are for 1992 and are taken from USDA (1994).

[d] These agricultural data are for 1997 and are taken from USDA (1999).

[e] Agricultural data are for 1992 and 1997.

3.2.8.3 Personal Income

Personal income in Knox County totaled about $11.3 billion in 2000 (in 2002 dollars) and was projected to reach $13.5 billion by 2003. The annual average rate of growth was 2.8% over the period 1990 through 2000 (Table 3.2-14). County per capita income also rose in the 1990s and was expected to reach $34,400 in 2003, compared with about $29,600 at the beginning of the period.

Personal income in Anderson County was almost $2 billion in 2000 (in 2002 dollars) and was expected to reach $2.2 billion by 2003. The annual average rate of growth was 1.9% over the period 1990 through 2000 (Table 3.2-14). County per capita income also rose in the 1990s and was expected to reach $31,100 in 2003, compared with about $27,200 at the beginning of the period.

TABLE 3.2-13 Unemployment Rate in the Knoxville Metropolitan Statistical Area and Tennessee

Location and Period	Rate (%)
Knoxville MSA[a]	
1992–2002 average	3.7
Dec. 2002 (current rate)	2.8
Tennessee	
1992–2002 average	4.6
Dec. 2002 (current rate)	4.1

[a] Knoxville Metropolitan Statistical Area (MSA) consists of Anderson, Blount, Knox, Loudon, Sevier, and Union Counties.

Source: BLS (2002).

TABLE 3.2-14 Personal Income in Knox and Anderson Counties and ETTP Region of Influence in 1990, 2000, and 2003

Location and Type of Income	1990	2000	Growth Rate (%), 1990–2000	2003 (Projected)[a]
Knox County				
Total personal income (millions of 2002 $)	8,790	11,308	2.8	13,500
Personal per capita income (2002 $)	26,180	29,599	1.4	34,400
Anderson County				
Total personal income (millions of 2002 $)	1,643	1,938	1.9	2,200
Personal per capita income (2002 $)	24,074	27,173	1.4	31,100
Total ROI				
Total personal income (millions of 2002 $)	12,118	15,516	2.8	18,500
Personal per capita income (2002 $)	25,115	28,503	1.4	33,000

[a] ANL projections, as detailed in Appendix F.

Source: U.S. Department of Commerce (2002).

Growth rates in total personal income in the ROI as a whole were the same as those for Knox County and slightly higher than those for Anderson County. Total personal income in the ROI grew at a rate of 2.8% over the period 1990 through 2000 and was expected to reach almost $18.5 billion by 2003. ROI per capita income was expected to grow from about $28,500 in 1990 to $33,000 by 2003, an average annual growth rate of 1.4%.

3.2.8.4 Housing

Housing stock in Knox County grew at an annual rate of 1.8% over the period 1990 through 2000 (Table 3.2-15) (U.S. Bureau of the Census 2002a), with 178,000 housing units expected by 2002, reflecting the growth in county population. Growth in the City of Knoxville during this period was 1.1%, with total housing units expected to reach 86,300 by 2003. During the 1990s, 27,900 new units were added to the existing housing stock in the county, with 8,528 of these units in the city of Knoxville in 2000. Vacancy rates in 2000 stood at 9.8% in the city and 7.9% in the county as a whole for all types of housing. On the basis of annual population growth rates, 14,900 housing units were expected to be vacant in the county in 2003, of which 4,800 were expected to be rental units.

Housing stock in Anderson County grew at an annual rate of 1.0% over the period 1990 to 2000 (Table 3.2-15) (U.S. Bureau of the Census 2002a), with total housing units expected to reach 33,500 in 2003, reflecting moderate growth in county population. Almost 3,130 new units were added to the existing housing stock in the county during the 1990s. Vacancy rates in 2000 stood at 8.2% in the county for all types of housing. On the basis of annual population growth rates, 2,900 housing units were expected to be vacant in the county in 2003, of which 800 were expected to be rental units.

Housing stock grew at a slightly slower rate in the ROI as a whole than it did in Knox County during the 1990s, with an overall growth rate of 1.7%. Total housing units were expected to reach 257,400 by 2003, with more than 38,300 housing units added in the 1990s. On the basis of vacancy rates in 2000, which stood at 8.1%, more than 6,400 rental units were expected to be available in 2003.

TABLE 3.2-15 Housing Characteristics in the City of Knoxville, Knox and Anderson Counties, and ETTP Region of Influence in 1990 and 2000

Location and Type of Unit	No. of Units	
	1990	2000
City of Knoxville		
Owner-occupied	34,892	39,208
Rental	35,081	37,442
Total unoccupied	6,480	8,331
Total	76,453	84,981
Knox County		
Owner-occupied	85,369	105,562
Rental	48,270	52,310
Total unoccupied	9,943	13,567
Total	143,582	171,439
Anderson County		
Owner-occupied	19,401	21,592
Rental	7,983	8,188
Total unoccupied	1,939	2,671
Total	29,323	32,451
ROI Total		
Owner-occupied	128,300	156,219
Rental	63,331	68,577
Total unoccupied	14,603	19,740
Total	206,234	244,536

Source: U.S. Bureau of the Census (2002a).

3.2.8.5 Community Resources

3.2.8.5.1 Community Fiscal Conditions. Construction and operation of the proposed facility might result in increased revenues and expenditures for local government jurisdictions, including counties, cities, and school districts. Revenues would come primarily from state and local sales tax revenues associated with employee spending during construction and operations, and they would be used to support additional local community services currently provided by each jurisdiction. Tables 1 and 2 of Allison (2002) present information on revenues and expenditures by the various local government jurisdictions in the ROI.

3.2.8.5.2 Community Public Services. Construction and operation of the proposed facility would result in increased demand for community services in the counties, cities, and school districts likely to host relocating construction workers and operations employees. Additional demands would also be placed on local medical facilities and physician services. Table 3.2-16 presents data on employment and levels of service (number of employees per 1,000 population) for public safety and general local government services, and Table 3.2-17 covers physicians. Tables 3.2-18 and 3.2-19 provide staffing data for school districts and hospitals.

TABLE 3.2-16 Public Service Employment in the City of Knoxville, Region-of-Influence Counties, and Tennessee in 2001

Employment Category	City of Knoxville		Knox County		Clinton	
	No. of Workers	Level of Service[a]	No. of Workers	Level of Service[a]	No. of Workers	Level of Service[a]
Police	429	2.5	495	2.3	24	2.5
Fire[b]	334	1.91.91	0	0.0	18	1.9
General	907	5.2	2,505	11.8	58	6.1
Total	1,670	9.6	3,000	14.1	100	10.6

Employment Category	Lake City		City of Oak Ridge		Anderson County		Tennessee[c]
	No. of Workers	Level of Service[a]	No. of Workers	Level of Service[a]	No. of Workers	Level of Service	Level of Service
Police	7	3.8	56	2.0	93	2.8	2.4
Fire[b]	3	1.6	42	1.5	0	0.0	1.1
General	19	10.2	256	9.3	336	10.2	39.1
Total	29	15.6	354	12.9	429	13.0	52.6

[a] Level of service represents the number of employees per 1,000 persons in each jurisdiction (U.S. Bureau of the Census 2002a).

[b] Volunteers not included.

[c] 2000 data.

Sources: City of Knoxville: Hatfield (2002); Knox County: Rodgers (2002), Parolari (2002); Clinton: Shootman (2002); Lake City: Hayden (2002); City of Oak Ridge: McGinnis (2002); Anderson County: Worthington (2002); Tennessee: U.S. Bureau of the Census (2002d).

TABLE 3.2-17 Number of Physicians in Knox and Anderson Counties and Tennessee in 1997

Employment Category	Knox County		Anderson County		Tennessee
	No.	Level of Service[a]	No.	Level of Service[a]	Level of Service[a]
Physicians	1,519	4.1	209	3.0	2.6

[a] Level of service represents the number of physicians per 1,000 persons in each jurisdiction.

Source: American Medical Association (1999).

TABLE 3.2-18 School District Data for Knox and Anderson Counties and Tennessee in 2001

	Knox County		Anderson County		Tennessee
Employment Category	No.	Student-to-Teacher Ratio[a]	No.	Student-to-Teacher Ratio[a]	Student-to-Teacher Ratio[a]
Teachers	3,380	15.4	488	12.5	15.8

[a] The number of students per teacher in each school district.

Source: Tennessee Department of Education (2001).

TABLE 3.2-19 Medical Facility Data for Knox and Anderson Counties in 1998

Hospital	No. of Staffed Beds	Occupancy Rate (%)[a]
Knox County		
Baptist Hospital of East Tennessee	316	66
East Tennessee Children's Hospital	103	67
County total	319	NA[b]
Anderson County		
Methodist Medical Center of Oak Ridge	250	72
Ridgeview Psychiatric Hospital and Center	20	35
County total	270	NA

[a] Percent of staffed beds occupied.

[b] NA = not available.

Source: Healthcare InfoSource, Inc. (1998).

3.2.9 Waste Management

The ETTP site generates industrial and sanitary waste, including wastewater, solid nonhazardous waste, solid and liquid hazardous waste, radioactive waste, and radioactive hazardous mixed waste. The ETTP site is an active participant in the waste minimization and recycling program within the ORR complex. Much of the waste generated at ETTP is from the ongoing environmental remediation efforts at the site. The ETTP site has the capability to treat wastewater and certain radioactive and hazardous wastes. Some of the wastes generated at ETTP can also be processed or disposed of at facilities located at the Y-12 Plant and ORNL. The ETTP facilities also store and process waste generated at Y-12 and ORNL and wastes from other DOE installations at Paducah, Portsmouth, and Fernald. Most radioactive waste at ETTP is contaminated with uranium and uranium decay products, with small amounts of fission products and TRU radionuclides from nuclear fuel recycling programs. Table 3.2-20 lists the ETTP site waste loads assumed for the analysis of impacts of projected activities in this report.

TABLE 3.2-20 Projected Waste Generation Volumes for ETTP[a]

Waste Category	Waste Treatment Volume (m^3/yr)
LLW	41,000
LLMW	2,700
TRU	0
Hazardous waste	350
Nonhazardous waste[b]	
Solids	12,000
Wastewater	47,000

[a] Volumes include operational and environmental restoration waste projected from FY 2002 to FY 2025. However, it is projected that the majority of the waste would be generated by FY 2008.

[b] Volumes include sanitary and industrial wastes.

Source: Cain (2002c).

3.2.9.1 Wastewater

Treated wastewater at the ETTP site is discharged under an NPDES Permit. Sanitary wastewater is processed at an on-site sewage treatment plant with a capacity of 0.92 million gal/d (3.5 million L/d).

3.2.9.2 Solid Nonhazardous, Nonradioactive Waste

About 35,000 yd^3/yr (27,500 m^3/yr) of solid nonhazardous waste is generated at ORR, which includes waste from the ETTP site. The waste is disposed of at the Y-12 landfill; it is projected that about 50% of the landfill's capacity, or about 920,000 yd^3 (700,000 m^3), would be available in the year 2020.

3.2.9.3 Nonradioactive Hazardous and Toxic Waste

The ETTP site generates both RCRA-hazardous and TSCA-hazardous waste. The site operates several RCRA hazardous waste treatment and storage facilities. The site also operates a permitted TSCA incinerator to treat hazardous and LLMW liquids contaminated with PCBs. The incinerator also processes PCB waste from other facilities at ORR and from off-site DOE installations.

3.2.9.4 Low-Level Radioactive Waste

Current ORR policy for newly generated LLW is to perform necessary packaging for direct shipment to appropriate on- and off-site treatment, storage, and disposal facilities. LLW that is not treated or disposed of at ORR is placed in storage, pending either treatment or disposal or both, at off-site facilities.

3.2.9.5 Low-Level Radioactive Mixed Waste

The majority of radioactive waste generated at ETTP is LLMW, which consists of two categories: (1) aqueous RCRA-hazardous radioactive waste contaminated with corrosives or metals and (2) organic liquids contaminated with PCBs.

Aqueous LLMW is treated on site, and resulting wastewaters are discharged to the NPDES-permitted discharges, which have a capacity of 450,000 yd^3/yr (340,000 m^3/yr). Organic LLMW liquids contaminated with PCBs are treated by the ETTP TSCA incinerator, which has a capacity of 1,800 yd^3/yr (1,400 m^3/yr).

ETTP has the capacity to treat approximately 6,500 yd^3/yr (5,000 m^3/yr) of liquid LLMW via grout stabilization. The site has the capacity to store 88,600 yd^3 (67,800 m^3) of LLMW containers.

3.2.10 Land Use

ETTP is located in east-central Tennessee, in the eastern part of Roane County about 25 mi (40 km) west of the City of Knoxville. An analysis of Landsat satellite imagery from 1992 shows that the dominant land cover categories in Roane County include deciduous forest (42.0%), mixed forest (19.7%), evergreen forest (13.6%), and pasture/hay (10.3%) (Figure 3.2-5). The 1997 agricultural census recorded 99 farms in Roane County, covering more than 53,100 acres (21,489 ha) (USDA 1999). Human settlement is sparse throughout much of the county, with most of the population residing in the communities of Harriman, Kingston, Oak Ridge, and Rockwood. The eastern third of Roane County, where ETTP is located, is dominated by deciduous and mixed forest and pasture.

The 1,700-acre (690-ha) ETTP site contains more than 300 buildings with a combined floor space of 13 million ft^2 (1.2 million m^2) (MMES 1994).

Land use at ETTP focuses on the reuse of facilities, equipment, materials, and utilities previously associated with the gaseous diffusion plant, with an emphasis on reindustralization (Bechtel Jacobs Company LLC 2002). Activities at the site include a range of operations associated with environmental management at the DOE Oak Ridge Operations facilities, such as management of the TSCA incinerator and the treatment, storage, and disposal of hazardous and radioactive waste (including DUF_6) (Operations Management International, Inc. 2002a). Currently, ETTP is home to two business centers: Heritage Center and Horizon Center. The Heritage Center encompasses 125 of the main buildings of the former gaseous diffusion facility, which are currently leased to more than 40 companies (Operations Management International, Inc. 2002b). The Horizon Center encompasses 1,000 acres (447 ha) of building sites aimed primarily at high-tech companies.

3.2.11 Cultural Resources

The ETTP site falls under the cultural resource management plan (CRMP) for ORR. That plan, which contains procedures for managing archaeological sites, historic structures, traditional cultural properties, and Native American sacred sites, was finalized in July 2001 (Souza et al. 2001). Under the plan, ETTP has responsibility for cultural resources at the eastern end of the reservation.

Cultural resource surveys at ORR have provided a considerable body of knowledge regarding the history and prehistory of the area. Archaeological evidence indicates that there has been a human presence at ORR for at least 12,000 years. All the major prehistoric Eastern Woodland archaeological periods are represented there: Paleo-Indian (10,000 B.C.–8,000 B.C.), Archaic (8,000 B.C.–900 B.C.), Woodland (900 B.C.–A.D. 900), and Mississippian (A.D. 900–A.D. 1600). While the ETTP area has not been completely surveyed, six prehistoric sites were identified there. Three of them were determined to be eligible for the *National Register of Historic Places* (NRHP). Five of the six sites lie outside the ETTP security fences. The area within the ETTP security fences underwent massive earthmoving operations during the construction of the gaseous diffusion plant. It is unlikely that unidentified intact archaeological sites remain within the fences (Morris 1998; Souza et al. 2001).

The Overhill Cherokee occupied part of eastern Tennessee from the 1700s until their relocation to Oklahoma in 1838. DOE Oak Ridge Operations has initiated consultations with the Eastern Band of the Cherokee Indians and the Cherokee Nation of Oklahoma regarding Native American issues related to the DUF_6 conversion project at ORR (see Appendix G). No religious or sacred sites, burial sites, or resources significant to the Cherokee have been identified at ETTP to date. However, there are mounds and other prehistoric sites at ORR thought likely to contain prehistoric burials. Similar resources could exist in the unsurveyed portions of the ETTP area (Souza et al. 2001).

Euro-American settlers began entering eastern Tennessee after 1798, and by 1804, settlement of the area that would become ORR in the 20th century had begun. An economy based on subsistence farming and, later, on coal mining developed. A survey of pre-World War II historic structures at ORR was conducted; 254 structures were evaluated, and 41 were recommended as being eligible for the NRHP, in addition to the 6 that were already listed (DuVall and Souza 1996). Two historic archaeological districts were proposed. Of these, the Wheat Community Historic District lies within the ETTP area. It includes 28 contributing structures; one (the George Jones Memorial Church) is already listed on the NRHP. The ETTP site also includes six historic cemeteries (Morris 1998; Souza et al. 2001).

In 1942, the U.S. Army began to acquire land in eastern Tennessee for the Manhattan Project's "Site X." Renamed the Clinton Engineer Works in 1943, the new facility included a gaseous diffusion plant at the K-25 Site. The K-25 Site played a significant role in the production of highly enriched uranium for weapons manufacture between 1944 and 1964, materially contributing to the development of nuclear weapons during World War II and the Cold War. The K-25 site forms the heart of ETTP. Buildings at the ETTP site were evaluated for their historical significance in 1994. One historic district, the Main Plant Historic District, is eligible for the NRHP. The district consists of 157 buildings, 120 of which contribute to the district (37 do not). Eleven additional buildings not adjacent to the district are also considered eligible by virtue of their supporting roles in the uranium-235 enrichment process (DuVall and Souza 1996; Holcombe-Burdette 1998; Souza et al. 2001).

3.2.12 Environmental Justice

3.2.12.1 Minority Populations

This EIS uses data from the most recent decennial census in 2000 to evaluate environmental justice implications of the proposed action and all alternatives with respect to minority populations. The CEQ guidelines on environmental justice recommend that "minority" be defined as members of American Indian or Alaska Native, Asian or Pacific Islander, Black non-Hispanic, and Hispanic populations (CEQ 1997). The earliest release of 2000 census data that included information necessary to identify minority populations identified individuals both according to race and Hispanic origin (U.S. Bureau of the Census 2001). It also identified individuals claiming multiple racial identities (up to six races). To remain consistent with the CEQ guidelines, the phrase "minority population" in this document refers to persons who identified themselves as partially or totally Black (including Black or Negro, African American, Afro-American, Black Puerto Rican, Jamaican, Nigerian, West Indian, or Haitian), American Indian or Alaska Native, Asian, Native Hawaiian or other Pacific Islander, or "Other Race." The minority category also includes White individuals of Hispanic origin, although the latter is technically an ethnic category. To avoid double counting, tabulations included only White Hispanics; the above racial groups already account for non-White Hispanics. In sum, then, the minority population considered under environmental justice consisted of all non-White persons (including those of multiple racial affiliations) plus White persons of Hispanic origin.

To identify census tracts with disproportionately high minority populations, this EIS uses the percentage of minorities in each state containing a given tract as the reference point. Using the individual states to identify disproportionality acknowledges that minority distributions in the state can differ from those found in the nation as a whole. In 2000, of the 240 census tracts within 50 mi (80 km) of the storage facility at ETTP, 19 had minority populations in excess of state-specified thresholds — a total of 24,235 minority persons in all (Figure 3.2-6). In 2000, 5.2% of the Roane County population was minority (U.S. Bureau of the Census 2002e).

3.2.12.2 Low-Income Populations

As recommended by the CEQ guidelines, the environmental justice analysis identifies low-income populations as those falling below the statistical poverty level identified annually by the U.S. Bureau of the Census in its Series P-60 documents on income and poverty. The Census Bureau defines poverty levels on the basis of a statistical threshold that considers for each family both overall family size and the number of related children younger than 18 years old.

For example, in 1999, the poverty threshold annual income for a family of three with one related child younger than 18 was $13,410, while the poverty threshold for a family of five with one related child younger than 18 was $21,024 (U.S. Bureau of the Census 2000). The 2000 census used 1999 thresholds because 1999 was the most recent year for which annual income data were available when the census was conducted. If a family fell below the poverty line for its particular composition, the census considered all individuals in that family to be below the poverty line.

To identify census tracts with disproportionately high low-income populations, this EIS uses the percentage of low-income persons in each state containing a given tract as a reference point. In 1999, of the 240 census tracts within 50 mi (80 km) of the storage facility at ETTP, 128 had low-income populations in excess of state-specified thresholds — a total of 157,843 low-income persons in all (Figure 3.2-7). In 1999, in Roane County, 13.9% of those individuals for whom poverty status was known were low-income (U.S. Bureau of the Census 2002e).

4 ENVIRONMENTAL IMPACT ASSESSMENT APPROACH, ASSUMPTIONS, AND METHODOLOGY

This EIS evaluates potential impacts on human health and the natural environment from building and operating a DUF_6 conversion facility at three alternative locations at the Portsmouth site and for a no action alternative. These impacts might be positive, in that they would improve conditions in the human or natural environment, or negative, in that they would cause a decline in those conditions. This chapter provides an overview of the methods used to estimate the potential impacts associated with the EIS alternatives, summarizes the major assumptions that formed the basis of the evaluation, and provides some background information on human health impacts. More detailed information on the assessment methods used to evaluate potential environmental impacts is provided in Appendix F.

4.1 GENERAL APPROACH

Potential environmental impacts were assessed by examining all of the activities required to implement each alternative, including construction of the required facility, operation of the facility, and transportation of materials between sites. Potential long-term impacts from cylinder breaches occurring at Portsmouth and ETTP were also estimated. For each alternative, potential impacts to workers, members of the general public, and the environment were estimated for both normal operations and for potential accidents.

The analysis for this EIS considered all potential areas of impact but emphasized those that might have a significant impact on human health or the environment, would be different under different alternatives, or would be of special interest to the public (such as potential radiation effects). The environmental characteristics of the Portsmouth site, where the conversion facility would be built and operated, are described in Section 3.1. The environmental setting of the ETTP site, where cylinders would be prepared for shipment to Portsmouth, is described in Section 3.2.

The estimates of potential environmental impacts for the proposed action were based on characteristics of the proposed UDS conversion facility. The two primary sources of information were excerpts from the UDS conversion facility conceptual design report (UDS 2003a) and the updated UDS NEPA data package (UDS 2003b). As noted in Section 2.2, current facility designs are at the 100% conceptual design stage. Several design options are considered in the EIS to provide future flexibility.

The NEPA data package (UDS 2003b) was prepared by UDS to support preparation of this EIS. For the proposed Portsmouth conversion facility, the NEPA data package includes facility descriptions, process descriptions and material flows, anticipated waste generation, anticipated air emissions, anticipated liquid effluents, waste minimization and pollution prevention approaches, anticipated water usage, anticipated energy consumption, anticipated materials usage, anticipated toxic or hazardous chemical storage, floodplain and wetland information, anticipated noise levels, estimated land use, employment needs, transportation needs, and safety analysis data.

The NEPA data and a variety of assessment tools and methods were used to evaluate the potential impacts that construction and operation of the conversion facility and shipment of the ETTP cylinders to Portsmouth would have on human health and the environment. These methods are described by technical discipline in Appendix F. The following sections summarize the major assessment assumptions and provide overview information on the estimation of human health impacts from radiation and chemical exposure.

4.2 MAJOR ASSUMPTIONS AND PARAMETERS

Table 4.2-1 gives the major assumptions and parameters that formed the basis of the analyses in this EIS. The primary source for UDS conversion facility data was the updated UDS NEPA data package (UDS 2003b). Discipline-specific information and technical assumptions are provided in the methods described in Appendix F.

4.3 METHODOLOGY

In general, the activities assessed in this EIS could affect workers, members of the general public, and the environment during construction of the new facility, during routine facility operations, during transportation, and during facility or transportation accidents. Activities could have adverse effects (e.g., human health impairment) or positive effects (e.g., regional socioeconomic benefits, such as the creation of jobs). Some impacts would result primarily from the unique characteristics of the uranium and other chemical compounds handled or generated under the alternatives. Other impacts would occur regardless of the types of materials involved, such as the impacts on air and water quality that can occur during any construction project and the vehicle-related impacts that can occur during transportation.

The areas of potential environmental impacts evaluated in this EIS are shown and described in Figure 4.3-1 (the order of presentation does not imply relative importance). For each area, different analytical methods were used to estimate the potential impacts from construction, operations, and accidents for each of the alternatives. The assessment methodologies are described in Appendix F.

Because of the chemical and radioactive nature of the materials being processed and produced, and the fact that the conversion facility would be built on a previously disturbed industrialized site, the potential impact to the health of workers and the public is one of the areas of primary concern in this EIS. Therefore, the following sections provide background information on radiation and chemical health effects and on the approach used to evaluate accidents. The information is presented to aid in the understanding and interpretation of the potential human health impacts presented in Chapters 2 and 5.

TABLE 4.2-1 Summary of Major EIS Data and Assumptions

Parameter/Characteristic	Data/Assumption
General	
Portsmouth DUF_6 cylinder inventory	16,109 cylinders; 195,800 t
Portsmouth non-DUF_6 cylinder inventory	2,693 cylinders: 13,500 t (14,900 tons)
ETTP DUF_6 cylinder inventory	4,822 cylinders; 54,300 t (60,000 tons)
ETTP non-DUF_6 cylinder inventory	1,102 cylinders; 26 t (29 tons)
No Action Alternative	No conversion facility constructed; continued long-term storage of DUF_6 in cylinders at Portsmouth and ETTP.
Assessment period	Through 2039, plus long-term groundwater impacts
Construction	None
Cylinder management	Continued surveillance and maintenance activities consistent with current plans and procedures.
Assumed total number of future cylinder breaches:	
Controlled-corrosion case	16 at Portsmouth; 7 at ETTP
Uncontrolled-corrosion case	74 at Portsmouth; 213 at ETTP
Action Alternatives	Build and operate a conversion facility at the Portsmouth site for conversion of the Portsmouth and ETTP DUF_6 inventories; construct a new cylinder storage yard at Portsmouth for ETTP cylinders.
Construction start	2004
Construction period	≈2 years
Start of operations	2006
Operational period	18 years (14 years if ETTP cylinders are converted at Paducah)
Facility footprint	10 acres (4 ha)
Facility throughput	13,500 t/yr (15,000 tons/yr) DUF_6
Conversion products	
Depleted U_3O_8	10,800 t/yr (11,800 tons/yr)
CaF_2	18 t/yr (20 tons/yr)
70% HF acid	2,500 t/yr (2,800 tons/yr)
49% HF acid	5,800 t/yr (6,300 tons/yr)
Steel (empty cylinders, if not used as disposal containers)	1,177 t/yr (1,300 tons/yr)
Proposed conversion product disposition (see Table 2.2-2 for details):	
Depleted U_3O_8	Disposal; Envirocare (primary), NTS (secondary)[a]
CaF_2	Disposal; Envirocare (primary), NTS (secondary)
70% HF acid	Sale pending DOE approval
49% HF acid	Sale pending DOE approval
Steel (empty cylinders, if not used as disposal containers)	Disposal; Envirocare (primary), NTS (secondary)

[a] DOE plans to decide the specific disposal location(s) for the depleted U_3O_8 conversion product after additional appropriate NEPA review. Accordingly, DOE will continue to evaluate its disposal options and will consider any further information or comments relevant to that decision. DOE will give a minimum 45-day notice before making the specific disposal decision and will provide any supplemental NEPA analysis for public review and comment.

Sources: UDS (2003a,b).

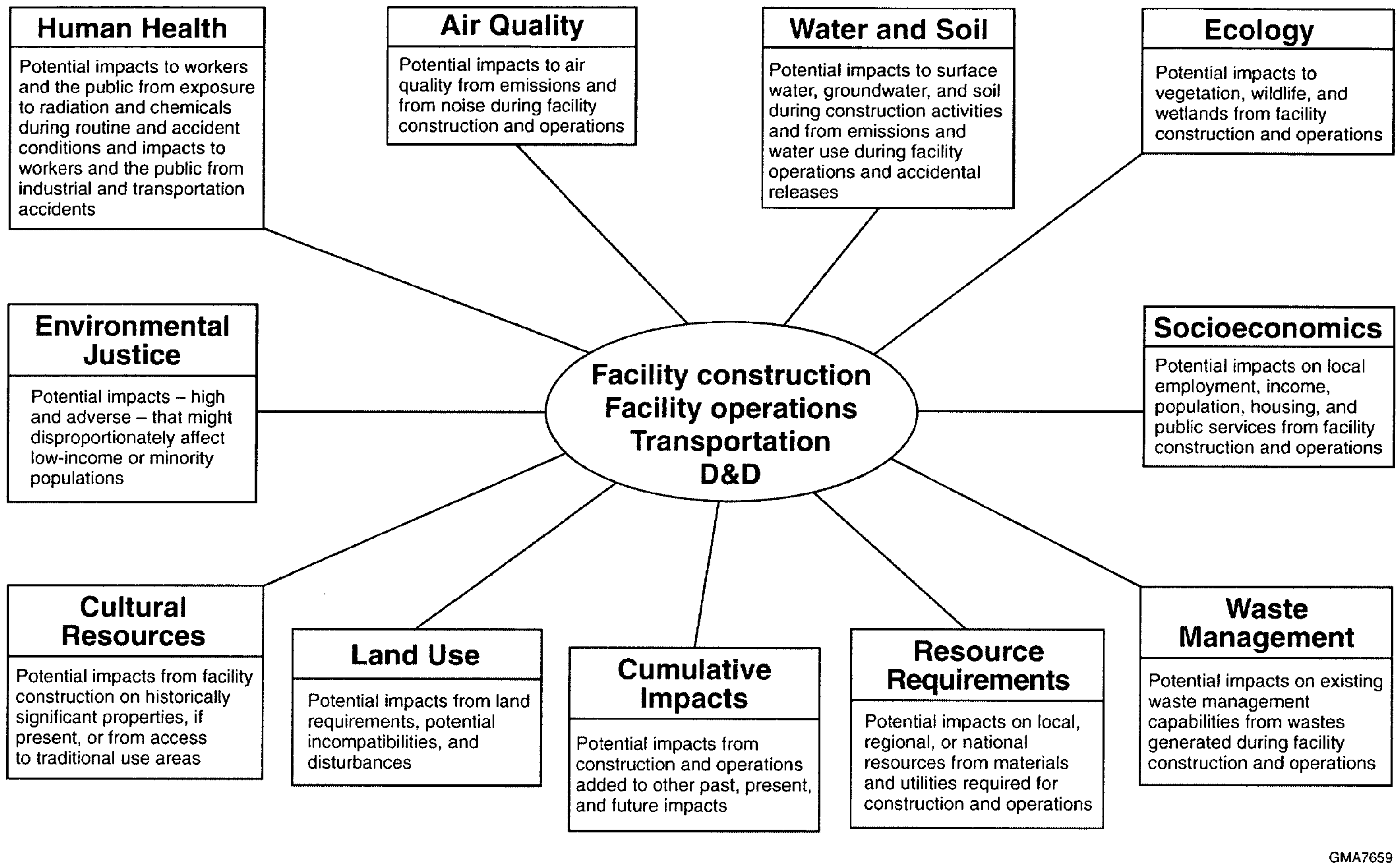

FIGURE 4.3-1 Areas of Potential Impact Evaluated for Each Alternative

4.3.1 Overview of the Human Health Assessment

Human health impacts were estimated for three types of potential exposures: exposure to radiation, exposure to chemicals, and exposure to physical hazards (e.g., on-the-job injuries or fatalities from falls, lifting, or equipment malfunctions). These potential human exposures could occur in and around facilities or during transportation of materials. Exposures could take place during incident-free (normal) operations or following accidents in the facilities or during transportation.

The nature of the potential impacts resulting from the three types of exposure differs. Table 4.3-1 lists and compares the key features of these types of exposures. Because of the differences in these features, it is not always appropriate to combine impacts from different exposures to get a total impact for a given human receptor.

4.3.2 Radiation

All of the alternatives would involve handling compounds of the element uranium, which is radioactive. Radiation, which occurs naturally, is released when one form of an element (an isotope) changes into some other atomic form. This process, called radioactive decay, occurs because unstable isotopes tend to transform into a more stable state. The radiation emitted may be in the form of particles, such as neutrons, alpha particles, or beta particles, or waves of pure energy, such as gamma rays.

The radiation released by radioactive materials (i.e., alpha, beta, neutron, and gamma radiation) can impart sufficient localized energy to living cells to cause cell damage. This damage may be repaired by the cell, the cell may die, or the cell may reproduce other altered cells, sometimes leading to the induction of cancer. An individual may be exposed to radiation from outside the body (called external exposure) or, if the radioactive material has entered the body through inhalation (breathing) or ingestion (swallowing), from inside the body (called internal exposure).

4.3.2.1 Background Radiation

Everyone is exposed to radiation on a daily basis, primarily from naturally occurring cosmic rays, radioactive elements in the soil, and radioactive elements incorporated in the body. Man-made sources of radiation, such as medical x-rays or fallout from historical nuclear weapons testing, also contribute, but to a lesser extent. About 80% of background radiation originates from naturally occurring sources, with the remaining 20% resulting from man-made sources.

The amount of exposure to radiation is commonly referred to as "dose." The estimation of radiation dose takes into account many factors, including the type of radiation exposure (neutron, alpha, gamma, or beta), the different effects each type of radiation has on living tissues,

TABLE 4.3-1 Key Features of Potential Human Exposures to Radiological, Chemical, and Physical Hazards

	Potential Exposures		
Feature	Radiological	Chemical	Physical Hazard
Materials of concern	Uranium and its compounds.	Uranium and its compounds, HF, and NH_3.	Physical hazards associated with all facilities and transportation conditions.
Health effects	Radiation-induced cancer incidence and potential fatalities would occur a considerable time after exposure (typically 10 to 50 years). The risks were assessed in terms of LCFs above background levels.	Adverse health effects (e.g., kidney damage and respiratory irritation or injury) could be immediate or could develop over time (typically less than 1 year).	Impacts would result from occurrences in the workplace or during transportation that were unrelated to the radiological and/or chemical nature of the materials being handled. Potential impacts would include bodily injury or death due to falls, lifting heavy objects, electrical fires, and traffic accidents.
Receptor	Generally the whole body of the receptor would be affected by external radiation, with internal organs affected by ingested or inhaled radioactive materials. Internal and external doses were combined to estimate the effective dose equivalent (see Appendix F).	Generally certain internal organs (e.g., kidneys and lungs) of the receptor would be affected.	Generally any part of the body of the receptor could be affected.
Threshold	No radiological threshold exists before the onset of impacts, i.e., any radiation exposure could result in a chance of LCFs. To show the significance of radiation exposures, the estimated number of LCFs is presented, and radiation doses are compared with existing regulatory limits.	A chemical threshold exposure level exists (different for each chemical) below which exposures are considered safe (see Section 4.3.3). Where exposures were calculated at below threshold levels, "no impacts" are reported.	No threshold exists for physical hazards. Impact estimates are based on the statistical occurrence of impacts in similar industries and on the amount of labor required.

the type of exposure (i.e., internal or external), and, for internal exposure, the fact that radioactive material may be retained in the body for long periods of time. The common unit for radiation dose that accounts for these factors is the rem (1 rem equals 1,000 mrem).

In the United States, the average dose from background radiation is about 360 mrem/yr per person, of which about 300 mrem is from natural sources. For perspective, the radiation doses resulting from a number of common activities are provided in Table 4.3-2. The total dose to an individual member of the general public from DOE and other federal activities is limited by law to 100 mrem/yr (in addition to background radiation), and the dose to a member of the public from airborne emissions released from DOE facilities must be below 10 mrem/yr (40 CFR Part 61).

4.3.2.2 Radiation Doses and Health Effects

Radiation exposure can cause a variety of adverse health effects in humans. Very large doses of radiation (about 450,000 mrem) delivered rapidly can cause death within days to weeks from tissue and organ damage. The potential adverse effect associated with the low doses typical of most environmental and occupational exposures is the inducement of cancers that may be fatal. This latter effect is called "latent" cancer fatality (LCF) because the cancer may take years to develop and cause death. In general, cancer caused by radiation is indistinguishable from cancer caused by other sources.

For this EIS, radiation effects were estimated by first calculating the radiation dose to workers and members of the general public from the anticipated activities required under each alternative. Doses were estimated for internal and external exposures that might occur during normal (or routine) operations and following hypothetical accidents. The analysis considered three groups of people: (1) involved workers, (2) noninvolved workers, and (3) members of the general public.

For each of these groups, doses were estimated for the group as a whole (population or collective dose). For noninvolved workers and the general public, doses were also estimated for a MEI. The MEI was defined as a hypothetical person who — because of proximity, activities, or living habits — could receive the highest possible dose. The MEI for noninvolved workers and members of the

Key Concepts in Estimating Risks from Radiation

The health effect of concern from exposure to radiation at levels typical of environmental and occupational exposures is the inducement of cancer. Radiation-induced cancers may take years to develop following exposure and are generally indistinguishable from cancers caused by other sources. Current radiation protection standards and practices are based on the premise that any radiation dose, no matter how small, can result in detrimental health effects (cancer) and that the number of effects produced is in direct proportion to the radiation dose. Therefore, doubling the radiation dose is assumed to result in doubling the number of induced cancers. This approach is called the "linear-no-threshold hypothesis" and is generally considered to result in conservative estimates (i.e., over-estimates) of the health effects from low doses of radiation.

TABLE 4.3-2 Comparison of Radiation Doses from Various Sources

Radiation Source	Dose to an Individual
Annual background radiation — U.S. average	
Total	360 mrem/yr
From natural sources (cosmic, terrestrial, radon)	300 mrem/yr
From man-made sources (medical, consumer products, fallout)	60 mrem/yr
Daily background radiation — U.S. average	1 mrem/d
Increase in cosmic radiation dose due to moving to a higher altitude, such as from Miami, Florida, to Denver, Colorado	25 mrem/yr
Chest x-ray	10 mrem
U.S. transcontinental flight (5 hours)	2.5 mrem
Dose from naturally occurring radioactive material in agricultural fertilizer — U.S. average	1 to 2 mrem/yr
Dose from standing 6 ft (2 m) from a full DUF_6 cylinder for 5 hours	1 mrem

Sources: National Council on Radiation Protection and Measurements (NCRP 1987).

general public usually was assumed to be at the location of the highest on-site or off-site air concentrations of contaminants, respectively — even if no individual actually worked or lived there. Under actual conditions, all radiation exposures and releases of radioactive material to the environment are required to be kept as low as reasonably achievable (ALARA), a practice that has as its objective the attainment of dose levels as far below applicable limits as possible.

Following estimation of the radiation dose, the number of potential LCFs was calculated by using health risk conversion factors. These factors relate the radiation dose to the potential number of expected LCFs on the basis of comprehensive studies of groups of people historically exposed to large doses of radiation, such as the Japanese atomic bomb survivors. The factors used for the analysis in this EIS were 0.0004 LCF/person-rem of exposure for workers and 0.0005 LCF/person-rem of exposure for members of the general public (International Commission on Radiological Protection [ICRP] 1991). The latter factor is slightly higher because some individuals in the public, such as infants, are more sensitive to radiation than the average worker. These factors imply that if a population of workers receives a total dose of 2,500 person-rem, on average, 1 additional LCF will occur among the workers. Similarly, if the general public receives a total dose of 2,000 person-rem, on average, 1 additional LCF will occur.

The calculation of human health effects from radiation is relatively straightforward. For example, assume the following situation:

- Each of 100,000 persons receives a radiation dose equal to background, or 360 mrem/yr (0.36 rem/yr), and

- The health risk conversion factor for the public is 0.0005 LCF/person-rem.

In this case, the number of radiation-induced LCFs caused by 1 year of exposure among the population would be 1 yr × 100,000 persons × 0.36 rem/yr × 0.0005 LCF/person-rem, or about 18 cancer cases, which would occur over the lifetimes of the individuals exposed. For perspective, in the same population of 100,000 persons, a total of about 23,000 (23%) would be expected to die of cancer from all causes over their lifetimes (Centers for Disease Control and Prevention 1996).

Sometimes the estimation of number of LCFs does not yield whole numbers and, especially in environmental applications, yields numbers less than 1. For example, if 100,000 persons were exposed to 1 mrem (0.001 rem) each, the estimated number of LCFs would be 0.05. The estimate of 0.05 LCF should be interpreted statistically — as the average number of deaths if the same radiation exposure was applied to many groups of 100,000 persons. In most groups, no one (zero persons) would incur an LCF from the 1-mrem exposure each person received. In some groups, 1 LCF would occur, and in exceptionally few groups, 2 or more LCFs would occur. The average number of deaths would be 0.05 (just as the average of 0, 0, 0, and 1 is 0.25). The result, 0.05 LCF, may also be interpreted as a 5% chance (1 in 20) of 1 radiation-induced LCF in the exposed population. In this EIS, fractional estimates of LCFs were rounded to the nearest whole number for purposes of comparison. Therefore, if a calculation yielded an estimate of 0.6 LCF, the outcome is presented as 1 LCF, the most likely outcome.

The same concept is assumed to apply to exposure of a single individual, such as the MEI. For example, the chance that an individual exposed to 360 mrem/yr (0.36 rem/yr) over a lifetime of 70 years would die from a radiation-induced cancer is about 0.01 (0.36 rem/yr × 0.0005 LCF/rem × 70 yr = 0.01 LCF). Again, this should be interpreted statistically; the estimated effect of radiation on this individual would be a 1% (1 in 100) increase in the chance of incurring an LCF over the individual's lifetime. In the EIS, the risk to individuals is generally presented as the increased chance that the individual exposed would die from a radiation-induced cancer. As noted, the baseline chance of dying from cancer in the United States is approximately 1 in 4.

4.3.3 Chemicals

For this EIS, the chemicals of greatest concern are soluble and insoluble uranium compounds, HF, and anhydrous NH_3. Uranium compounds can cause chemical toxicity to the kidneys; soluble compounds are more readily absorbed into the body and thus are more toxic to the kidneys. HF and NH_3 are corrosive gases that can cause respiratory irritation in humans, with tissue destruction or death resulting from exposure to large concentrations. Both have a pungent and irritating odor. No deaths are known to have occurred as a result of short-term (i.e., 1 hour or less) exposures to 50 ppm or less of HF, or 1,000 ppm or less of NH_3. Uranium compounds, HF, and NH_3 are not chemical carcinogens; thus, cancer risk calculations are not applicable for the chemical hazard assessment.

For long-term, low-level (chronic) exposures to uranium compounds and HF emitted during normal operations, potential adverse health effects for the hypothetical MEI in the noninvolved worker and general public populations were calculated by estimating the intake levels associated with anticipated activities. Intake levels were then compared with reference levels below which adverse effects are very unlikely. Risks from normal operations were quantified as hazard quotients and hazard indices (see text box).

Key Concepts in Estimating Risks from Low-Level Chemical Exposures

Reference Level

- Intake level of a chemical below which adverse effects are very unlikely.

Hazard Quotient

- A comparison of the estimated intake level or dose of a chemical with its reference dose.
- Expressed as a ratio of estimated intake level to reference dose.
- Example:
  - The EPA reference level (reference dose) for ingestion of soluble compounds of uranium is 0.003 mg/kg of body weight per day.
  - If a 150-lb (70-kg) person ingested 0.1 mg of soluble uranium per day, the daily rate would be $0.1 \div 70 \approx 0.001$ mg/kg, which is below the reference dose and thus unlikely to cause adverse health effects. This would yield a hazard quotient of $0.001 \div 0.003 = 0.33$.

Hazard Index

- Sum of the hazard quotients for all chemicals to which an individual is exposed.
- A value less than 1 indicates that the exposed person is unlikely to develop adverse human health effects.

4.3.4 Accidents

The EIS considers a range of potential accidents that could occur during conversion operations and transportation. An accident is defined as a series of unexpected or undesirable events leading to a release of radioactive or hazardous material within a facility or into the natural environment. Because an accident could involve a large and uncontrolled release, such an event potentially could pose considerable health risks to workers and members of the general public. Two important elements must be considered in the assessment of risks from accidents: the consequence of the accident and the expected frequency (or probability) of the accident.

4.3.4.1 Accident Consequences

The term accident consequence refers to the estimated impacts if an accident were to occur — including health effects such as fatalities. For accidents involving releases of radioactive material, the consequences are expressed in the same way as the consequences from routine operations — that is, LCFs are estimated for the MEI and for populations on the basis of estimated doses from all important exposure pathways.

Assessing the consequences of accidental releases of chemicals differs from assessing routine chemical exposures, primarily because the reference doses used to generate hazard indices for long-term, low-level exposures were not intended for use in the evaluation of the short-term (e.g., duration of several hours or less), higher-level exposures often accompanying accidents. In addition, the analysis of accidental releases often requires evaluation of different chemicals, especially irritant gases, which can cause tissue damage at higher levels associated with accidental releases but are not generally associated with adverse effects from chronic, low-level exposures.

To estimate the consequences of chemical accidents, two potential health effects endpoints were evaluated: (1) adverse effects and (2) irreversible adverse effects (see text box). In addition, the number of fatalities from accidental chemical exposures was estimated. For exposures to uranium and HF, it was estimated that the number of fatalities occurring would be about 1% of the number of irreversible adverse effects (EPA 1993; Policastro et al. 1997). Similarly, for exposure to NH_3, the number of fatalities was estimated to be about 2% of the number of irreversible adverse effects (Policastro et al. 1997).

Health Effects from Accidental Chemical Releases

The impacts from accidental chemical releases were estimated by determining the numbers of people downwind who might experience adverse effects and irreversible adverse effects:

Adverse Effects: Any adverse health effects from exposure to a chemical release, ranging from mild and transient effects, such as respiratory irritation or skin rash (associated with lower chemical concentrations), to irreversible (permanent) effects, including death or impaired organ function (associated with higher chemical concentrations).

Irreversible Adverse Effects: A subset of adverse effects, irreversible adverse effects are those that generally occur at higher concentrations and are permanent in nature. Irreversible effects may include death, impaired organ function (such as central nervous system or lung damage), and other effects that may impair everyday functions.

Human responses to chemicals do not occur at precise exposure levels but can extend over a wide range of concentrations. However, in this EIS, the values used to estimate the number of potential chemical effects should be applicable to most individuals in the general population. In all populations, there are hypersensitive individuals who will show adverse responses at exposure concentrations far below levels at which most individuals would normally respond (American Industrial Hygiene Association [AIHA] 2002). Similarly, many individuals will show no adverse response at exposure concentrations even somewhat higher than the guideline values. For comparative purposes in this EIS analysis, use of the guideline values discussed above allowed a uniform comparison of the impacts from potential accidental chemical releases across all alternatives.

4.3.4.2 Accident Frequencies

The expected frequency of an accident is the chance that the accident might occur while an operation is being conducted. If an accident is expected to happen once every 50 years, the frequency of occurrence is 0.02 per year: 1 occurrence every 50 years = 1 ÷ 50 = 0.02 occurrence per year. A frequency estimate can be converted to a probability statement. If the frequency of an accident is 0.02 per year, the probability of the accident occurring sometime during a 10-year program is 0.2 (10 years × 0.02 occurrence per year).

Accident Categories and Frequency Ranges

Likely (L): Accidents estimated to occur one or more times in 100 years of facility operations (frequency ≥ 1×10^{-2}/yr).

Unlikely (U): Accidents estimated to occur between once in 100 years and once in 10,000 years of facility operations (frequency = from 1×10^{-2}/yr to 1×10^{-4}/yr).

Extremely Unlikely (EU): Accidents estimated to occur between once in 10,000 years and once in 1 million years of facility operations (frequency = from 1×10^{-4}/yr to 1×10^{-6}/yr).

Incredible (I): Accidents estimated to occur less than one time in 1 million years of facility operations (frequency < 1×10^{-6}/yr).

The accidents evaluated in this EIS were anticipated to occur over a wide range of frequencies, from once every few years to less than once in 1 million years. In general, the more unlikely it would be for an accident to occur (the lower its probability), the greater the expected consequences. Accidents were evaluated for each activity required for four frequency categories: likely, unlikely, extremely unlikely, and incredible (see text box). To interpret the importance of a predicted accident, the analysis considered the estimated frequency of occurrence of that accident. Although the predicted consequences of an incredible accident might be high, the lower consequences of a likely accident (i.e., one much more likely to occur) might be considered more important.

4.3.4.3 Accident Risk

The term “accident risk” refers to a quantity that considers both the severity of an accident (consequence) and the probability that the accident will occur. Accident risk is calculated by multiplying the consequence of an accident by the accident frequency. For example, if the frequency of occurrence of a facility accident is estimated to be once in 100 years (0.01 per year) and if the estimated consequence, should the accident occur, is estimated to be 10 LCFs among the people exposed, then the risk of the accident would be reported as 0.1 LCF per year (0.01 per year × 10 LCFs). If the facility was operated for a period of 20 years, the accident risk over the operational phase of the facility would be 2 LCFs (20 years × 0.1 LCF per year).

This definition of accident risk was used to compare accidents that have different frequencies and consequences. Certain high-frequency accidents that have relatively low consequences might pose a larger overall risk than low-frequency accidents that have potentially high consequences. When calculating accident risk, the consequences are expressed in terms of

LCFs for radiological releases and in terms of adverse health effects, irreversible adverse health effects, and fatalities for chemical releases.

4.3.4.4 Physical Hazard (On-the-Job) Accidents

Physical hazards, unrelated to radiation or chemical exposures, were assessed for each alternative by estimating the number of on-the-job fatalities and injuries that could occur among workers. These impacts were calculated by using industry-specific statistics from the BLS. The injury incidence rates were for injuries involving lost workdays (excluding the day of injury). The analysis calculated the predicted number of worker fatalities and injuries as the product of the appropriate annual incidence rate, the number of years estimated for the project, and the number of full-time equivalents (FTEs) required for the project each year. Estimates for construction and operation of the facilities were computed separately because these activities have different incidence statistics. The calculation of fatalities and injuries from industrial accidents was based solely on historical industrywide statistics and therefore did not consider a threshold (i.e., any activity would result in some estimated risk of fatality and injury).

4.4 UNCERTAINTY IN ESTIMATED IMPACTS

Estimates of the environmental impacts from DUF_6 conversion are subject to considerable uncertainty. This uncertainty is a consequence primarily of characteristics of the methods used to estimate impacts. To account for this uncertainty, the impact assessment was designed to ensure — through uniform and careful selection of assumptions, models, and input parameters — that impacts would not be underestimated and that relative comparisons among the alternatives would be meaningful. This goal was accomplished by uniformly applying common assumptions to each alternative and by choosing assumptions that would produce conservative estimates of impacts (i.e., assumptions that would lead to overestimates of the expected impacts). Although using a uniform approach to assess impacts can still result in some uncertainty in estimates of the absolute magnitude of impacts, this approach enhances the ability to make valid comparisons among alternatives.

5 ENVIRONMENTAL IMPACTS OF ALTERNATIVES

This chapter discusses estimated potential impacts to the environment, including impacts to workers and members of the general public, under the no action alternative (Section 5.1) and the action alternatives (Section 5.2). The general assessment methodologies and major assumptions used to estimate the impacts are described in Chapter 4 and Appendix F of this EIS.

This EIS evaluates the proposed action, which is to construct and operate a conversion facility at the Portsmouth site for conversion of the Portsmouth and ETTP DUF_6 inventories into depleted uranium oxide and other conversion products. Three alternative locations at the site are evaluated, one of which has been selected as the preferred location. This EIS also discusses impacts from preparation of cylinders for shipment at ETTP and shipment of these cylinders to the Portsmouth site. Shipment of ETTP cylinders to Portsmouth is part of the proposed action, as is the construction of a new cylinder storage yard for those cylinders, if required.

Under the no action alternative, potential environmental impacts from continued storage and maintenance of the cylinders in their current locations at the Portsmouth and ETTP sites are evaluated primarily through the year 2039, although potential long-term impacts from releases of DUF_6 and HF from future cylinder breaches are also evaluated.

This chapter also discusses the potential cumulative impacts of the alternatives (Section 5.3), potential mitigation actions (Section 5.4), unavoidable adverse impacts of the alternatives (Section 5.5), irreversible and irretrievable commitment of resources (Section 5.6), the relationship between short-term use of the environment and long-term productivity (Section 5.7), pollution prevention and waste minimization (Section 5.8), and D&D of conversion facilities (Section 5.9).

5.1 NO ACTION ALTERNATIVE

5.1.1 Introduction

Under the no action alternative, it is assumed that storage of DUF_6 cylinders would continue indefinitely at the Portsmouth and ETTP sites and that DOE surveillance and maintenance activities would be ongoing to ensure the continued safe storage of cylinders. Potential environmental impacts from this alternative are estimated through 2039 in this EIS, and long-term impacts (i.e., those that would occur after 2039) from cylinder breaches are also estimated. A similarly defined no action alternative is evaluated in the DUF_6 PEIS (DOE 1999a). The assessment of the no

> **No Action Alternative**
>
> The no action alternative assumes that storage of the DUF_6 cylinders would continue for an indefinite period at the Portsmouth site, along with continued cylinder surveillance and maintenance. Impacts were evaluated through the year 2039, and potential long-term (beyond 2039) impacts were also evaluated.

action alternative in this EIS has been updated to reflect changes that have occurred since publication of the PEIS (e.g., changes in plans for new cylinder yard construction and changes in noninvolved worker and general population numbers).

A detailed discussion of the assumptions about and impacts from continued cylinder storage activities is included in Appendix D of the PEIS; changes in impacts due to the addition of USEC-generated cylinders are discussed in Section 6.3.1 of the PEIS (DOE 1999a). Updated information on ongoing and planned cylinder maintenance activities has been compiled from a database on the cylinders at the three sites and from life-cycle baseline documents for cylinder maintenance (Hightower 2002). This information was compiled prior to awarding the conversion contract to UDS and thus represents DOE's plans for long-term maintenance of cylinders without conversion, as would be the case under the no action alternative. In Section 5.1.1.1, the ongoing and planned cylinder maintenance activities assumed for the Portsmouth and ETTP sites under the no action alternative are reviewed.

Impacts associated with the following activities under the no action alternative are considered in both the PEIS and this EIS: (1) storage yard reconstruction and cylinder relocations, (2) routine and ultrasonic test inspections of cylinders and radiological monitoring and maintenance of the cylinder exteriors and valves, (3) cylinder painting, and (4) repair and removal of the contents of any cylinders that might be breached during the storage period. The frequencies for each activity assumed for the Portsmouth and ETTP sites in the PEIS are compared with planned future frequencies in Table 5.1-1. Overall, the assumptions in the PEIS result in the PEIS impacts bounding the actual impacts that could occur under current and planned future activities.

5.1.1.1 Cylinder Maintenance Activities

The PEIS assessment covered maintenance of up to 16,388 cylinders at the Portsmouth site and 4,683 cylinders at the ETTP site. The actual inventory of cylinders actively managed by DOE is changing over time as USEC transfers cylinders to DOE under three MOAs. As of January 2004, the DOE inventory at the Portsmouth site consisted of 16,109 full, partially full, and heels DUF_6 cylinders; the inventory at the ETTP site consisted of 4,822 full, partially full and heels DUF_6 cylinders (Hightower 2004). Maintenance efforts completed at the two sites include (1) reconstruction/upgrading of a yard at each site to provide stabilized concrete bases and monitored drainage for the cylinder storage areas, and (2) relocation of some cylinders that either were too close to one another to allow for adequate inspections or were located in yards that required reconstruction. Most required cylinder relocations have already been completed; few additional relocations would be required under the no action alternative.

Under the DOE-approved DUF_6 management plan (DOE 1996e), the stored cylinders are regularly inspected for evidence of damage or accelerated corrosion. Each cylinder must be inspected at least once every 4 years; however, annual inspections are required for cylinders that were previously stored in substandard conditions and those that show areas of heavy pitting or corrosion. In addition to these routine inspections, ultrasonic inspections are conducted on some

TABLE 5.1-1 No Action Alternative: Comparison of Frequencies Assumed in the PEIS with Planned Frequencies for Activities at the Portsmouth and ETTP Sites

Activity	Activity-Specific Assumption	PEIS-Assumed Average Annual Activity Frequency for Portsmouth[a]	Planned Average Annual Frequency for 2003–2007 for Portsmouth	PEIS-Assumed Average Annual Activity Frequency for ETTP	Planned Average Annual Frequency for 2003–2007 for ETTP
Routine cylinder inspections	30-min exposure at 1-ft (0.30-m) distance per inspection	5,900	7,000	3,400	3,900
Ultrasonic inspections	90-min exposure at about 2-ft (0.61-m) distance per inspection	165	150	70[b]	120
Radiological monitoring and valve maintenance	1-h exposure at 1-ft (0.30-m) distance per inspection	5	700	2	230
Cylinder relocations	4-h exposure at about 8-ft (2.44-m) distance per relocation	0	0	0	53[c]
Cylinder painting	7-h exposure at 1 to 10 ft (0.30 to 3.05 m) distance per cylinder, 2 gal (8 L) of paint used, 2 gal (8 L) of LLMW generated per cylinder	1,650	0	900	510[d]

[a] Source: Parks (1997), with the addition of the assumption that there would be an overall increase of 22% in Portsmouth activities to address the addition of USEC cylinders.

[b] Average for 1999 to 2008.

[c] Data for 2002.

[d] Average for 2000 to 2004, years for which data are available.

of the cylinders. The ultrasonic testing is a nondestructive method of measuring the thickness of cylinder walls. Radiological monitoring of the cylinder surface, especially around the valves, and maintenance are also conducted for cylinders that exhibit discoloration of the valve or surrounding area during routine inspections. Leaking valves are replaced in the field. Impacts from routine inspections, ultrasonic inspections, and radiological monitoring and valve maintenance are evaluated as components of the no action alternative. In the PEIS assessment, the assumed frequencies of routine inspections were somewhat underestimated (by 20% for Portsmouth and 15% for ETTP) in comparison with rates planned for the period 2003 to 2007 (see Table 5.1-1). Radiological monitoring and valve maintenance was underestimated by a factor of more than 100; however, this activity is of short duration, with little radiological exposure.

At the time the PEIS was prepared, a painting program was undertaken in an effort to arrest corrosion of the cylinders. Because the long-term painting schedule was unknown at the time, the PEIS assessment of the no action alternative assumed that as an upper bound, each cylinder would be painted every 10 years. However, after the PEIS was prepared, it was discovered that painting the cylinders increased toxicity indicators in cylinder yard runoff, such that NPDES Permit violations were occurring. Also, the ongoing rate of cylinder breaches was found to be much less than the rate that had been predicted on the basis of theoretical estimates of cylinder corrosion rates, indicating that the other steps that had been taken to improve storage conditions (e.g., regular inspections and relocating cylinders out of ground contact and onto concrete saddles in well-drained, concrete storage yards) were also effective in controlling corrosion. Therefore, continued cylinder maintenance plans call for a greatly reduced frequency of cylinder painting in comparison with the frequency that was assumed in the PEIS (for the Portsmouth site, no cylinder painting is planned; for the ETTP site, the PEIS-assumed painting schedule overestimated that currently planned by a factor of 1.8; see Table 5.1-1). The most frequent ongoing painting activity is partial painting of the ends of skirted cylinders, which are problem areas for corrosion.

The levels of worker activity, worker exposure, and waste generation associated with cylinder painting are much higher than the levels associated with inspection, relocation, and radiological monitoring and valve maintenance activities (Table 5.1-1). Therefore, because the PEIS assumed a high frequency of cylinder painting, its estimates of impacts in several technical areas (e.g., radiological exposures of involved workers, socioeconomics, waste management) represent an upper bound on the impacts that are expected under the current and planned future cylinder maintenance programs. For this EIS, the continued storage impacts for the Portsmouth and ETTP sites estimated in the PEIS were used as the basis for the no action alternative impacts. The data have been revised as appropriate (e.g., the worker and general population numbers have been updated). Under the no action alternative in this EIS, there would not be any additional cylinder yard construction or reconstruction at either the Portsmouth or the ETTP site. Therefore, for most technical areas, the continued storage impacts for the Portsmouth and ETTP sites estimated in the DUF_6 PEIS are presented in this EIS as the no action alternative impacts. Impacts for cylinder yard construction at the ETTP site, included in the PEIS, have been deleted.

5.1.1.2 Assumptions and Methods Used to Assess Impacts Associated with Cylinder Breaches

To estimate the impacts from continued cylinder storage, it is necessary to predict the number of cylinder breaches that might occur in the future. A cylinder is considered breached if it has a hole of any size at some location on the cylinder wall. At the time the PEIS was published (1999), 8 breached cylinders had been identified at the three storage sites; 3 of these were at the Portsmouth site, and 4 were at the ETTP site. Investigation of these breaches indicated that 6 of the 8 were initiated by mechanical damage during stacking; the damage was not noticed immediately, and subsequent corrosion occurred at the point of damage. It was concluded that the other 2 cylinder breaches (both at the ETTP site) had been caused by external corrosion due to prolonged ground contact. The breached cylinders were patched, pending decisions on long-term management. However, patched cylinders may eventually require emptying through cold-feeding (a lengthy process of heating a cylinder to a temperature just below the UF_6 liquefaction point so that the UF_6 changes directly from solid to gaseous form).

From 1998 through 2002, 1 additional breach was discovered at the ETTP site (Hightower 2002).[1] This breach was the result of handling damage. The breach rate over this time period was 0.2 per year (1 breach in 5 years). The breached cylinder was subsequently patched.

For assessment purposes in this EIS, 2 cylinder breach cases were evaluated. The first is a case in which it was assumed that the planned cylinder maintenance and painting program would maintain the cylinders in a protected condition and control further corrosion. It was assumed that after the initial painting, some cylinder breaches would result from handling damage. For this case, the number of future breaches estimated through 2039 was 16 for the Portsmouth site and 7 for the ETTP site. In the second case, it was assumed that external corrosion would not be halted by improved storage conditions, cylinder maintenance, and/or painting. This case was considered in order to account for uncertainties in both the effectiveness of painting in controlling cylinder corrosion and uncertainties in the future painting schedule. For this scenario, the number of breaches estimated through 2039 was 74 for the Portsmouth site and 213 for the ETTP site. These breach estimates are based on the historical corrosion rate determined when the cylinders were stored under poor conditions (i.e., cylinders were stacked too close together, were stacked on wooden chocks, or came in contact with the ground). Details concerning development of the breach estimates are provided in Appendix B of the PEIS (DOE 1999a).

The impacts to human health and safety, surface water, groundwater, soil, air quality, and ecology from uranium and HF releases from breached cylinders are assessed in this EIS. For all hypothetical cylinder breaches, it was assumed that the breach would go undetected for 4 years, which is the period between planned inspections for most of the cylinders. In practice, cylinders that show evidence of damage or heavy external corrosion are inspected annually, so it is very unlikely that a breach would go undetected for a 4-year period. For each hypothetical cylinder breach, it was further assumed that 1 lb (0.45 kg) of uranium (as UO_2F_2) and 4.4 lb (2 kg) of HF would be released from the cylinder annually for a period of 4 years. The DUF_6 Management Plan (DOE 1996e) outlines procedures to be taken in the event of a cylinder breach and/or release of DUF_6 from one or more cylinders.

Radiological exposures of involved workers could result from patching breached cylinders or emptying the contents of breached cylinders into new cylinders. The assumptions used to estimate impacts to involved workers were that (1) it would require 32 hours of exposure at a distance of 1 ft (0.30 m) to temporarily patch each cylinder, and (2) it would require an additional 961 hours of exposure at a distance of about 10 ft (3.05 m) to empty a cylinder by cold-feeding.

Groundwater impacts were assessed by first estimating the amount of uranium that could be transported from the yards in surface runoff, and then by estimating migration through the soil to groundwater. HF air concentrations were also modeled.

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[1] A breach that occurred at the ETTP site in 1998 was discussed in Section B.2 of the PEIS (DOE 1999a). A total of 11 breaches have been identified at the Portsmouth, ETTP, and Paducah sites (Hightower 2002).

The lower breach estimate for breaches due to cylinder handling is likely to be a reasonable upper-bound estimate of a breach rate that would occur during long-term continued storage under a no action alternative (e.g., the actual rate over the last 5 years was 0.2 breach per year; the model estimates 1 breach per year). Because storage conditions have improved dramatically as a result of cylinder yard upgrades and restacking activities over the last several years, the breach estimate based on the historical corrosion rate is likely a worst-case estimate of what could occur if DOE discontinued active management of the cylinders. In this assessment, the worst-case scenario is used to estimate the earliest time when continued cylinder storage could begin to raise regulatory concerns, such as when drinking water standards would be exceeded in groundwater or when air quality criteria would be exceeded (see Sections 5.1.2.3 and 5.1.2.4.2).

5.1.2 Impacts of No Action at the Portsmouth Site

The impacts described in this section are similar to those presented in Section 3.5.2 of the data compilation report for the Portsmouth site (Hartmann 1999a); however, they have been adjusted to account for changes in the numbers of noninvolved workers and general population since the time of that earlier assessment.

5.1.2.1 Human Health and Safety

Under the no action alternative, impacts to human health and safety could result from cylinder maintenance operations during both routine conditions and accidents. In general, the impacts during normal facility operations would be limited to workers directly involved in handling cylinders. Under accident conditions, the health and safety of both workers and members of the general public around the site could be affected.

5.1.2.1.1 Normal Facility Operations

Workers. Cylinders containing DUF_6 emit low levels of gamma and neutron radiation. Involved workers would be exposed to this radiation when working near cylinders, such as during routine cylinder monitoring and maintenance activities, cylinder relocation and painting, and patching or repairing of cylinders. It is estimated that an average of about 20 cylinder yard workers would be required at the Portsmouth site. These workers would be trained to function in a radiation environment, they would use protective equipment as necessary, and their radiation exposure levels would be measured and monitored by safety personnel at the sites. Radiation exposure of workers is required by law to be maintained ALARA and not to exceed 5,000 mrem/yr (10 CFR Part 835).

The radiation exposure of involved workers (cylinder yard workers) in future years through 2039 is estimated to be well within public health standards (10 CFR Part 835). If the same 20 workers conducted all cylinder management activities, the average annual dose to individual involved workers would be about 600 mrem/yr. Worker doses are required by health regulations to be maintained below 5,000 mrem/yr (10 CFR Part 835). The estimated doses do not account for standard ALARA practices that would be used to keep the actual doses as far below the limit as practicable. Thus, the future doses to workers are expected to be less than those estimated because of the conservatism in the assumptions and the models used to generate the estimates. In fact, in 2001, the average measured dose to cylinder yard workers at Portsmouth was about 64 mrem (DOE 2002c). The radiation exposure of the noninvolved workers was estimated to be less than 0.15 mrem/yr.

It is estimated that the total collective dose to all involved cylinder maintenance workers at the Portsmouth site from 1999 through 2039 would be about 460 person-rem. (The collective dose to noninvolved workers would be negligible [i.e., less than 0.01%], compared with the collective dose to involved workers.) This dose would be distributed among all of the workers involved with cylinder activities over the no action period. Although 20 workers would be required each year, the actual number of different individuals involved over the period would probably be much greater than 20 because workers could be rotated to different jobs and could change jobs. This level of exposure could potentially result in less than 1 LCF (i.e., 0.2 LCF) among all the workers exposed, in addition to the cancer cases that would result from all other causes not related to activities under the no action alternative.

As discussed in Chapter 1 and Appendix B of this EIS, some portion of the DUF_6 inventory contains TRU and Tc contamination. The contribution of these contaminants to potential external radiation exposures under normal operations was evaluated on the basis of the bounding concentrations presented in Appendix B. The dose from these contaminants was estimated and compared with the dose from the depleted uranium and uranium decay products in the DUF_6. It is estimated that under normal operational conditions, the TRU and Tc contaminants would make only a very small contribution to the radiation doses, amounting to approximately 0.2% of the dose from the depleted uranium and its decay products.

No impacts to involved workers are expected from exposure to chemicals during normal cylinder maintenance operations. Exposures to chemicals during cylinder painting operations would be monitored to ensure that airborne chemical concentrations were within applicable health standards that are protective of human health and safety. If planned work activities were likely to expose involved workers to chemicals, those workers would be provided with appropriate protective equipment as necessary.

Chemical exposures to noninvolved workers could result from airborne emissions of UO_2F_2 and HF that could be dispersed from hypothetical cylinder breaches into the atmosphere and to ground surfaces. It is estimated that the potential chemical exposures of noninvolved workers from any airborne releases during normal operations would be below levels expected to cause adverse effects. (The hazard index was estimated to be less than 0.0001 for noninvolved workers.)

General Public. Potential health impacts to members of the general public could occur if material released from breached cylinders entered the environment and was transported from the site through the air, surface water, or groundwater. Off-site releases of uranium and HF from breached cylinders are possible; however, the predicted future off-site concentrations of these contaminants would be much less than levels expected to cause adverse effects. Potential exposures of members of the general public would be well within public health standards. No adverse effects (LCFs or chemical effects) are expected to occur among members of the general public residing within 50 mi (80 km) of the Portsmouth site as a result of DUF_6 management activities.

If all the uranium and HF assumed to be released from hypothetical breached cylinders through 2039 were dispersed from the site through the air, the total radiation dose to the general public (all persons within 50 mi [80 km]) would be about 0.07 person-rem through 2039. This level of exposure would most likely result in zero cancer fatalities among members of the general public. For comparison, the average radiation dose from natural background and medical sources to the same population group in 40 years would be about 1×10^7 person-rem. The maximum radiation dose to an individual near the site would be less than about 0.1 mrem/yr, well within health standards. Radiation doses to the general public are required by health regulations to be maintained at below 10 mrem/yr from airborne sources (40 CFR Part 61) and below a total of 100 mrem/yr from all sources combined (DOE 1990). If an individual received the maximum estimated dose every year (1999 to 2039), the total dose would be about 4 mrem, resulting in an additional chance of dying from a latent cancer of about 1 in 500,000. No noncancer health effects from exposure to airborne uranium and HF releases are expected; the estimated hazard index for an MEI is less than 0.01. This means that the total exposure would be at least 100 times less than exposure levels that might cause adverse effects.

The material released from breached cylinders could also potentially be transported from the sites in water, either in surface water runoff or by infiltrating the soil and contaminating groundwater. Members of the general public could be exposed if they used this contaminated surface water or groundwater as a source of drinking water. The results of the surface water and groundwater analyses indicate that the maximum estimated uranium concentrations in surface water accessible to the general public and in groundwater beneath the sites would be less than 20 μg/L (the proposed EPA drinking water standard has now been finalized at 30 μg/L and became effective in December 2003 [EPA 2003a]). Drinking water standards, meant to apply to water "at the tap" of the user, are set at levels protective of human health. In this assessment, 20 μg/L is used as a guideline for surface water and groundwater analyses.

If a member of the general public used contaminated water at the maximum concentrations estimated, adverse effects would be unlikely. Even if a member of the general public used contaminated surface water or groundwater as his or her primary water source, the maximum radiation dose in the future would be less than 0.4 mrem/yr. The corresponding increased risk to this individual of dying from a latent cancer would be less than 1 in 5 million per year. Noncancer health effects from exposure to possible water contamination are not expected; the estimated maximum hazard index for an individual assumed to use the groundwater is less than 0.05. This means that the total exposure would be 20 times less than the exposure level that might cause adverse effects.

If no credit was taken for the reduction in cylinder corrosion rates as a result of cylinder maintenance and painting activities, the groundwater analysis indicates that the uranium concentration in groundwater at the Portsmouth site could exceed 20 µg/L at some time after 2100 (see Hartmann 1999a, Section 3.3). This scenario is highly unlikely because ongoing cylinder inspections and maintenance prevent significant releases from occurring, especially for as many cylinders as are assumed here (i.e., 74 breaches). Nonetheless, if contamination of groundwater used as drinking water occurred in the future, treating the water or supplying an alternative source of water might be required to ensure the safety of those potentially using the water.

5.1.2.1.2 Facility Accidents

Physical Hazards (On-the-Job Injuries and Fatalities). Accidents occur in all work environments. In 2000, about 5,200 people in the United States were killed in accidents while at work, and approximately 3.9 million disabling work-related injuries were reported (National Safety Council 2002). Although all work activities would be conducted in as safe a manner as possible, there is a chance that workers could be accidentally killed or injured under the no action alternative, unrelated to any radiation or chemical exposures.

The numbers of accidental worker injuries and fatalities that might occur through 2039 were estimated on the basis of the number of workers required and on the historical accident fatality and injury rates in similar types of industries. It is estimated that a total of less than 1 accidental fatality (i.e., about 0.03, or about 3 chances in 100 of a single fatality) might occur at the Portsmouth site over the no action period evaluated. Similarly, a total of about 40 accidental injuries (defined as injuries resulting in lost workdays) are estimated. These rates are not unique to the activities required for the no action alternative but are typical of any industrial project of similar size and scope.

Accidents Involving Radiation or Chemical Releases. Under the no action alternative, accidents could release radiation and chemicals from cylinders. Several types of accidents were evaluated. The accidents included those initiated by operational events, such as equipment or operator failure; external hazards; and natural phenomena, such as earthquakes. The assessment considered accidents ranging from those that would be reasonably likely to occur (expected one or more times in 100 years on average) to those that would be extremely rare (estimated to occur less than once in 1 million years on average).

The accidents of most concern at the Portsmouth site under the no action alternative would be those that could cause a release of UF_6 from cylinders. In a given accident, the amount potentially released would depend on the severity of the accident and the number of cylinders involved. Following a release, the UF_6 could combine with moisture in the air, forming gaseous HF and UO_2F_2, a soluble solid in the form of small particles. The depleted uranium and HF could be dispersed downwind, potentially exposing workers and members of the general public living near the site to radiation and chemical effects. The workers considered in the accident assessment were those noninvolved workers not immediately in the vicinity of the accident; fatalities and injuries among involved workers would be possible if accidents were severe.

The estimated consequences of cylinder accidents are summarized in Table 5.1-2 for chemical effects and Table 5.1-3 for radiation effects. The impacts are the maximums estimated for the Portsmouth site. The impacts are presented separately for likely accidents and for rare, low-probability accidents estimated to result in the largest potential impacts. Although other accidents were evaluated (see Hartmann 1999a; Section 3.2.2), the estimated consequences of those other accidents would be less than those summarized in the tables. The estimated consequences are conservative in that they were based on the assumption that at the time of the accident, the wind would be blowing in the direction of the greatest number of people. In addition, the mitigating effects of protective measures, such as evacuation, were not considered.

An exception to the discussion above would be a certain class of accidents that DOE investigated; however, because of security concerns, information about such accidents is not available for public review but is presented in a classified appendix to this EIS. All classified information will be presented to state and local officials, as appropriate.

Chemical Effects. The potential likely accident (defined as an accident that is estimated to occur one or more times in 100 years) that would cause the largest chemical health effects is the failure of a corroded cylinder that would spill part of its contents under dry weather conditions. Such an accident could occur, for example, during cylinder handling activities. It is estimated that about 24 lb (11 kg) of UF_6 could be released in such an accident. The potential consequences from this type of accident would affect only on-site workers. The off-site concentrations of HF and uranium were calculated to be less than the levels that would cause adverse effects from exposure to these chemicals. Therefore, no adverse effects are expected among members of the general public. It is estimated that if this accident did occur, up to 48 noninvolved workers might experience potential adverse effects from exposure to HF and uranium (mostly mild and transient effects, such as respiratory irritation or temporary decrease in kidney function). It is also estimated that no noninvolved workers would experience potential irreversible adverse effects (such as lung or kidney damage). The number of fatalities following an HF or uranium exposure is expected to be somewhat less than 1% of the number of potential irreversible adverse effects (Policastro et al. 1997). Therefore, no fatalities are expected.

For assessment purposes, the estimated frequency of a corroded cylinder spill accident is assumed to be about once in 10 years. Therefore, over the no action period, about 4 such accidents are expected. The accident risk (defined as consequence × probability) would be about 200 workers with potential adverse effects, and no workers with potential irreversible adverse effects. The number of workers actually experiencing adverse effects would probably be considerably less, depending on the actual circumstances of the accidents and the individual chemical sensitivity of the individual workers. In previous accidental exposure incidents involving liquid UF_6 in gaseous diffusion plants, a few workers were exposed to amounts of uranium estimated to be approximately three times the guidelines used for assessing irreversible adverse effects in this EIS; none of those workers actually experienced irreversible adverse effects (McGuire 1991).

TABLE 5.1-2 No Action Alternative: Estimated Consequences of Chemical Exposures for Cylinder Accidents at the Portsmouth Site[a]

Receptor[b]	Accident Scenario	Accident Frequency Category[c]	Potential Effect[d]	Consequence[e] (no. of persons affected)
Likely Accidents				
General public	Corroded cylinder spill, dry conditions	L	Adverse effects	0
	Corroded cylinder spill, dry conditions	L	Irreversible adverse effects	0
	Corroded cylinder spill, dry conditions	L	Fatalities	0
Noninvolved workers	Corroded cylinder spill, dry conditions	L	Adverse effects	0–48
	Corroded cylinder spill, dry conditions	L	Irreversible adverse effects	0
	Corroded cylinder spill, dry conditions	L	Fatalities	0
Low Frequency-High Consequence Accidents				
General public	Rupture of cylinders – fire	EU	Adverse effects	4–680
	Corroded cylinder spill, wet conditions – water pool	EU	Irreversible adverse effects	0–1
	Corroded cylinder spill, wet conditions – water pool	EU	Potential fatalities	0
Noninvolved workers	Rupture of cylinders – fire	EU	Adverse effects	160–1,000
	Corroded cylinder spill, wet conditions – water pool	EU	Irreversible adverse effects	0–110
	Corroded cylinder spill, wet conditions – water pool	EU	Fatalities	0–1

Footnotes on next page.

TABLE 5.1-2 (Cont.)

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[a] The accidents listed are those estimated to result in the greatest impacts among all the accidents considered (except for certain accidents with security concerns). The site-specific impacts for a range of accidents at the Portsmouth site are given in Hartmann et al. (1999a).

[b] Noninvolved workers are persons who work at the site but who are not involved in handling materials. Depending on the circumstances of the accident, injuries and fatalities among involved workers are possible for all accidents.

[c] Accident frequencies: L = likely, estimated to occur one or more times in 100 years of facility operations ($> 10^{-2}$/yr); EU = extremely unlikely, estimated to occur between once in 10,000 years and once in 1 million years of facility operations (10^{-4} to 10^{-6}/yr).

[d] Potential adverse effects include exposures that could result in mild and transient injury, such as respiratory irritation. Potential irreversible adverse effects include exposures that could result in permanent injury (e.g., impaired organ function) or death. The majority of the adverse effects would be mild and temporary in nature. It is estimated that less than 1% of the predicted potential irreversible adverse effects would result in fatalities (see text).

[e] The consequence is expressed as the number of individuals with a predicted exposure level sufficient to cause the corresponding health endpoint. The range of estimated consequences reflects different atmospheric conditions at the time of an accident assumed to occur at the cylinder yard closest to the site boundary. In general, maximum risks would occur under the atmospheric conditions of F stability with a 1-m/s (2-mph) wind speed; minimum risks would occur under D stability with a 4-m/s (9-mph) wind speed. For both conditions, it was assumed that the wind would be blowing in the direction of the highest density of worker or public populations.

Accidents that are less likely to occur could have higher consequences. The potential cylinder accident at any of the sites estimated to result in the greatest total number of adverse chemical effects would be an accident involving several cylinders in a fire. It is estimated that about 24,000 lb (11,000 kg) of UF_6 could be released in such an accident. It is estimated that if this accident occurred, up to 680 members of the general public and 1,000 noninvolved workers might experience adverse effects from HF and uranium exposure (mostly mild and transient effects, such as respiratory irritation or temporary decrease in kidney function). This accident is considered extremely unlikely, estimated to occur between once in 10,000 years and once in 1 million years. If the frequency is assumed to be once in 100,000 years, the accident risk over the no action period would be less than one adverse effect for both workers and members of the general public.

The potential cylinder accident estimated to result in the largest total number of irreversible adverse effects is a corroded cylinder spill under wet conditions, with the UF_6 being released into a pool of standing water. This accident is considered extremely unlikely, expected to occur between once in 10,000 years and once in 1 million years. It is estimated that if this accident did occur, about 1 member of the general public and 110 noninvolved workers might experience irreversible adverse effects (such as lung damage) from HF and uranium exposure. The number of fatalities would be somewhat less than 1% of the estimated number of potential irreversible adverse effects (Policastro et al. 1997). Thus, no fatalities are expected among the

TABLE 5.1-3 No Action Alternative: Estimated Consequences from Radiation Exposures for Cylinder Accidents at the Portsmouth Site[a]

			MEI		Population	
Receptor[b]	Accident Scenario	Accident Frequency Category[c]	Dose (rem)	Lifetime Risk of LCF	Dose (person-rem)	Number of LCFs
Likely Accidents						
General public	Corroded cylinder spill, dry conditions	L	0.0022	1×10^{-6}	0.22	0.0001
Noninvolved workers	Corroded cylinder spill, dry conditions	L	0.077	3×10^{-5}	2.2	0.0009
Low Frequency-High Consequence Accidents						
General public	Rupture of cylinders – fire	EU	0.013	6×10^{-6}	34	0.02
Noninvolved workers	Rupture of cylinders – fire	EU	0.02	8×10^{-6}	16	0.006

[a] The accidents listed are those estimated to have the greatest impacts among all the accidents considered (except for certain crash accidents with security concerns). The site-specific impacts for a range of accidents at the Portsmouth site are given in Hartmann et al. (1999a). The estimated consequences were based on the assumption that at the time of an accident, the wind would be blowing in the direction of the highest density of worker or public populations and that weather conditions limited dispersion.

[b] Noninvolved workers are persons who work at the site but who are not involved in handling materials. Depending on the circumstances of the accident, injuries and fatalities among involved workers are possible for all accidents.

[c] Accident frequencies: L = likely, estimated to occur one or more times in 100 years of facility operations ($> 10^{-2}$/yr); EU = extremely unlikely, estimated to occur between once in 10,000 years and once in 1 million years of facility operations (10^{-4} to 10^{-6}/yr).

general public, although 1 fatality could occur among noninvolved workers (1% of 110). If the frequency of this accident is assumed to be once in 100,000 years, the accident risk over the period 1999 through 2039 would be less than 1 (0.1) irreversible adverse health effect among workers and the general public combined.

Radiation Effects. Potential cylinder accidents could release uranium, which is radioactive in addition to being chemically toxic. The potential radiation exposures of members of the general public and noninvolved workers were estimated for the same cylinder accidents as those for which chemical effects were estimated (Table 5.1-3). For all cylinder accidents considered, the radiation doses from released uranium would be considerably below levels likely to cause radiation-induced effects among noninvolved workers and the general public and below the 25-rem total effective dose equivalent established by DOE as a guideline for assessing the adequacy of protection of public health and safety from potential accidents (DOE 2000c).

For the corroded cylinder spill accident (dry conditions), the radiation dose to a maximally exposed member of the general public would be less than 3 mrem (lifetime dose), resulting in an increased risk of death from cancer of about 1 in 1 million. The total population dose to the general public within 50 mi (80 km) would be less than 1 person-rem, most likely resulting in zero LCFs. Among noninvolved workers, the dose to an MEI would be 77 mrem, resulting in an increased risk of death from cancer of about 1 in 30,000. The total dose to all noninvolved workers would be about 2.2 person-rem. This dose to workers would result in zero LCFs. The risk (consequence × probability) of additional LCFs among members of the general public and workers combined would be much less than 1 over the period 1999 through 2039.

The cylinder accident estimated to result in the largest potential radiation doses would be the accident involving several cylinders in a fire. For this accident, it is estimated that the radiation dose to a maximally exposed member of the general public would be about 13 mrem, resulting in an increased risk of death from cancer of about 1 in 150,000. The total population dose to the general public within 50 mi (80 km) would be 34 person-rem, most likely resulting in zero LCFs. Among noninvolved workers, the dose to an MEI would be about 20 mrem, resulting in an increased risk of death from cancer of about 1 in 100,000. The total dose to all noninvolved workers would be about 16 person-rem. This dose to workers would result in zero LCFs. The risk (consequence × probability) of additional LCFs among members of the general public and workers combined would be much less than 1 over the period 1999 through 2039.

5.1.2.2 Transportation

Continued cylinder storage under the no action alternative would potentially generate small amounts of LLW and LLMW during cylinder monitoring and maintenance activities. This material could require transportation to a treatment or disposal facility. Shipments would be made in accordance with all DOE and DOT regulations and guidelines. It is estimated that less than one waste shipment would be required each year. Because of the small number of shipments and the low concentrations of contaminants expected, the potential environmental impacts from these shipments would be negligible.

5.1.2.3 Air Quality and Noise

The assessment of potential impacts to air quality from the no action alternative at Portsmouth included a consideration of air pollutant emissions from continued cylinder storage activities, including emissions from operations (cylinder painting and vehicle emissions) and HF emissions from breached cylinders. No cylinder yard construction activities are planned at the Portsmouth site. An atmospheric dispersion model was used to estimate the concentrations of criteria pollutants at the site boundaries: SO_2, NO_2, CO, O_3, PM (PM_{10} and $PM_{2.5}$), and Pb. The site boundary concentrations were compared with existing air quality standards given in Chapter 3. The air concentrations of all criteria pollutants resulting from no action alternative activities would be less than 1% of the respective standards.

Painting activities could generate hydrocarbon emissions. Although no explicit air quality standard has been set for hydrocarbon emissions, these emissions are associated with the formation of O_3, for which standards have been set. For the Portsmouth site, hydrocarbon emissions from painting activities would be about 0.2% of the hydrocarbon emissions from the entire surrounding county. Because O_3 formation is a regional issue affected by emissions for an entire area, this small additional contribution to the county total would be unlikely to substantially alter the O_3 levels of the county. In addition, the actual frequency of cylinder painting would likely be greatly reduced from the frequency assumed for these analyses.

Taking credit for reduced corrosion from better maintenance and painting, the estimated maximum 24-hour and annual average site boundary HF concentrations from hypothetical cylinder breaches occurring under the no action alternative are 0.12 $\mu g/m^3$ and 0.013 $\mu g/m^3$, respectively, at the Portsmouth site. Ohio does not have ambient air quality standards for HF. However, these estimated Portsmouth concentrations are well below the Commonwealth of Kentucky standards (used for comparison) of 2.9 $\mu g/m^3$ (secondary standard) and 400 $\mu g/m^3$ (primary standard), respectively. Calculations indicate that if no credit was taken for the reduction in corrosion as a result of painting and continued maintenance and if storage continued at the Portsmouth site indefinitely, breaches occurring at the site by around 2039 could result in maximum 24-hour average HF concentrations at the site boundaries of less than 0.8 $\mu g/m^3$, also considerably below the Kentucky secondary standard. Because of the ongoing maintenance program, it is not expected that this higher breach rate would occur at the Portsmouth site.

No construction activities are planned under the no action alternative at the Portsmouth site; therefore, there would be no adverse noise impacts.

Continued storage operations could result in somewhat increased noise levels at the site as a result of projected activities such as painting cylinders or repairing any infrequent cylinder breaches. However, it is estimated that the noise levels at off-site residences would not increase noticeably. Noise impacts are expected to be negligible under the no action alternative.

5.1.2.4 Water and Soil

Under the no action alternative, impacts on surface water, groundwater, and soil could occur during continued storage of the cylinders. Important elements in assessing potential impacts on surface water include changes in runoff, floodplain encroachment, and water quality. Groundwater impacts were assessed in terms of changes in recharge to the underlying aquifers, depth to groundwater, direction of groundwater flow, and groundwater quality. Potential soil impacts considered were changes in topography, permeability, erosion potential, and soil quality.

Under the no action alternative, the assessment area in which potentially important impacts might occur was determined to be quality of surface water, groundwater, and soil. The other potential impacts include changes in water use and effluent volumes. Maximum water use during continued cylinder maintenance operations at the site would be 73,000 gal/yr (276,000 L/yr).

A contaminant of concern for evaluating surface water, groundwater, and soil quality is uranium. Surface water and groundwater concentrations of contaminants are generally evaluated through comparison with the EPA MCLs, as given in Safe Drinking Water Act regulations (40 CFR Part 141), although these limits are only directly applicable "at the tap" of the water user. The water concentration value used for comparison in this EIS is 20 μg/L (i.e., the proposed MCL for uranium has now been finalized at 30 μg/L and will become effective in December 2003 [EPA 2003a]). The 20-μg/L value is used as a guideline for evaluating surface water and groundwater concentrations of uranium in this EIS, even though it is not directly applicable as a standard. There is no standard available for limiting concentrations of uranium in soil; a health-based value of 230 μg/g (EPA 1995), applicable for residential settings, is used as a guideline for comparison.

The nearest surface water to the Portsmouth site is Little Beaver Creek, which is a tributary to the Scioto River. The Scioto is used as a drinking water source. Because of very large dilution effects, even high levels of contaminants in Little Beaver Creek would not be expected to cause levels exceeding guidelines at the drinking water intakes of the Scioto River.

5.1.2.4.1 Surface Water. Potential impacts on the nearest receiving water at the site (Little Beaver Creek) were estimated for uranium released from hypothetical cylinder breaches occurring through 2039. The estimated maximum concentration of uranium in Little Beaver Creek would be 0.7 μg/L, considerably below the 20-μg/L level used for comparison.

Cylinder painting activities have been associated with increased toxicity in runoff at the Paducah site. If such an impact occurred at the Portsmouth site as a result of future cylinder painting, mitigating actions, such as treating runoff, might be required.

5.1.2.4.2 Groundwater. Groundwater in the vicinity of the Portsmouth site is used for domestic and industrial supplies. See Chapter 3 for a discussion of existing groundwater quality at the site. At Portsmouth, sampling results indicate that residential water supplies have not been affected by site operations. Activities associated with the no action alternative would not affect migration of existing groundwater contamination or impact off-site water supplies.

Potential impacts on groundwater quality from hypothetical releases of uranium from breached cylinders were also assessed. The maximum future concentration of uranium in groundwater directly below the Portsmouth site is estimated to be 5 μg/L, considerably below the 20-μg/L level used for comparison. It is estimated that if the rate of uranium migration was rapid, this concentration would occur sometime after 2070. A lower concentration would occur if uranium migration through the soil was slower than assumed for this analysis.

Calculations indicate that if no credit was taken for the reduction in corrosion as a result of cylinder painting and maintenance and if storage continued at the Portsmouth site indefinitely, uranium releases from future cylinder breaches occurring prior to about 2050 could result in a sufficient amount of uranium in the soil column to increase the groundwater concentration of uranium to 20 μg/L in the future (about 2100 or later). However, because of the ongoing maintenance program, it is not expected that breaches occurring prior to 2039 would be sufficient to increase the groundwater concentration to 20 μg/L at the site.

5.1.2.4.3 Soil. Potential impacts on soil that could receive contaminated rainwater runoff from the cylinder storage yards were estimated. The source is assumed to be uranium released from hypothetical breached cylinders. It is assumed that any releases from future cylinder painting activities would be controlled or treated to avoid soil contamination. The estimated maximum soil concentration is 1 μg/g for the Portsmouth site, considerably below the 230-μg/g guideline used for comparison.

5.1.2.5 Socioeconomics

The potential socioeconomic impacts of operational activities at the Portsmouth site under the no action alternative would be low. No construction activities are planned for this site under this alternative. Operational activities would create 20 direct jobs and 40 total jobs per year. During operations, direct and total income would be $0.8 million/yr and $1.0 million/yr, respectively.

The employment created in the ROI for the Portsmouth site during continued cylinder maintenance would represent a change of less than 0.1 of a percentage point in the projected annual average growth in employment over the period 2004 to 2039. No migration into the ROI would occur, meaning that there would be no impact expected on local housing markets, local public service employment, or local public finances.

5.1.2.6 Ecology

The no action alternative would have a negligible impact on ecological resources in the area of the Portsmouth site. Because no construction activities are planned, there would be no impacts on wetlands or on federal- and state-protected species.

The assessment results indicate that impacts to ecological resources from continued storage activities, including hypothetical cylinder breaches, would be negligible. Analysis of potential impacts was based on exposure of biota to airborne contaminants or contaminants released (e.g., from painting activities or from breached cylinders) to soil, groundwater, or surface water. Predicted concentrations of contaminants in environmental media were compared with benchmark values for toxic and radiological effects (see Appendix F). At the Portsmouth site, air, soil, and surface water concentrations would be below levels harmful to biota. However, as discussed in Section 5.1.2.4, cylinder painting activities may potentially result in future reductions in surface water quality and may consequently result in impacts to aquatic biota downstream of the cylinder storage yards. Although groundwater uranium concentrations (5 to 20 µg/L) would be below the lowest effects level (150 µg/L) and below radiological benchmark levels (4.55×10^3 pCi/L), they would exceed the ecological screening value for surface water (2.6 µg/L). However, contaminants in groundwater discharging to a surface water body, such as a local stream, would be quickly diluted to negligible concentrations.

5.1.2.7 Waste Management

Under the no action alternative, operations at the Portsmouth site would generate relatively small amounts of LLW and LLMW (including PCB-containing wastes). The volume of LLW generated by continued storage activities would represent less than 1% of the annual generation at the site from all activities. The maximum annual amount of LLMW generation from stripping/painting operations at the Portsmouth site would generate less than 1% of the site's total annual LLMW load, resulting in negligible waste management impacts for this site. The overall impact on waste management operations from the no action alternative would be negligible.

5.1.2.8 Resource Requirements

Operations under the no action alternative would use electricity, fuel, concrete, steel and other metals, and miscellaneous chemicals. The total quantities of commonly used materials would be small compared with local sources and would not affect local, regional, or national availability of these materials. No strategic or critical materials are expected to be consumed. The anticipated utilities requirements would be within the supply capacities at the Portsmouth site. The required material resources would be readily available.

5.1.2.9 Land Use

Because no new construction is planned for the Portsmouth site under the no action alternative, no impacts to land use are expected.

5.1.2.10 Cultural Resources

Impacts to cultural resources at the Portsmouth site would not be likely under the no action alternative. The existing storage yards would continue to be used for cylinder storage. These yards are located in previously disturbed areas (graded during the original construction of the yards) and are unlikely to contain cultural properties or resources listed on or eligible for the NRHP. No new or expanded cylinder storage yards are proposed at Portsmouth under this alternative. Cylinder breaches are not expected to result in HF or criteria pollutant emissions sufficient to impact cultural resources (see Section 5.1.2.3).

5.1.2.11 Environmental Justice

A review of the potential human health and safety impacts anticipated under the no action alternative indicates that no disproportionately high and adverse effects to minority or low-income populations are expected on or in the vicinity of the Portsmouth site during DUF_6 cylinder storage. Although such populations occur in certain areas within the 50-mi (80-km) radius used to identify the maximum geographic extent of human health impacts (see Section 3.1.12), no noteworthy impacts to these populations are anticipated. The results of accident analyses for the no action alternative also did not identify high and adverse impacts to the general public; the risk of accidents (consequence × probability) yields less than 1 fatality for all accidents considered.

5.1.3 ETTP Site

The impacts described in this section are similar to those presented in Section 3.2 of the data compilation report for the ETTP site (Hartmann 1999b); however, they have been adjusted to account for changes in planned activities. For example, no construction activities are currently planned for the ETTP site under the no action alternative.

5.1.3.1 Human Health and Safety

Potential impacts to human health and safety could result from operations during both routine conditions and accidents under the no action alternative. In general, the impacts during normal operations at the ETTP site would be limited to workers directly involved in handling cylinders. Under accident conditions, the health and safety of both workers and members of the general public around the site could potentially be affected.

5.1.3.1.1 Normal Facility Operations

Workers. Cylinders containing DUF_6 emit low levels of gamma and neutron radiation. Involved workers would be exposed to this radiation when working near cylinders, such as during routine cylinder monitoring and maintenance activities, cylinder relocation and painting, and cylinder patching or repairing activities. It is estimated that an average of about 13 cylinder yard workers would be required at the ETTP site. These workers would be trained to work in a radiation environment, they would use protective equipment as necessary, and their radiation exposure levels would be measured and monitored by safety personnel at the sites. Radiation exposure of workers is required by law to be maintained ALARA and not to exceed 5,000 mrem/yr (10 CFR Part 835).

The radiation exposure of involved workers (cylinder yard workers) in future years through 2039 is estimated to be well within public health standards (10 CFR Part 835). It is estimated conservatively that if the same 13 workers conducted all cylinder management activities, the average annual dose to individual involved workers would be about 410 mrem/yr. The estimated future doses do not account for standard ALARA practices that would be used to keep the actual doses as far below the limit as practicable. Thus, the future doses to workers are expected to be less than those estimated because of the conservatism incorporated into the assumptions and models used to generate the estimates. In fact, from 1990 through 1995, the average measured doses to cylinder yard workers at ETTP ranged from about 32 to 92 mrem/yr (Hodges 1996), and the maximum dose resulting from painting of 400 cylinders in 1998 was 107 mrem/yr (Cain 2002b). The radiation exposure of the noninvolved workers was estimated to be less than 0.048 mrem/yr.

It is estimated that the total collective dose to all involved workers at the ETTP site through 2039 would be about 200 person-rem. (The collective dose to noninvolved workers would be negligible [i.e., less than 0.01%] compared with the collective dose to involved workers.) This dose would be distributed among all of the workers involved with cylinder activities over the no action period. Although about 13 workers would be required each year, the actual number of different individuals involved over the period would probably be much greater than 13 because workers could be rotated to different jobs and could change jobs. This level of exposure could potentially result in less than 1 LCF (i.e., 0.1 LCF) among all the workers exposed, in addition to the cancer cases that would result from all other causes not related to activities under the no action alternative.

As discussed in Chapter 1 and Appendix B of this EIS, some portion of the DUF_6 inventory contains TRU and Tc contamination. The contribution of these contaminants to potential external radiation exposures under normal operations was evaluated on the basis of the bounding concentrations presented in Appendix B. The dose from these contaminants was estimated and compared with the dose from the depleted uranium and uranium decay products in the DUF_6. It is estimated that under typical cylinder maintenance conditions, the TRU and Tc contaminants would make only a very small contribution to the radiation doses, amounting to approximately 0.2% of the dose from the depleted uranium and its decay products.

No impacts to involved workers from exposure to chemicals during normal operations are expected. Exposures to chemicals during cylinder painting operations would be monitored to ensure that airborne chemical concentrations were within applicable health standards that are protective of human health and safety. If planned work activities were likely to expose involved workers to chemicals, the workers would be provided with appropriate protective equipment as necessary.

Chemical exposures to noninvolved workers could result from airborne emissions of UO_2F_2 and HF that would be dispersed from any cylinder breaches into the atmosphere and ground surfaces. The potential chemical exposures of noninvolved workers from any airborne releases during normal operations would be below levels expected to cause adverse effects. (The hazard index is estimated to be less than 0.1 for noninvolved workers.)

General Public. Potential health impacts to members of the general public could occur if material released from breached cylinders entered the environment and was transported from the site through the air, surface water, or groundwater. Off-site releases of uranium and HF from breached cylinders are possible. However, the predicted off-site concentrations of these contaminants in the future would be much less than levels expected to cause adverse effects. Potential exposures of members of the general public would be well within public health standards. No adverse effects (LCFs or chemical effects) are expected to occur among members of the general public residing within 50 mi (80 km) of the ETTP site from continued DUF_6 storage activities.

It is estimated that if all the uranium and HF assumed to be released from breached cylinders through 2039 was dispersed from the site through the air, the total radiation dose to the general public (all persons within 50 mi [80 km]) would be less than 0.2 person-rem through 2039. This level of exposure would most likely result in zero cancer fatalities among members of the general public. For comparison, the average radiation dose from natural background and medical sources to the same population group over 40 years would be about 1.3×10^7 person-rem. The maximum radiation dose to an individual near the site is estimated to be less than about 0.2 mrem/yr, well within health standards. Radiation doses to the general public are required by health regulations to be maintained below 10 mrem/yr from airborne sources (40 CFR Part 61) and below a total of 100 mrem/yr from all sources combined (DOE 1990). If an individual received the maximum estimated dose every year, the total dose would be about 8 mrem, resulting in an additional chance of dying from a latent cancer of about 1 in 250,000. No noncancer health effects from exposure to airborne uranium and HF releases are expected; the hazard index for an MEI is estimated to be less than 0.1. This means that the total exposure would be at least 10 times less than exposure levels that might cause adverse effects.

The material released from breached cylinders could also potentially be transported from the site in water, either in surface water runoff or by infiltrating the soil and contaminating groundwater. Members of the general public potentially could be exposed if they used this contaminated surface water or groundwater as a source of drinking water. The results of the surface water and groundwater analyses indicate that the maximum estimated uranium concentrations in surface water accessible to the general public and in groundwater beneath the site would be less than 20 μg/L (the EPA drinking water standard has now been finalized at 30 μg/L). Drinking water standards, meant to apply to water "at the tap" of the user, are set at levels protective of human health.

If a member of the public used contaminated water at the maximum concentrations estimated, adverse effects would be unlikely. Even if a member of the general public used contaminated surface water or groundwater as his or her primary water source, the maximum radiation dose in the future would be less than 0.5 mrem/yr. The corresponding risk to this individual of dying from a latent cancer would be less than 1 in 4 million per year. Noncancer health effects from exposure to possible water contamination are not expected; the estimated maximum hazard index for an individual assumed to use the groundwater is less than 0.05. This means that the total exposure would be 20 times less than the exposure that might cause adverse effects.

The groundwater analysis indicates that if no credit was taken for the reduction in cylinder corrosion rates as a result of cylinder maintenance and painting activities, the uranium concentration in groundwater at the ETTP site could exceed 20 μg/L at some time in the future (see Section 5.1.3.4.2). This scenario is highly unlikely because ongoing cylinder inspections and maintenance would prevent significant releases from occurring, especially for as many cylinders as are assumed here (i.e., 213 breaches). Nonetheless, if contamination of groundwater used as drinking water occurred in the future, treating the water or supplying an alternative source of water might be required to ensure the safety of those potentially using the water.

5.1.3.1.2 Facility Accidents

Physical Hazards (On-the-Job Injuries and Fatalities). Accidents occur in all work environments. In 2002, about 5,200 people in the United States were killed in accidents while at work, and approximately 3.9 million disabling work-related injuries were reported (National Safety Council 2002). Although all work activities would be conducted in as safe a manner as possible, there is a chance that workers could be accidentally killed or injured under the no action alternative, unrelated to any radiation or chemical exposures.

The numbers of accidental worker injuries and fatalities that might occur through 2039 were estimated on the basis of the number of workers required and on the historical accident fatality and injury rates in similar types of industries. It is estimated that a total of less than 1 accidental fatality (i.e., about 0.02, or about 2 chances in 100 of a single fatality) might occur at the ETTP site over the no action period evaluated. Similarly, a total of about 25 accidental injuries (defined as injuries resulting in lost workdays) are estimated. These rates are not unique to the activities required for the no action alternative but are typical of any industrial project of similar size and scope.

Accidents Involving Radiation or Chemical Releases. Accidents that could release radiation and chemicals from cylinders are possible under the no action alternative. Several types of accidents were evaluated, including those initiated by operational events, such as equipment or operator failure; external hazards; and natural phenomena, such as earthquakes. The assessment considered accidents ranging from those that would be reasonably likely to occur (estimated to occur one or more times in 100 years on average) to those that would be extremely rare (estimated to occur less than once in 1 million years on average). A listing of the cylinder accidents considered during storage is provided in the PEIS (DOE 1999a).

The accidents of most concern at the ETTP site would be accidents that could cause a release of UF_6 from cylinders. In a given accident, the amount potentially released would depend on the severity of the accident and the number of cylinders involved. Following a release, the UF_6 could combine with moisture in the air, forming gaseous HF and UO_2F_2, a soluble solid in the form of small particles. The depleted uranium and HF could be dispersed downwind, potentially exposing workers and members of the general public living near the site to radiation and chemical effects. The workers considered in the accident assessment were those noninvolved workers not immediately in the vicinity of the accident. Fatalities and injuries among involved workers would be possible if accidents were severe.

The estimated consequences of cylinder accidents are summarized in Table 5.1-4 for chemical effects and Table 5.1-5 for radiation effects. The impacts shown are the maximums estimated for the ETTP site. The impacts are presented separately for likely accidents and for rare, low-probability accidents estimated to result in the largest potential impacts. Although other accidents were evaluated (see Hartmann 1999b, Section 3.2.2), the estimated consequences of those other accidents would be less than the consequences of the accidents summarized in the tables. The estimated consequences are conservative in that they were based on the assumptions that at the time of the accident, the wind would be blowing in the direction of the greatest number of people. In addition, the effects of protective measures, such as evacuation, were not considered.

An exception to the discussion above would be a certain class of accidents that DOE investigated; however, because of security concerns, information about such accidents is not available for public review but is presented in a classified appendix to this EIS. All classified information will be presented to state and local officials, as appropriate.

Chemical Effects. The potential likely accident (defined as an accident that is estimated to occur one or more times in 100 years) that would cause the largest chemical health effects is the failure of a corroded cylinder, spilling part of its contents under dry weather conditions. Such an accident could occur, for example, during cylinder handling activities. It is estimated that about 24 lb (11 kg) of DUF_6 could be released in such an accident. The potential consequences from this type of accident would be limited to on-site workers. The off-site concentrations of HF and uranium were calculated to be less than the levels that would cause adverse effects from exposure to these chemicals, so that no adverse effects would occur among members of the general public. It is estimated that if such an accident did occur, up to 70 noninvolved workers might experience potential adverse effects from exposure to HF and uranium (mostly mild and transient effects, such as respiratory irritation or temporary decrease in kidney function). It is estimated that three noninvolved workers might experience potential irreversible adverse effects (such as lung or kidney damage). The number of fatalities following an HF or uranium exposure is expected to be somewhat less than 1% of the number of potential irreversible adverse effects (Policastro et al. 1997). Therefore, no fatalities are expected.

For assessment purposes, the estimated frequency of a corroded cylinder spill accident is assumed to be about once in 10 years. Therefore, over the no action period, about 4 such accidents are expected. The accident risk (defined as consequence × probability) would be about 280 workers with potential adverse effects and 12 workers with potential irreversible adverse effects. The number of workers actually experiencing these effects would probably be considerably less, depending on the actual circumstances of the accidents and the individual chemical sensitivity of the workers. In previous accidental exposure incidents involving liquid UF_6 in gaseous diffusion plants, a few workers were exposed to amounts of uranium estimated to be approximately three times the guidelines used for assessing irreversible adverse effects in this EIS, and none actually experienced irreversible adverse effects (McGuire 1991).

TABLE 5.1-4 No Action Alternative: Estimated Consequences of Chemical Exposures from Cylinder Accidents at the ETTP Site[a]

Receptor[b]	Accident Scenario	Accident Frequency Category[c]	Potential Effect[d]	Consequence[e] (no. of persons affected)
Likely Accidents				
General public	Corroded cylinder spill, dry conditions	L	Adverse effects	0
	Corroded cylinder spill, dry conditions	L	Irreversible adverse effects	0
	Corroded cylinder spill, dry conditions	L	Fatalities	0
Noninvolved workers	Corroded cylinder spill, dry conditions	L	Adverse effects	0–70
	Corroded cylinder spill, dry conditions	L	Irreversible adverse effects	0–3
	Corroded cylinder spill, dry conditions	L	Fatalities	0
Low Frequency-High Consequence Accidents				
General public	Rupture of cylinders – fire	EU	Adverse effects	14–620
	Corroded cylinder spill, wet conditions – water pool	EU	Irreversible adverse effects	0
	Corroded cylinder spill, wet conditions – water pool	EU	Fatalities	0
Noninvolved workers	Rupture of cylinders – fire	EU	Adverse effects	0–770
	Corroded cylinder spill, wet conditions – rain	EU	Irreversible adverse effects	2–140
	Corroded cylinder spill, wet conditions – rain	EU	Fatalities	0–1

Footnotes on next page.

TABLE 5.1-4 (Cont.)

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[a] The accidents listed are those estimated to result in the greatest impacts among all the accidents considered (except for certain accidents with security concerns). The site-specific impacts for a range of accidents at ETTP are given in Hartmann et al. (1999b).

[b] Noninvolved workers are persons who work at the site but who are not involved in handling materials. Depending on the circumstances of the accident, injuries and fatalities among involved workers are possible for all accidents.

[c] Accident frequencies: L = likely, estimated to occur one or more times in 100 years of facility operations ($> 10^{-2}$/yr); EU = extremely unlikely, estimated to occur between once in 10,000 years and once in 1 million years of facility operations (10^{-4} to 10^{-6}/yr).

[d] Potential adverse effects include exposures that could result in mild and transient injury, such as respiratory irritation. Potential irreversible adverse effects include exposures that could result in permanent injury (e.g., impaired organ function) or death. The majority of the adverse effects would be mild and temporary in nature. It is estimated that less than 1% of the predicted potential irreversible adverse effects would result in fatalities (see text).

[e] The consequence is expressed as the number of individuals with a predicted exposure level sufficient to cause the corresponding health endpoint. The range of consequences reflects different atmospheric conditions at the time of an accident assumed to occur at the cylinder yard closest to the site boundary. In general, maximum risks would occur under the atmospheric conditions of a 1-m/s (2-mph) wind speed; minimum risks would occur under D stability with a 4-m/s (9-mph) wind speed. For both conditions, it was assumed that the wind would be blowing in the direction with the highest density of worker or public populations.

Accidents that are less likely to occur could have higher consequences. The potential cylinder accident at any of the sites estimated to result in the greatest total number of adverse chemical effects would be an accident involving several cylinders in a fire. It is estimated that if this accident occurred, up to 635 members of the general public and 770 noninvolved workers might experience adverse effects from HF and uranium exposure (mostly mild and transient effects, such as respiratory irritation or temporary decrease in kidney function). This accident is considered extremely unlikely, estimated to occur between once in 10,000 years and once in 1 million years. If the frequency is assumed to be once in 100,000 years, the accident risk over the no action period would be less than 1 adverse effect for both workers and members of the general public.

The potential cylinder accident estimated to result in the largest total number of irreversible adverse effects is a corroded cylinder spill under wet conditions, for which the UF_6 is assumed to be released into a pool of standing water. This accident is also considered extremely unlikely, expected to occur only between once in 10,000 years and once in 1 million years. It is estimated that if this accident did occur, no members of the general public but about 140 noninvolved workers might experience irreversible adverse effects (such as lung damage) from HF and uranium exposure. The number of fatalities would be somewhat less than 1% of the estimated number of potential irreversible adverse effects (Policastro et al. 1997). Thus, no fatalities are expected among the general public, but one fatality could occur among noninvolved

TABLE 5.1-5 No Action Alternative: Estimated Consequences from Radiation Exposures for Cylinder Accidents at the ETTP Site[a]

			MEI		Population	
Receptor[b]	Accident Scenario	Accident Frequency Category[c]	Dose (rem)	Lifetime Risk of LCF	Dose (person-rem)	Number of LCFs
Likely Accidents						
General public	Corroded cylinder spill, dry conditions	L	0.003	1×10^{-6}	0.49	0.0002
Noninvolved workers	Corroded cylinder spill, dry conditions	L	0.077	3×10^{-5}	1.3	0.0005
Low Frequency-High Consequence Accidents						
General public	Rupture of cylinders – fire	EU	0.013	7×10^{-6}	73	0.04
Noninvolved workers	Rupture of cylinders – fire	EU	0.02	8×10^{-6}	16	0.006

[a] The accidents listed are those estimated to have the greatest impacts among all accidents considered (except for certain accidents with a security concern). The impacts for a range of accidents at each of the three current storage sites are listed in Appendix D of the DUF_6 PEIS (DOE 1999a). The estimated consequences were based on the assumption that at the time of the accident, the wind would be blowing in the direction of the highest worker or public population density and that meteorological conditions would limit dispersion.

[b] Noninvolved workers are persons who work at the site but who are not involved in handling of materials. Depending on the circumstances of the accident, injuries and fatalities among involved workers are possible for all accidents.

[c] Accident frequencies: L = likely, estimated to occur one or more times in 100 years of facility operations ($> 1 \times 10^{-2}$/yr); EU = extremely unlikely, estimated to occur between once in 10,000 years and once in 1 million years of facility operations (1×10^{-4} to 1×10^{-6}/yr).

workers (1% of 140). If this accident is assumed to occur once in 100,000 years, the accident risk through 2039 would be less than 1 (0.1) irreversible adverse health effect among workers and the general public combined.

Radiation Effects. Potential cylinder accidents could release uranium, which is radioactive in addition to being chemically toxic. The potential radiation exposures of members of the general public and noninvolved workers were estimated for the same cylinder accidents as those for which chemical effects were estimated (Table 5.1-5). For all cylinder accidents considered, the radiation doses from released uranium would be considerably below levels likely to cause radiation-induced effects among noninvolved workers and the general public and below the 25-rem total effective dose equivalent established by DOE as a guideline for assessing the adequacy of protection of public health and safety from potential accidents (DOE 2000c).

For the corroded cylinder spill accident (dry conditions), it is estimated that the radiation dose to a maximally exposed member of the general public would be less than 3 mrem (lifetime dose), resulting in an increased risk of death from cancer of about 1 in 1 million. The total population dose to the general public within 50 mi (80 km) would be less than 1 person-rem, most likely resulting in zero LCFs. Among noninvolved workers, the dose to an MEI would be 77 mrem, resulting in an increased risk of death from cancer of about 1 in 30,000. The total dose to all noninvolved workers would be about 1.3 person-rem. This dose to workers would result in zero LCFs. The risk (consequence × probability) of additional LCFs among members of the general public and workers combined would be much less than 1 through 2039.

The cylinder accident estimated to result in the largest potential radiation doses would be an accident involving several cylinders in a fire. For this accident, it is estimated that the radiation dose to a maximally exposed member of the general public would be about 13 mrem, resulting in an increased risk of death from cancer of about 1 in 150,000. The total population dose to the general public within 50 mi (80 km) would be 73 person-rem, most likely resulting in zero LCFs. Among noninvolved workers, the dose to an MEI would be about 20 mrem, resulting in an increased risk of death from cancer of about 1 in 100,000. The total dose to all noninvolved workers would be about 16 person-rem. This dose to workers would result in zero LCFs. The risk (consequence × probability) of additional LCFs among members of the general public and workers combined would be much less than 1 through 2039.

5.1.3.2 Transportation

Continued cylinder storage under the no action alternative would have the potential to generate small amounts of LLW and LLMW during cylinder monitoring and maintenance activities. This material could require transportation to a treatment or disposal facility. Shipments would be made in accordance with all DOE and DOT regulations and guidelines. It is estimated that less than one waste shipment would be required each year. Because of the small number of shipments and the low concentrations of contaminants expected, the potential environmental impacts from these shipments would be negligible.

5.1.3.3 Air Quality and Noise

The assessment of potential impacts to air quality under the no action alternative at the ETTP site included a consideration of air pollutant emissions from continued cylinder storage activities, including emissions from operations (cylinder painting and vehicle emissions) and HF emissions from breached cylinders. No cylinder yard construction activities are planned at the ETTP site. Atmospheric dispersion models were used to estimate the concentrations of criteria pollutants at the site boundaries: SO_2, NO_2, CO, O_3, PM (PM_{10} and PM_2), and Pb. The site boundary concentrations were compared with existing air quality standards or with guidelines for pollutants that do not have corresponding standards as given in Chapter 3. The air concentrations of all criteria pollutants resulting from no action alternative activities would be less than 1% of the respective standards.

Painting activities could generate hydrocarbon emissions. No explicit air quality standard has been set for hydrocarbon emissions, but these emissions are associated with O_3 formation. Standards have been set for O_3. For the ETTP site, hydrocarbon emissions from painting activities would be about 0.1% of the hydrocarbon emissions from the entire surrounding county. Because O_3 formation is a regional issue affected by emissions for an entire area, this small additional contribution to the county total would be unlikely to substantially alter the O_3 levels of the county. In addition, the actual frequency of cylinder painting would likely be much reduced in comparison with the frequency assumed for these analyses.

When credit is taken for reduced corrosion from better maintenance and painting, the estimated maximum 24-hour and annual average site boundary HF concentrations from hypothetical cylinder breaches occurring under the no action alternative at the ETTP site are 0.67 $\mu g/m^3$ and 0.084 $\mu g/m^3$, respectively. Tennessee's primary HF 24-hour maximum average air standard is 2.9 $\mu g/m^3$ (there is no annual average standard). The estimated maximum 24-hour average would be about 23% of the standard.

Calculations indicate that if no credit was taken for the reduction in corrosion as a result of painting and continued maintenance and if storage continued at the ETTP site indefinitely, cylinder breaches occurring at the site by around 2020 could result in maximum 24-hour average HF concentrations at the site boundaries of 2.9 $\mu g/m^3$, approximately equal to the Tennessee standard. However, because of the ongoing cylinder maintenance program, it is not expected that a breach rate this high would occur at the ETTP site.

No construction activities are planned under the no action alternative at the ETTP site; therefore, there would be no adverse noise impacts.

Continued storage operations could result in somewhat increased noise levels as a result of projected activities such as painting cylinders or repairing any infrequent cylinder breaches. However, it is expected that noise levels at off-site residences would not increase noticeably. Noise impacts are expected to be negligible under the no action alternative.

5.1.3.4 Water and Soil

Under the no action alternative, impacts on surface water, groundwater, and soil could result from continued storage of the cylinders. Important elements in assessing potential impacts on surface water include changes in runoff, floodplain encroachment, and water quality. Groundwater impacts were assessed in terms of changes in recharge to the underlying aquifers, depth to groundwater, direction of groundwater flow, and groundwater quality. Potential soil impacts considered were changes in topography, permeability, erosion potential, and soil quality.

For the no action alternative at the ETTP site, the assessment area in which potentially important impacts might occur was determined to be quality of surface water, groundwater, and soil. The other potential impacts include changes in water use and effluent volumes. Maximum water use during continued cylinder maintenance operations at the site would be 32,000 gal/yr (120,000 L/yr).

A contaminant of concern in evaluating surface water, groundwater, and soil quality is uranium. Surface water and groundwater concentrations of contaminants are generally evaluated through comparison with EPA MCLs, as given in Safe Drinking Water Act regulations (40 CFR Part 141), although these limits are only directly applicable "at the tap" of the water user. The water concentration value used for comparison in this EIS is 20 µg/L (the proposed MCL for uranium has now been finalized at 30 µg/L and became effective in December 2003 [EPA 2003a]). The 20-µg/L value is used as a guideline for evaluating surface water and groundwater concentrations of uranium in this EIS, even though it is not directly applicable as a standard. There is also no standard available for limiting concentrations of uranium in soil. A health-based value of 230 µg/g (EPA 1995), applicable for residential settings, is used as a guideline for comparison.

The nearest surface water to the ETTP site is Poplar Creek, which is a tributary of the Clinch River. The Clinch River is used as a drinking water source. Because of very large dilution effects, even high levels of contaminants in Poplar Creek would not be expected to cause concentrations to exceed guidelines at the drinking water intakes of the Clinch River.

5.1.3.4.1 Surface Water. Potential impacts on the nearest receiving water at the site (i.e., Poplar Creek) were estimated for uranium released from hypothetical cylinder breaches occurring through 2039. The estimated potential maximum concentration of uranium in Poplar Creek was calculated to be 0.02 µg/L, considerably below the 20-µg/L level used for comparison.

Cylinder painting activities have been associated with increased toxicity in runoff at the Paducah site. If such an impact occurred at the ETTP site as a result of future cylinder painting, mitigating actions, such as treating runoff, might be required.

5.1.3.4.2 Groundwater. Groundwater in the vicinity of the ETTP site discharges to nearby surface waters and is not known to be used as a domestic or industrial source. (See Chapter 3 for a discussion of existing groundwater quality at the site.) Activities associated with the no action alternative would not affect migration of existing groundwater contamination or impact off-site water supplies.

Potential impacts on groundwater quality from hypothetical releases of uranium from breached cylinders were assessed, taking credit for reduced corrosion from better maintenance and painting. The maximum future concentration of uranium in groundwater directly below the ETTP site is estimated to be 7 µg/L, which is considerably below the 20-µg/L level used for comparison. It was estimated that if the rate of uranium migration was rapid, this concentration would occur sometime after 2070. A lower concentration would occur if uranium migration through the soil was slower than assumed for this analysis.

Calculations indicate that if no credit was taken for the reduction in corrosion resulting from cylinder painting and maintenance and if storage continued at the ETTP site indefinitely, uranium releases from future cylinder breaches occurring before about 2025 could result in a sufficient amount of uranium in the soil column to increase the groundwater concentration of uranium to 20 μg/L in the future. The groundwater concentration would not actually reach 20 μg/L at the site until about 2100 or later. However, because of the ongoing maintenance program, it is expected that breaches occurring before 2039 would not be sufficient to increase the groundwater concentration to 20 μg/L at the site.

5.1.3.4.3 Soil. Potential impacts on soil that could receive contaminated rainwater runoff from the cylinder storage yards were estimated. The contaminant source is assumed to be uranium released from hypothetical breached cylinders. It is assumed that any releases from future cylinder painting activities would be controlled or treated to avoid soil contamination. The estimated maximum soil concentration is 3 μg/g for the ETTP site, considerably below the 230-μg/g guideline used for comparison.

5.1.3.5 Socioeconomics

The potential socioeconomic impacts of activities at the ETTP site under the no action alternative would be low. No construction activities are planned for the site under the no action alternative, and operational activities would create 30 direct jobs and 90 total jobs per year. During operations, direct and total income would be $3.1 million/yr and $4.2 million/yr, respectively.

The employment created in the ROI for the ETTP site during continued cylinder maintenance activities would represent a change of less than 0.1 of a percentage point in the projected annual average growth in employment over the period 2004 to 2039. No migration into the ROI would occur because of the ETTP activities; thus, no impacts are expected on local housing markets, local public service employment, or local public finances.

5.1.3.6 Ecology

The no action alternative would have a negligible impact on ecological resources in the area of the ETTP site. Because no construction activities are planned, there would be no new impacts on wetlands or on federal- and state-protected species.

The assessment results indicate that impacts to ecological resources from continued storage activities, including hypothetical cylinder breaches, would be negligible. Analysis of potential impacts was based on exposure of biota to airborne contaminants or contaminants released to soil, groundwater, or surface water (e.g., from painting activities or from breached cylinders). Predicted concentrations of contaminants in environmental media were compared with benchmark values of toxic and radiological effects (see Appendix F). At the ETTP site, air, soil, and surface water concentrations would be below levels harmful to biota. However, as discussed in Section 5.1.3.4, cylinder painting activities may potentially cause future reductions in surface water quality, and they may consequently result in impacts to aquatic biota downstream of the cylinder storage yards. Although groundwater uranium concentrations

(7 to 20 μg/L) would be below the lowest effects level (150 μg/L) and below radiological benchmark levels (4.55×10^3 pCi/L), they would exceed the ecological screening value for surface water (2.6 μg/L). However, contaminants in groundwater discharging to a surface water body, such as a local stream, would be quickly diluted to negligible concentrations.

5.1.3.7 Waste Management

Under the no action alternative, operations at the ETTP site would generate relatively small amounts of LLW and LLMW. The volume of LLW generated by continued storage activities would represent less than 1% of the annual generation at the site from all activities. The maximum annual amount of LLMW generation from stripping/painting operations at the ETTP site would generate less than 1% of the site's total annual LLMW load, resulting in negligible waste management impacts for this site. Thus, the overall impact on waste management operations from the no action alternative would be negligible.

5.1.3.8 Resource Requirements

Operations under the no action alternative would use electricity, fuel, concrete, steel and other metals, and miscellaneous chemicals. The total quantities of commonly used materials would be small compared with local sources and would not affect local, regional, or national availability of these materials. No strategic or critical materials are expected to be consumed. The anticipated utilities requirements would be within the supply capacities at the ETTP site. The required material resources would be readily available.

5.1.3.9 Land Use

Because no new construction is planned for the ETTP site, no impacts on land use are anticipated for the no action alternative.

5.1.3.10 Cultural Resources

Impacts to cultural resources at the ETTP site would not be likely under the no action alternative. The existing cylinder storage yards would continue to be used for cylinder storage. These yards are currently located in previously disturbed areas (graded during the original construction of the yards) and are unlikely to contain cultural properties or resources listed on or eligible for listing on the NRHP. No new or expanded cylinder storage yards are proposed at ETTP. Cylinder breaches are not expected to result in HF or criteria pollutant emissions sufficient to impact cultural resources (see Section 5.1.2.3).

5.1.3.11 Environmental Justice

A review of the potential human health and safety impacts anticipated under the no action alternative indicates that no disproportionately high and adverse effects to minority or low-income populations are expected on or in the vicinity of the ETTP site during DUF_6 cylinder storage. Although such populations occur in certain areas within the 50-mi (80-km) radius used to identify the maximum geographic extent of human health impacts (see Section 3.2.12), no noteworthy impacts to these populations are anticipated. The results of accident analyses for the no action alternative also did not identify high and adverse impacts to the general public; the risk of accidents (consequence × probability) yields less than 1 fatality for all accidents considered.

5.2 PROPOSED ACTION ALTERNATIVES

This section presents the estimated potential environmental impacts for the proposed action alternatives, including:

- Impacts from construction of a new cylinder storage yard at two possible locations at the Portsmouth site (Section 5.2.1);
- Impacts from construction of the conversion facility at the three alternative locations within the Portsmouth site (Section 5.2.2);
- Impacts from operation of the conversion facility at the three alternative locations (Section 5.2.3);
- Impacts at ETTP from preparing cylinders for transportation to Portsmouth (Section 5.2.4);
- Impacts from the transportation of UF_6 cylinders from ETTP to Portsmouth, and uranium conversion products and waste materials from the Portsmouth site to a disposal facility (Section 5.2.5);
- Impacts associated with the potential sale and use of HF and CaF_2 (Section 5.2.6);
- Impacts that would occur if the cylinders at ETTP were shipped to Paducah for conversion rather than to Portsmouth (Section 5.2.7); and
- Impacts from expanded plant operations, including extending the operational period and increasing throughput (Section 5.2.8).

In general, within each technical area, impacts are discussed for the construction and operation of the facility at the preferred location (Location A) as well as for two alternative locations (Locations B and C). The time period considered is a construction period of approximately 2 years and an operational period of 18 years.

5.2.1 Portsmouth Site — Cylinder Storage Yard Construction Impacts

As discussed in Chapter 2, it may be necessary to construct an additional yard at Portsmouth for the storage of the ETTP cylinders, depending on when and at what rate the ETTP cylinders are shipped. DOE will not know if a new yard is required, or if existing storage yard space could be used for the ETTP cylinders, until some time in the future. The potential environmental impacts from the construction of a new cylinder storage yard are included in this section to account for current uncertainties. Two possible areas for new cylinder yard construction are evaluated, as shown in Figure 2.2-4. (Also identified in Figure 2.2-4 is an existing concrete pad being evaluated for temporary storage of the ETTP cylinders.) Both areas are adjacent to current DOE cylinder storage yards. Proposed Area 1 consists of three smaller sections, with a total area of about 5.5 acres (2.2 ha). Proposed Area 2 consists of two smaller sections, with a total area of about 6.3 acres (2.5 ha). A new yard would be constructed of concrete and would be similar to other concrete yards constructed at the Portsmouth site.

5.2.1.1 Human Health and Safety — Normal Construction Activities

5.2.1.1.1 Radiological Impacts. Proposed Area 1 includes three separate sections in close proximity to the existing cylinder yards (X-745E and X-745C). While constructing concrete pads in this area, construction workers, due to proximity to the DUF_6 cylinders, would be exposed to external radiation. On the basis of thermoluminescence dosimeter (TLD) monitoring data at these cylinder yards and the assumption that a worker would spend a total of 500 hours close to the cylinders, potential radiation exposure is estimated to be about 30 mrem.

Proposed Area 2 includes two separate sections. The smaller section to the north is close to existing cylinder yard X-745C; the larger one to the south is away from existing cylinder yards. Construction workers working in the smaller section would receive radiation exposure from cylinders in the X-745C yards. On the basis of the assumption that the total exposure duration would be the same here as at Proposed Area 1 (500 hours), the potential radiation dose to a construction worker would be about 30 mrem. The exposures estimated are conservative because of the use of the TLD data taken from the cylinder yards. Furthermore, the construction work is expected to last for only 3 months (Folga 2003); therefore, the actual time a worker would spend at a distance close to the cylinder yard boundary would be less than 500 hours. For comparison, the average annual dose received by cylinder yard workers was 64 mrem/yr in year 2001 (DOE 2002e). The radiation dose limit set to protect the general public is 100 mrem/yr (DOE 1990), and workers are limited to a dose of 5,000 mrem/yr (10 CFR 835).

5.2.1.1.2 Chemical Impacts. Chemical exposures during construction of the new Portsmouth cylinder storage yard are expected to be low and mitigated by using personal protective equipment and engineering controls to comply with OSHA PELs that are applicable for construction activities.

5.2.1.2 Human Health and Safety — Accidents

The risk of on-the-job fatalities and injuries to cylinder storage yard construction workers was calculated by using industry-specific statistics from the BLS, as reported by the National Safety Council (2002). Annual fatality and injury rates from the BLS construction industry division were used for the 3-month construction phase. Construction of the cylinder storage yard is estimated to require approximately 21 or 24 FTEs over 3 months for Areas 1 or 2, respectively. No on-the-job fatalities are predicted during the cylinder storage yard construction phase; however, approximately 1 injury is predicted (Table 5.2-1).

TABLE 5.2-1 Potential Impacts to Human Health from Physical Hazards during Construction of an Additional Cylinder Storage Yard at the Portsmouth Site

	Impacts to Cylinder Storage Yard Workers[a]	
Area	Incidence of Fatalities	Incidence of Injuries
1	0.003	1
2	0.003	1

[a] Potential hazards were estimated for all cylinder storage yard workers over the 3-month construction phase.

Source: Injury and fatality rates used in calculations were taken from National Safety Council (2002).

5.2.1.3 Air Quality and Noise

5.2.1.3.1 Air Quality Impacts. Emissions of criteria pollutants — SO_2, NO_x, CO, and PM (PM_{10} and $PM_{2.5}$) — and of VOCs would occur during the construction period, which would last about 3 months. These emissions would include fugitive dust emissions from earthmoving activities and exhaust emissions from heavy equipment and commuter/delivery vehicles. The total emissions from fugitive and exhaust sources are estimated to be 0.02 ton (0.02 t) for SO_2, 0.28 ton (0.25 t) for NO_x, 0.19 ton (0.17 t) for CO, 2.96 tons (2.69 t) for PM_{10}, 0.46 ton (0.42 t) for $PM_{2.5}$, and 0.08 ton (0.07 t) for VOCs (Folga 2003). Estimated maximum pollutant concentrations during construction are shown in Table 5.2-2.

All of the pollutant concentration increments would remain below NAAQS and SAAQS. For SO_2, NO_2, and CO, it is predicted that maximum concentration increments would be about 2% of their applicable standards. The highest concentration increment would occur for 24-hour average PM_{10}, which is predicted to be about 49% of the standard for PM_{10}. The highest concentration increment for $PM_{2.5}$ is predicted to be about 12% of its standard.

To obtain the total concentrations for comparison with applicable air quality standards, the modeled concentration increments were added to measured background values (see Table 3.1-3). The total concentrations for SO_2, NO_2, CO, and PM_{10} are estimated to be below 91% of applicable ambient standards. Total $PM_{2.5}$ concentrations are estimated to be near or above applicable ambient standards. In fact, concentrations of $PM_{2.5}$ at most statewide monitoring stations either approach or are above the standards. Construction activities should be conducted so as to minimize potential impacts on ambient air quality. Water could be sprayed on disturbed areas frequently, as needed, and dust suppressant or pavement could be applied to roads with frequent traffic.

TABLE 5.2-2 Maximum Air Quality Impacts at the Construction Site Boundary Due to Emissions from Activities Associated with Construction of a New Cylinder Storage Yard at the Portsmouth Site

			Concentration ($\mu g/m^3$)				Percent of NAAQS/SAAQS[e]	
Candidate Area	Pollutant[a]	Averaging Time	Maximum Increment[b]	Back-ground[c]	Total[d]	NAAQS and SAAQS	Increment	Total
1	SO_2	3 hours	29.5	307	337	1,300	2.3	25.9
		24 hours	5.5	110	115	365	1.5	31.6
		Annual	0.2	18.7	18.9	80	0.2	23.6
	NO_2	Annual	0.2	54.7	54.9	100	0.2	54.9
	CO	1 hour	68.0	13,400	13,500	40,000	0.2	33.7
		8 hours	15.7	4,780	4,800	10,000	0.2	48.0
	PM_{10}	24 hours	63.0	64.0	127	150	42.0	84.7
		Annual	2.4	32.0	34.4	50	4.7	68.7
	$PM_{2.5}$	24 hours	7.4	57.5	64.9	65	11.4	99.9
		Annual	0.36	24.1	24.5	15	2.4	163
2	SO_2	3 hours	29.1	307	336	1,300	2.2	25.9
		24 hours	6.7	110	117	365	1.8	32.0
		Annual	0.1	18.7	18.8	80	0.1	23.5
	NO_2	Annual	0.2	54.7	54.9	100	0.2	54.9
	CO	1 hour	59.5	13,400	13,500	40,000	0.1	33.6
		8 hours	19.7	4,780	4,800	10,000	0.2	48.0
	PM_{10}	24 hours	72.8	64.0	137	150	48.6	91.2
		Annual	1.7	32.0	33.7	50	3.4	67.4
	$PM_{2.5}$	24 hours	7.5	57.5	65.0	65	11.5	100
		Annual	0.3	24.1	24.4	15	1.7	162

a Emissions are from equipment and vehicle engine exhaust, except for PM_{10} and $PM_{2.5}$, which are also from soil disturbance.

b Data represent the maximum concentration increments estimated, except that the fourth- and eighth-highest concentration increments estimated are listed for 24-hour PM_{10} and $PM_{2.5}$.

c See Table 3.1-3.

d Total equals the maximum modeled concentration increment plus background concentration.

e The values in the next-to-last column are maximum concentration increments as a percent of NAAQS and SAAQS. The values presented in the last column are total concentration increments as a percent of NAAQS and SAAQS.

The potential impacts of PM (PM_{10} and $PM_{2.5}$) released from near-ground level would be limited to the immediate vicinity of the construction site boundaries — areas that the general public is expected to occupy only infrequently. The PM concentrations would decrease rapidly with distance from the source. At the nearest residence (about 1.5 km [0.9 mi] west of the construction Area 2), predicted concentration increments would be less than 2% of the highest concentration increments at construction site boundaries.

Potential air quality impacts due to emissions from new cylinder yard construction activities were predicted to be comparable between the two alternative areas. However, potential impacts for Area 2 would be slightly higher than those for Area 1 if construction of the new cylinder yard occurred simultaneously with construction of the conversion facility.

5.2.1.3.2 Noise Impacts. During construction, the commuting/delivery vehicular traffic around the construction site would generate intermittent noise. However, the contribution to noise from these intermittent sources would be limited to the immediate vicinity of the traffic route and would be minor in comparison with the contribution from the continuous noise sources, such as a compressor or bulldozer, during construction. Noise sources during the construction of the cylinder yard would include site clearing followed by concrete padding. Noise levels from these activities would be comparable to those from other construction sites of similar size.

Average noise levels for construction equipment range from 76 dB(A) for a pump to 89 dB(A) for a scraper (Harris Miller Miller & Hanson, Inc. [HMMH] 1995). To estimate noise levels at the nearest residence, it was assumed that the two noisiest pieces of equipment would operate simultaneously (HMMH 1995). A scraper and a heavy truck operating continuously typically generate noise levels of 89 and 88 dB(A), respectively, at a distance of 15 m (50 ft) from the source, which results in a combined noise level of about 91.5 dB(A) at a distance of 15 m (50 ft).

The nearest residences to the proposed cylinder yard Areas 1 and 2 are located about 1.6 km (1.0 mi) and 1.5 km (0.9 mi) west-southwest and west of them, respectively. An analysis of the potential noise impacts was performed for the construction of cylinder yard Area 2, which is closer to the nearest residence. Noise levels decrease about 6 dB per doubling of distance from the point source because of the way sound spreads geometrically over an increasing distance. Thus, construction activities would result in an estimated noise level of about 52 dB(A) at the nearest residence. This level would be 47 dB(A) as DNL if it is assumed that construction activities would be limited to an 8-hour daytime shift. This value is below the EPA guideline of 55 dB(A) as DNL for residential zones (see Section 3.1.3.4), which was established to prevent interference with activity, annoyance, or hearing impairment. This 47-dB(A) estimate is probably an upper bound because it does not account for other types of attenuation, such as air absorption and ground effects due to terrain and vegetation. If other attenuation mechanisms were considered, noise levels at the nearest residence would decrease further. The resulting noise levels would be barely noticeable at the nearest residence.

Most of these construction activities would occur during the day, when noise is tolerated better than at night because of the masking effect of background noise. Nighttime noise levels would drop to the background levels of a rural environment because construction activities would cease at night.

If construction of the cylinder yard would occur simultaneously with construction of the conversion facility, noise levels at the nearest residence would increase by about 3 dB at most, but resultant noise levels would still be below the EPA guideline level. At the end of the 3-month construction period, noise impacts associated with construction of the cylinder yard would cease to exist.

5.2.1.4 Water and Soil

Construction and operation of a new cylinder storage yard at Portsmouth could impact surface water, groundwater, and soil resources. Potential impacts are discussed below for the two alternative locations, Areas 1 and 2.

5.2.1.4.1 Proposed Area 1

Surface Water. Construction of the storage yard would require about 0.75 million gal (2.8 million L) of water. This water would be obtained from groundwater resources. Because all water needs would be met by using groundwater, there would be no direct impacts to surface waters.

Construction of the storage yard at Portsmouth would also generate sanitary wastewater (0.11 million gal [0.42 million L]). If it was discharged at a constant rate over a year, the rate of release would be about 0.2 gal/min (0.8 L/min). After treatment in the existing wastewater treatment facility, the wastewater would be released to Little Beaver Creek or piped directly to the Scioto River under an existing NPDES permit. For average flow conditions in Little Beaver Creek (940 gal/min [3,558 L/min]), contaminant concentrations would be diluted by a factor of about 4,700. Additional dilution would occur at the confluence with Big Beaver Creek and again at the confluence with the Scioto River. Even under low-flow conditions, contaminants would be diluted by a factor of about 140,000.

Although water resources would not be impacted by withdrawals, surface waters could be affected indirectly by receiving contaminated runoff from the construction sites. By following good construction practices (e.g., stockpiling materials away from surface drainage paths, covering construction materials with tarps, and cleaning up any spills thoroughly as soon as they occur), indirect impacts to surface water quality could be minimized.

Groundwater. Construction of the storage yard would require about 0.75 million gal (2.8 million L) of water. Construction is expected to be completed in about 3 months. However, even if it was completed in 1 year, and the rate of water use was constant, a withdrawal rate of about 1.4 gal/min (5.4 L/min) would be required. Current water use at the Portsmouth facility is about 4,312 million gal/yr (16,323 million L/yr). The maximum capacity of the well system is about 13,900 million gal/yr (52,617 million L/yr). The water required for yard construction would, therefore, be about 0.02% of the existing use and 0.005% of the existing capacity. Groundwater withdrawal for construction would, therefore, have no measurable impact on the groundwater system beneath Portsmouth.

Construction of the storage yards at Portsmouth would also affect the permeability of the surface soil and its ability to transmit water as recharge to the underlying aquifers. However, impacts to recharge would not be measurable because the total area of land that would be permanently altered by construction of the yards would be very small (about 5.5 acres [2.2 ha] or about 0.2% of the total site area). Similarly, the quality of groundwater beneath the storage yards could be affected by construction activities through infiltration of surface water contaminated from spills of construction materials. By following good engineering and construction practices (e.g., covering chemicals with tarps to prevent contact with rainfall, promptly and thoroughly cleaning up spills, and providing retention basins to catch and hold any contaminated runoff), impacts to groundwater quality would be minimal.

Soils. Construction of the cylinder storage yard at Portsmouth would affect a total of 5.5 acres (2.2 ha). This amount of land is small (about 0.2% of the land area available), and impacts would be negligible. By following good engineering and construction practices, impacts to soil quality would also be minimal.

Operations. Operation of the proposed new cylinder storage areas at Portsmouth could affect water and soil resources, primarily from breached cylinders releasing a maximum of 4 lb (2 kg) of uranium over a 4-year period. As discussed above, approximately 5,000 cylinders containing DUF_6 would be stored in the new yards. This number of cylinders is less than 32% of the current inventory (about 16,000 cylinders). Because the number of additional cylinders stored would be less than the current inventory, impacts associated with their storage would be correspondingly smaller than the impacts predicted for continued cylinder storage at Portsmouth under the no action alternative (Section 5.1). For such conditions, impacts to surface water would not be measurable; a maximum groundwater concentration of 5 μg/L would occur somewhat before 2080 (assuming that the uranium in the groundwater was fairly mobile [Tomasko 1997]), and concentrations in the soil adjacent to the yards would be below the recommended EPA guideline of 230 μg/g for residential soil and 6,100 μg/g for industrial soil (EPA 2003a). These impacts could be reduced further by surrounding the storage yards with drainage ditches that could capture potentially contaminated runoff from the new yards and divert it for treatment, as needed.

5.2.1.4.2 Proposed Area 2. The quantity of water needed to construct the two storage yards for Proposed Area 2 would be about 0.85 million gal (3.2 million L). About 0.13 million gal (0.50 million L) of sanitary wastewater would be generated. Because the resources required to construct these yards are about the same as those discussed above for Proposed Area 1, the impacts would be about the same.

5.2.1.5 Socioeconomics

The potential socioeconomic impacts of construction and operation of a new cylinder yard at Portsmouth would be low. Construction activities would create short-term employment (60 direct jobs, 150 total jobs). Direct and total personal income from construction would be $1.7 million and $5.6 million, respectively.

The employment created in the ROI for the Portsmouth site would represent a change of less than 0.1 of a percentage point in the projected average annual growth in employment over the period of operations. Since no population in-migration is expected during either construction or operation, there would be no impact on local housing, local public finances, or local public service employment.

5.2.1.6 Ecology

Construction of a yard at Proposed Area 1 would result in the disturbance of approximately 6.1 acres (2.5 ha) of land, due to construction-related activities, and in the loss of previously disturbed managed grassland vegetation. The yard would not replace undisturbed natural communities. Managed grassland communities comprise most of the vegetation on the Portsmouth site, within the Perimeter Road. Thus, the loss of up to 6.1 acres (2.5 ha) would represent a minor decrease in this vegetation type on the Portsmouth site. Immediate replanting of areas disturbed by temporary construction-related activities with native species would help reduce impacts to vegetation.

Construction at Proposed Area 1 would primarily impact wildlife species commonly associated with managed grassland communities. Wildlife would be disturbed by land clearing, noise, and human presence. Wildlife with restricted mobility, such as burrowing species or juveniles of nesting species, would be destroyed during land clearing activities. More mobile individuals would relocate to adjacent areas with similar habitat, which is commonly available in the area. Wildlife in nearby woodland communities might also be disturbed by noise up to 91.5 dB(A) at 15 m (50 ft) during the construction period.

Wetlands do not occur within the areas that would be disturbed at Proposed Area 1. Therefore construction would not directly impact wetlands. Wetlands downgradient of the construction sites could be impacted by storm water runoff; however, the implementation of good construction practices, including erosion and sediment controls, would minimize impacts to surface water quality. Because surface water impacts from breached cylinders during use of the storage yards would be negligible, impacts to wetlands from cylinder storage would not be expected. The increase in impervious surface and discharge of storm water runoff from the yards could result in a greater fluctuation in flows within the stream northeast of the yards, across Perimeter Road. However, because the yard would not be located adjacent to the stream and only a small portion of the watershed would be involved, such effects would likely be very small.

Construction would not be expected to result in direct or indirect impacts to any federal- or state-listed species. Although the riparian forest along the stream north of Perimeter

Road might include trees that can be used by Indiana bats (federal- and state-listed as endangered) for roosting, this area has not been identified as summer roosting habitat. Although noise associated with construction activities might disturb wildlife, Indiana bats that might use habitats near the Portsmouth site are currently exposed to noise and other effects of human disturbance. Consequently, these effects related to construction activities would be expected to be minor.

Construction of a yard at Proposed Area 2 would result in the disturbance of approximately 6.9 acres (2.8 ha) of land, due to construction-related activities. Impacts to vegetation and wildlife would be similar to those for Proposed Area 1. Two intermittent streams originate in the area northeast of "A" Road and flow to the west, converging to form the stream immediately north of Location A. Storage yard construction would result in the elimination of the northernmost of these streams and partial filling of the other. Placement of a storage yard in this area could also result in a greater fluctuation in flows in downstream areas and reduced water quality. Impacts to federal- or state-listed species would not be expected.

5.2.1.7 Waste Management

The construction of a cylinder storage yard at Portsmouth would generate a total of about 353 yd^3 (270 m^3) of nonhazardous solid waste and 130,000 gal (470,000 L) of nonhazardous sanitary wastewater (Folga 2003). Only minimal impacts would result from these construction-generated wastes.

5.2.1.8 Resource Requirements

A new storage yard would be an 8-in. (20-cm) thick concrete pad on top of a 12-in. (30-cm) layer of crushed stone. Table 5.2-3 provides an estimate of the construction requirements. None of the identified construction resources is in short supply, and all should be readily available in the local region.

TABLE 5.2-3 Materials/Resources Consumed during Construction of a Cylinder Storage Yard at the Portsmouth Site

Materials/Resources	Total Consumption	Unit
Utilities		
Water	840,000	gal
Solids		
Concrete	7,400	yd^3
Aggregate (gravel)	11,000	yd^3
Special coatings	33,000	yd^2
Liquids		
Fuel	2.8×10^3	gal

5.2.1.9 Land Use

Both locations being considered for a storage yard are in an area of existing structures and on a site with more than 150 structures. Constructing an additional storage yard on the Portsmouth site would involve very slight modifications of existing land use. The resulting storage yard would be consistent with the heavy industrialized land use currently found at the Portsmouth site — a consequence of producing enriched uranium and its DUF_6 by-product, as well as storing the latter. As a consequence, no land use impacts are anticipated as a result of construction of a new yard.

5.2.1.10 Cultural Resources

The construction of a new cylinder storage yard at Portsmouth could potentially impact cultural resources. The amount of data available on cultural resources within the project area at Portsmouth is not sufficient to determine whether or not the construction would adversely impact significant cultural resources. Consequently, the possibility of adverse effects on cultural resources as a result of the construction cannot be excluded.

Archaeological and architectural surveys were undertaken for Portsmouth in 1996. The findings of these surveys have not been finalized and have not received concurrence from the Ohio SHPO. Past ground disturbance resulting from grading and construction make it unlikely that intact archaeological remains are present at the proposed locations for a new cylinder storage yard (Anderson 2002). However, unless these findings receive SHPO concurrence, a separate archaeological assessment of the proposed location for the construction of the cylinder storage yard (conducted by a qualified professional archaeologist) would be required to ensure that cultural material is not present and that Section 106 obligations under the National Historic Preservation Act (NHPA) of 1966 are met. If archaeological resources were encountered and a site or sites were determined to be significant, a mitigation plan would have to be developed and executed in consultation with the Ohio SHPO prior to construction. In general, mitigation of an adverse effect of yard construction on cultural resources could entail site avoidance, site monitoring during construction, or site excavation/data recovery. No buildings or structures are located at the proposed construction locations for a new cylinder storage yard; thus, no impacts to historic structures are anticipated.

No Native American traditional cultural properties have been identified at Portsmouth to date. Consultations with the SHPO and Native American groups have been initiated (Appendix G). If construction of a cylinder storage yard would result in an adverse effect on any such property identified, appropriate mitigation, as determined through continued consultation, would have to be undertaken before construction could begin.

5.2.1.11 Environmental Justice

The evaluation of environmental justice impacts associated with constructing a cylinder storage yard at the Portsmouth site is based on the identification of high and adverse impacts in other impact areas considered in this EIS, followed by a determination if those impacts would affect minority and low-income populations disproportionately. Disproportionate impacts could take two forms: (1) when the environmental justice population is present at a higher percentage in the affected area than in the reference population (i.e., the state in which a potentially impacted population occurs) and (2) when the environmental justice population is more susceptible to impacts than the population as a whole. In either case, high and adverse impacts are a necessary precondition for environmental justice concerns in an EIS.

Analyses of impacts from constructing a cylinder storage yard do not indicate the presence of high and adverse impacts for any of the other impact areas considered in this EIS (see Sections 5.2.1.1 through 5.2.1.10). Despite the presence of disproportionately high percentages of both minority and low-income populations within 50 mi (80 km) of the proposed cylinder yard, no environmental justice impacts from constructing this yard are anticipated. Similarly, no evidence indicates that minority or low-income populations would experience high and adverse impacts from the proposed construction in the absence of such impacts in the population as a whole.

5.2.2 Portsmouth Site — Conversion Facility Construction Impacts

This section discusses the potential environmental impacts during construction of a conversion facility at the three alternative locations within the Portsmouth site. When completed, the conversion facility would occupy approximately 10 acres (4 ha), including process and support buildings and parking areas. However, up to 65 acres (26 ha) of land might be disturbed during construction, including temporary lay-down areas (areas for staging construction material and equipment or for excavated material) and areas for utility access. Some of the disturbed areas would not be adjacent to the construction area. The disturbed area would include access roads, rail lines, and utility corridors.

The preferred conversion facility location (Location A) is adjacent to the RCRA X-616 chromium sludge lagoon unit and its related monitoring wells, an area that has a deed notice and associated restrictions. The X-616 chromium sludge lagoon and monitoring wells are, at their nearest point, located approximately 100 ft (30 m) from the DUF_6 conversion facility site boundary. To prevent direct impacts and ensure the integrity of this area, it will be clearly marked and identified, a suitable buffer zone will be established around it, and the entry of conversion facility personnel or equipment into these areas will be prohibited. To prevent indirect impacts, best available technologies will be identified and implemented to prevent the transport of air particulates and liquid effluents or discharges originating at the conversion facility site from trespassing at or impacting the RCRA unit. Technologies to prevent air particulate transport could include covering and/or spraying exposed bare soil, prohibiting open burning, and using windbreaks around construction areas. Technologies to prevent impacts from liquid discharges could include storm water and sediment controls such as silt fences, sediment traps, and seeding; secondary containment around liquid storage areas; and prompt cleanup of any inadvertent spills.

5.2.2.1 Human Health and Safety — Normal Construction Activities

5.2.2.1.1 Radiological Impacts. Of the three alternative locations at the Portsmouth site, none are close to the existing cylinder storage yards. According to site-specific external radiation data (DOE 2001d), external gamma radiation at all three locations is close to the background level. Therefore, construction workers at Locations A, B, or C are not expected to incur any external radiation from the depleted uranium currently stored in the cylinder yards.

However, if Proposed Area 2 is selected as the new yard and the larger lot to the south is used, potential external exposure could result from constructing the conversion facility at Location A, the preferred alternative. The incurred radiation dose would be less than 60 mrem/yr, calculated by using the TLD data from cylinder yard X-745C and an exposure duration of 1,000 hours per year. Once the surrounding walls of the conversion facility were built, radiation exposure would be further reduced because of the shielding provided by the walls. No radiological impacts would be expected at alternative Locations B and C from the new cylinder yard because of the greater distance between them and the yard.

5.2.2.1.2 Chemical Impacts. Chemical exposures during construction at the Portsmouth site are expected to be low and mitigated by using personal protective equipment and engineering controls to comply with OSHA PELs that are applicable for construction activities. No differences among the three alternative locations are expected.

5.2.2.2 Human Health and Safety — Accidents

The risk of on-the-job fatalities and injuries to conversion facility construction workers would not be dependent on the location of the facility. The estimated injuries and fatalities were calculated by using industry-specific statistics from the BLS, as reported by the National Safety Council (2002). Annual fatality and injury rates from the BLS construction industry division were used for the 20-month construction phase. Construction of the conversion facility is estimated to require approximately 164 FTEs per year. For all three alternative locations, no on-the-job fatalities are predicted during the construction phase; however, approximately 11 injuries are predicted (Table 5.2-4).

5.2.2.3 Air Quality and Noise

5.2.2.3.1 Air Quality Impacts. Currently, detailed information on the location of facility boundaries is available only for the preferred Location A. For modeling air quality impacts at Locations B and C, the proposed facilities were assumed to be located in the middle of the alternative locations.

Emissions of criteria pollutants — SO_2, NO_x (emissions are in NO_x but the ambient air quality standards are in NO_2), CO, and PM (PM_{10} and $PM_{2.5}$) — and of VOCs would occur during the construction period. These emissions would include fugitive dust emissions from earthmoving activities and exhaust emissions from heavy equipment and commuter/delivery vehicles. The annual emissions of criteria pollutants and VOCs expected during facility

TABLE 5.2-4 Potential Impacts to Human Health from Physical Hazards during Conversion Facility Construction and Operations at the Portsmouth Site

	Impacts to Conversion Facility Workers[a]			
	Incidence of Fatalities		Incidence of Injuries	
Activity	Construction	Operations	Construction	Operations
Conversion to U_3O_8	0.04	0.10	11	142
Conversion to U_3O_8 (without ETTP cylinders)	0.04	0.08	11	110

[a] Potential hazards were estimated for all conversion facility workers over the entire construction (20 months) and operation (18 and 14 years, with and without ETTP cylinders, respectively) phases.

Source: Injury and fatality rates used in calculations were taken from National Safety Council (2002).

construction are presented in Table 5.2-5. Estimated maximum pollutant concentrations during construction are shown in Table 5.2-6 for the three alternative locations.

All of the pollutant concentration increments would remain below NAAQS and SAAQS. For SO_2, NO_2, and CO, it is predicted that concentration increments would be below 32% of their applicable standards. The highest concentration increment would occur for 24-hour average PM_{10}, which is predicted to be up to about 79% of the standard for PM_{10}. The highest concentration increment for $PM_{2.5}$ is predicted to be less than 43% of its standard.

To obtain the total concentrations for comparison with applicable air quality standards, the modeled PM_{10} concentration increments were added to measured background values (Table 3.1-3). The total concentrations for SO_2, NO_2, and CO would be below 86% of applicable ambient standards. Total PM_{10} and $PM_{2.5}$ concentrations are estimated to either approach or be above their applicable ambient standards. In fact, concentrations of $PM_{2.5}$ at most statewide monitoring stations either approach or are above the standard. Predicted PM (PM_{10} and $PM_{2.5}$) concentration increments at the site boundaries would be high for the following two reasons: (1) the conversion facility would be constructed outside the current fenced site boundaries, so the general public would have access,[2] and (2) wind speeds measured at the on-site meteorological tower were relatively low, about half the speed of those at the Paducah GDP. Accordingly, construction activities should be conducted so as to minimize potential impacts on ambient air quality. Water could be sprayed on disturbed areas frequently, as needed, and/or dust suppressant or pavement could be applied to roads with frequent traffic.

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[2] Formerly, the general public had access to the existing fenced boundaries. However, since the September 11, 2001, terrorist attack, site access for the general public has been restricted indefinitely to the DOE property boundaries.

TABLE 5.2-5 Annual Criteria Pollutant and Volatile Organic Compound Emissions from Construction of the Conversion Facility at the Portsmouth Site

	Emission Rate (tons/yr)					
Emission Source	SO_2	NO_x	CO	VOCs	PM_{10}	$PM_{2.5}$
Exhaust	1.7	24.9	16.8	7.0	2.5	2.5[a]
Fugitive	–[b]	–	–	–	15.8[c]	2.3[c]

[a] For exhaust emissions, $PM_{2.5}$ emissions were conservatively assumed to be 100% of PM_{10} emissions.

[b] A dash indicates no emissions.

[c] Fugitive dust emissions were estimated under the assumption that the conversion facility construction area would continuously disturb about 8.5 acres (3.4 ha). This is the maximum amount of the approximate 10-acre (4-ha) facility footprint that would be disturbed at one time. A conventional control measure of water spraying with an emission control efficiency of 50% would be applied over the disturbed area. For fugitive dust emissions from earthmoving activities, $PM_{2.5}$ emissions were assumed to be 15% of PM_{10} emissions (EPA 2002).

Source: Folga (2003).

The potential impacts of PM (PM_{10} and $PM_{2.5}$) released from near-ground level would be limited to the immediate vicinity of the site boundaries — areas that the general public is expected to occupy only infrequently. The PM concentrations would decrease rapidly with distance from the source. At the nearest residence just off DOE's southern boundary (about 0.9 km [0.6 mi] from alternative Location B), predicted concentration increments would be less than 10% of the highest concentration increments at the site boundaries.

Among the three alternative locations, potential air quality impacts due to emissions from construction activities would be similar, with the highest at Location B and the lowest at Location A, as shown in Table 5.2-6. However, as mentioned previously, locations of facility boundaries for Locations B and C are assumed arbitrarily; thus, results for the two alternative locations should be interpreted in that context.

5.2.2.3.2 Noise Impacts. Noise levels from construction would be similar among the alternative locations. During construction, the commuting/delivery vehicular traffic around the facilities would generate intermittent noise. However, the contribution to noise from these intermittent sources would be limited to the immediate vicinity of the traffic route and would be minor in comparison with the contribution from continuous noise sources, such as compressors

TABLE 5.2-6 Maximum Air Quality Impacts at the Construction Site Boundary Due to Emissions from Activities Associated with Construction of the Conversion Facility at the Portsmouth Site

			Concentration (µg/m^3)					
							Percent of NAAQS/SAAQS[e]	
Location	Pollutant[a]	Averaging Time	Maximum Increment[b]	Back-ground[c]	Total[d]	NAAQS and SAAQS	Increment	Total
A	SO_2	3 hours	55.4	307	362	1,300	4.3	27.9
		24 hours	13.7	110	124	365	3.8	33.9
		Annual	1.5	18.7	20.2	80	1.8	25.2
	NO_2	Annual	21.8	54.7	76.5	100	21.8	76.5
	CO	1 hour	1,100	13,400	14,500	40,000	2.7	36.2
		8 hours	405	4,780	5,190	10,000	4.1	51.9
	PM_{10}	24 hours	95.8	64.0	160	150	63.9	107
		Annual	16.7	32.0	48.7	50	33.3	97.3
	$PM_{2.5}$	24 hours	19.7	57.5	77.2	65	30.3	119
		Annual	4.3	24.1	28.4	15	28.7	189
B	SO_2	3 hours	63.5	307	371	1,300	4.9	28.5
		24 hours	15.2	110	125	365	4.2	34.3
		Annual	2.1	18.7	20.8	80	2.7	26.0
	NO_2	Annual	31.5	54.7	86.2	100	31.5	86.2
	CO	1 hour	1,180	13,400	14,600	40,000	2.9	36.4
		8 hours	441	4,780	5,220	10,000	4.4	52.2
	PM_{10}	24 hours	118	64.0	182	150	78.6	121
		Annual	25.7	32.0	57.7	50	51.4	115
	$PM_{2.5}$	24 hours	24.0	57.5	81.5	65	37.0	126
		Annual	6.5	24.1	30.6	15	43.1	204
C	SO_2	3 hours	56.6	307	364	1,300	4.4	28.0
		24 hours	13.0	110	123	365	3.6	33.7
		Annual	1.8	18.7	20.5	80	2.2	25.6
	NO_2	Annual	26.4	54.7	81.1	100	26.4	81.1
	CO	1 hour	1,130	13,400	14,500	40,000	2.8	36.3
		8 hours	411	4,780	5,190	10,000	4.1	51.9
	PM_{10}	24 hours	115	64.0	179	150	76.7	119
		Annual	21.5	32.0	53.5	50	43.0	107
	$PM_{2.5}$	24 hours	24.2	57.5	81.7	65	37.3	126
		Annual	5.4	24.1	29.5	15	36.1	197

Footnotes on next page.

TABLE 5.2-6 (Cont.)

[a] Emissions are from equipment and vehicle engine exhaust, except for PM_{10} and $PM_{2.5}$, which are also from soil disturbance.

[b] Data represent the maximum concentration increments estimated, except that the fourth- and eighth-highest concentration increments estimated are listed for 24-hour PM_{10} and $PM_{2.5}$.

[c] See Table 3.1-3.

[d] Total equals maximum modeled concentration plus background concentration.

[e] The values presented in the next-to-last column are maximum concentration increments as a percent of NAAQS and SAAQS. The values in the last column are total concentration increments as a percent of NAAQS and SAAQS.

or bulldozers during construction. Sources of noise during the construction of the conversion facility would include standard commercial and industrial activities for moving earth and erecting concrete and steel structures. Noise levels from these activities would be comparable to those from other construction sites of similar size.

The noise levels would be highest during the early phases of construction, when heavy equipment would be used to clear the site. This early phase of construction would last for about 6 months of the entire construction period of 1.5 years. Average noise levels for typical construction equipment range from 76 dB(A) for a pump, to 85 dB(A) for a bulldozer, to 101 dB(A) at peak for a pile driver (HMMH 1995). To estimate noise levels at the nearest residence, it was assumed the two noisiest pieces of equipment would operate simultaneously. A scraper and a heavy truck operating continuously typically generate noise levels of 89 and 88 dB(A), respectively, at a distance of 15 m (50 ft) from the source (HMMH 1995),[3] which results in a noise level of about 91.5 dB(A) at a distance of 15 m (50 ft).

The nearest residences to alternative Locations A, B, and C are located west, south-southeast, and northeast of them, respectively. The nearest residence, located about 0.9 km (0.6 mi) south-southeast of Location B and just off DOE's southern boundary, was selected as the receptor for the analysis of potential noise impacts. Noise levels decrease about 6 dB per doubling of distance from the point source because of the way sound spreads geometrically over an increasing distance. Thus, construction activities, which result in a combined noise level of about 91.5 dB(A) at a distance of 15 m (50 ft), would result in an estimated noise level of about 56 dB(A) at the nearest residence. This level would be 51 dB(A) as DNL, if it is assumed that construction activities would be limited to an 8-hour daytime shift. This 51-dB(A) estimate is below the EPA guideline of 55 dB(A) as DNL for residential zones (see Section 3.1.3.4), which was established to prevent interference with activity, annoyance, and hearing impairment. The 51-dB(A) estimate is probably an upper bound because it does not account for other types of attenuation, such as air absorption and ground effects due to terrain and vegetation. If only ground effects were considered (HMMH 1995), more than 10 dB(A) of attenuation would occur at the nearest residence, which would result in about 41 dB(A).

[3] Pile drivers were excluded because piles would not be required for buildings at the site.

Most of these construction activities would occur during the day, when noise is tolerated better than at night because of the masking effects of background noise. The resulting noise levels would be barely noticeable to the nearest residence for all three alternative locations. Nighttime noise levels would drop to the background levels of a rural environment because construction activities would cease at night.

5.2.2.4 Water and Soil

Construction of a conversion plant at Portsmouth would disturb land, use water, and produce liquid wastes. Impacts from constructing a conversion plant on surface water, groundwater, and soil resources are discussed below. Because site-specific impacts were not identified, impacts to water and soil at alternative Locations A, B, and C would be the same.

5.2.2.4.1 Surface Water. Construction of a conversion facility at the Portsmouth site would result in increased runoff to nearby surface waters because soil and vegetation would be replaced by either buildings or paved areas. The amount of increased runoff from the new, impermeable land surface would be negligible compared with the existing area that contributes to runoff (less than about 2% of the site area). None of the construction activities would measurably affect the existing floodplains.

During construction, water would be needed. Peak water consumption would be 5,500 gal/d (20,800 L/d) or 2.0 million gal/yr (7.6 million L/yr). This water would include 1,500 gal/d (5,700 L/d) for construction use and 4,000 gal/d (15,100 L/d) for the workforce. Water requirements for construction would be independent of the specific location selected at Portsmouth. Although the Portsmouth site has the ability to use water from the Scioto River, almost all water is currently obtained from four on-site wells and 31 off-site wells. Because construction water needs would be met by using groundwater, there would be no impacts on surface water resources.

Wastewater would also be produced during construction. For the assumed workforce, about 4,000 gal/d (15,140 L/d) or 1.5 million gal/yr (5.7 million L/yr) of sanitary wastewater would be generated. There would be no sanitary wastewater discharge to the environment because portable toilets would be used.

5.2.2.4.2 Groundwater. Potential impacts to groundwater could occur during construction. These impacts could include changes in effective recharge to underlying aquifers, changes in the depth to groundwater, changes in the direction of groundwater flow, and changes in groundwater quality.

Current water use at Portsmouth is about 4,312 million gal/yr (16,323 million L/yr). The maximum capacity of the well system is about 13,900 million gal/yr (52,617 million L/yr). If the rate of withdrawal was constant over time, about 3.8 gal/min (14.4 L/min) would be needed to construct the conversion plant. This rate of withdrawal would be about 0.05% of the annual average withdrawal and 0.01% of the excess well capacity. Direct impacts from such a withdrawal on groundwater resources (e.g., depth to groundwater and flow direction) would not be measurable and would be the same for all three alternative locations.

Construction could also affect the permeability of the surface soil and its ability to transmit water as recharge to the underlying aquifers. Because of the small associated operational areas (less than 2% of the land area available), these differences in permeability would produce changes in the effective recharge that would not be measurable. Similarly, the quality of groundwater beneath the selected location could be affected by surface construction activities through infiltration of contaminated surface water from spills. These impacts would be indirect because there would be no direct releases of contaminants to groundwater. Indirect contamination could result from the mobilization of exposed chemicals by precipitation, followed by infiltration of contaminated runoff water. Following good engineering and construction practices and implementing storm water and erosion control measures would minimize impacts to groundwater quality.

5.2.2.4.3 Soils. Potential impacts on soil could occur during construction and postulated accident scenarios. These impacts would include changes in topography, permeability, quality, and erosion potential.

Construction of a conversion facility at Portsmouth would disturb about 65 acres (26 ha) of land. Location A, however, has only 26 acres (11 ha) available. An additional 39 acres (16 ha) would be required for the disturbed area. An additional 19 acres (8 ha) of land would be required at the 46-acre (19-ha) Location B site. No additional land would be needed for the 78-acre (32-ha) Location C site. Because the conversion plant sites are relatively flat, there would be no significant changes in topography, and the maximum amount of land needed for construction would be small relative to the total land available at the site (less than about 2%). Erosion potential would increase during construction; the impacts, however, would be local and temporary.

Construction activities could also affect the quality of the land at the location selected for the conversion facility. The impacts could result from spills and other construction activities that could release contaminants to the surface. By following good engineering and construction practices (e.g., covering chemical stockpiles, cleaning up spills thoroughly as soon as they occur, and installing detention basins), impacts to soil quality would be minimized.

5.2.2.5 Socioeconomics

The socioeconomic analysis covers the effects from construction on population, employment, income, regional growth, housing, and community resources in the ROI around the Portsmouth site. Impacts from construction are summarized in Table 5.2-7. The socioeconomic impacts are not dependent on the location of the conversion facility; thus, the impacts would be the same for alternative Locations A, B, and C.

The potential socioeconomic impacts would be relatively small. Construction activities would create direct employment of about 190 people in the peak construction year and about 90 additional indirect jobs in the ROI. Construction activities would increase the annual average employment growth rate by about 0.1 percentage point over the duration of construction. A conversion facility at Portsmouth would produce about $9 million in personal income in the peak year of construction.

In the peak year of construction, it is estimated that about 300 people would in-migrate to the ROI. However, in-migration would only marginally affect population growth and would only require about 4% of vacant rental housing in the peak year. No significant impact on public finances would occur as a result of in-migration, and fewer than 5 local public service employees would be required to maintain existing levels of service in the various local public service jurisdictions in Pike and Scioto Counties.

TABLE 5.2-7 Socioeconomic Impacts from Construction of the Conversion Facility at the Portsmouth Site

Impact Area	Construction Impacts[a]
Employment	
Direct	190
Total	290
Income (millions of 2002 $)	
Direct	5.3
Total	8.9
Population (no. of new ROI residents)	300
Housing (no. of units required)	110
Public finances (% impact on fiscal balance)	
Cities in Pike County[b]	0.3
Pike County	0.2
Schools in Pike County[c]	0.3
Cities in Scioto County[d]	0.2
Scioto County	0.2
Schools in Scioto County[e]	0.2
Public service employment (no. of new employees)	
Pike County	
Police officers	0
Firefighters	0
General	1
Physicians	0
Teachers	1
Scioto County	
Police officers	0
Firefighters	0
General	2
Physicians	0
Teachers	1
No. of new staffed hospital beds	
Pike County	1
Scioto County	1

[a] Impacts are shown for the peak year of construction (2005).

[b] Includes impacts that would occur in the cities of Waverly and Piketon.

[c] Includes impacts that would occur in Waverly and Pike County school districts.

[d] Includes impacts that would occur in the City of Portsmouth.

[e] Includes impacts that would occur in New Boston, Portsmouth, Wheelersburg, and Scioto County school districts.

5.2.2.6 Ecology

Potential impacts to vegetation, wildlife, wetlands, and threatened and endangered species that could result from the construction of a conversion facility are described below. Additional information regarding wetlands and federally listed species can be found in Van Lonkhuyzen (2004).

5.2.2.6.1 Vegetation. Existing vegetation within the disturbed area would be destroyed during land clearing activities. Construction of a conversion facility at any of the three alternative locations at the Portsmouth site is not expected to threaten the local population of any species. Replanting disturbed areas with native species would comply with Executive Order 13148, *Greening the Government through Leadership in Environmental Management* (U.S. President 2000). Erosion of exposed soil at construction sites could reduce the effectiveness of restoration efforts and create sedimentation downgradient of the construction site. However, the implementation of standard erosion control measures, installation of storm water retention ponds, and immediate replanting of disturbed areas with native species would help minimize impacts to vegetation. Deposition of fugitive dust resulting from construction activities could adversely affect vegetation; however, the use of control measures to reduce dust production could minimize impacts (see Section 5.2.2.3).

Constructing a facility at Location A, the preferred alternative, would result in the loss of about 10 acres (4 ha) of previously disturbed managed grassland and old field vegetation. The facility would not replace undisturbed natural communities. Managed grassland and old field communities comprise most of the vegetation on the Portsmouth site, within the Perimeter Road. The loss of 10 acres (4 ha) would, therefore, represent a minor decrease in these habitats on the Portsmouth site. This area represents about 38% of the area available at the 26-acre (11-ha) Location A. The total area of construction-related disturbance, however, would be approximately 65 acres (26 ha) in size. Although construction-related activities would primarily affect managed grassland and old field vegetation, impacts to the wooded areas at this location would also occur during the construction period. Construction of the conversion facility access road and rail lines would result in impacts to several wooded areas within Location A. These areas, east of Building X-744-S (and "C" Road), north of Building X-744-U, and northwest of Building X-744-T, primarily support sapling and mature black locust. Additional impacts to wooded areas could occur unless temporary construction areas, such as lay-down areas, were positioned outside Location A in adjacent, previously disturbed areas. If facility construction required the disturbance of all of Location A, the entire wooded area at this location, including the riparian forest community, would potentially be eliminated. Riparian forest represents only a small portion (only about 4%) of the Portsmouth site. The construction of utility lines, access roads, and rail lines would extend beyond Location A and would result in additional impacts to vegetation. Construction of rail lines west of Location A would primarily affect managed grassland vegetation. However, impacts to the riparian forest community along the intermittent stream might occur near the point of connection of the new rail line with the existing line east of Perimeter Road.

Construction at Location B would affect previously disturbed managed grassland vegetation. The type of vegetation community affected by construction would not depend on the positioning of the facility within this 46-acre (19-ha) location. However, impacts to vegetation in the western portion of this location would be small because buildings and paved areas are already located there. A facility 10 acres (4 ha) in size would occupy approximately 22% of the area available at this location. However, the total area expected to be disturbed would likely require the use of areas outside Location B for construction-related activities.

The vegetation communities affected by construction at Location C would depend on the placement of the facility within the 78-acre (32-ha) area; however, construction at Location C would not directly affect undisturbed natural communities. A facility 10 acres (4 ha) in size would occupy only 13% of the area available at this location. Facility construction would primarily affect previously disturbed managed grassland vegetation. The wooded areas in the west-central portion of Location C could be avoided by placing the facility in other areas of the location. Impacts to these wooded areas from construction-related activities could be avoided by positioning of the facility in the northern portion of Location C.

5.2.2.6.2 Wildlife. Wildlife would be disturbed by land clearing, noise, and human presence. Construction noise, up to 91.5 dB(A) at 15 m (50 ft), would disturb wildlife in the vicinity of the construction site during daylight construction hours. Wildlife with restricted mobility, such as burrowing species or juveniles of nesting species, would be destroyed during land clearing activities. More mobile individuals would relocate to adjacent available areas with suitable habitat. Population densities, and thus competition for food and nesting sites, would increase in these areas, potentially reducing the survivability or reproductive capacity of displaced individuals. Some wildlife species would be expected to recolonize replanted areas near the conversion facility following completion of construction. Construction of a conversion facility at any of the three locations is not expected to threaten the local population of any wildlife species because similar habitat would be available near the site.

Constructing a conversion facility at Location A would primarily impact those species commonly associated with managed grasslands and old field communities. Large areas of similar habitat would be available nearby. Construction would also affect the habitat of woodland species, such as neotropical migratory birds. Woodland habitat would be impacted by construction of the access roads and rail lines, and additional woodland habitat could be eliminated unless temporary construction areas were positioned outside Location A. However, the wooded areas that would be affected by rail line and access road construction are small and previously disturbed and do not represent a mature forest community. Similar habitat would be available nearby. The construction of the new rail line adjacent to the riparian woodland along the northern margin of Location A could limit the suitability of this habitat for some wildlife species. If facility construction required the disturbance of all of Location A, the entire wooded habitat at this location would potentially be eliminated. The construction of utility lines, access roads, and rail lines would extend beyond Location A and would result in additional impacts to wildlife habitat.

Constructing a conversion facility at Location B would affect the habitat of those species commonly associated with managed grasslands. Similar habitat would be abundant in areas near the Portsmouth site. Impacts to wildlife would be minimized in the western portion of Location B since buildings already exist there.

Facility construction at Location C would also affect the habitat of species associated with managed grasslands. However, similar habitat would be abundant in other areas of the Portsmouth site. Impacts to species associated with the open woodland areas in the west-central portion of Location C could be avoided by placing the facility in the northern portion of this location. Construction of a facility immediately adjacent to the woodlands could reduce the habitat's suitability for some wildlife species. However, the wooded areas that would be affected are small and previously disturbed and do not represent mature forest communities.

5.2.2.6.3 Wetlands. Wetlands could be affected by filling or draining during construction. Impacts to wetlands due to alteration of surface water runoff patterns, soil compaction, or groundwater flow could occur if the conversion facility was located immediately adjacent to wetland areas. Impacts to wetlands could be minimized, however, by maintaining a buffer area around them during facility construction. Executive Order 11990, *Protection of Wetlands* (U.S. President 1977a), requires federal agencies to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial uses of wetlands. 10 CFR Part 1022 sets forth DOE regulations for implementing Executive Order 11990 as well as Executive Order 11988, *Floodplain Management* (U.S. President 1977b). Unavoidable impacts to wetlands that are within the jurisdiction of the USACE might require a CWA Section 404 Permit, which would trigger the requirement for a CWA 401 water quality certification from Ohio. An approved mitigation plan might be required prior to the initiation of construction.

Surface water sources are not expected to be used to meet water requirements during construction. Changes in groundwater as a result of withdrawing water for construction and the increase in the impermeable surface related to facility construction would be small to negligible (Section 5.2.2.4). Therefore, except for the potential local indirect impacts noted above, impacts to regional wetlands due to groundwater or surface water levels or flow patterns are not expected to occur.

Construction of a conversion facility at Location A would result in impacts to the small wetland located within the drainage channel in the east-central portion of this location (Figure 5.2-1). Construction of the south access road connecting to "C" Road would eliminate much of this wetland. Approximately 950 ft^2 (88 m^2) of palustrine emergent wetland would likely be eliminated by direct placement of fill material. In addition, portions of the facility fence line cross this wetland, and a small building would be adjacent to the wetland. Portions of this wetland that are not filled might be indirectly affected by an altered hydrologic regime because of the proximity of construction, possibly resulting in a decreased frequency or duration of inundation or soil saturation, and potential loss of hydrology necessary to sustain wetland conditions, which would result in likely changes to the wetland plant and animal communities. However, the impact may potentially be avoided by an alternative routing of the entrance road, or mitigation may be developed in coordination with the appropriate regulatory agencies. Placement of temporary construction areas outside Location A might be necessary to avoid additional impacts to this wetland. Construction of a conversion facility could also affect the hydrology of the intermittent stream along the northern margin of Location A. The increase in impervious surface and discharge of storm water runoff could result in a greater fluctuation in flows, with a greater amplitude in high flows and extended low flows within the stream. However, because the facility would not be located adjacent to the stream and only a small portion of the watershed would be involved, impacts would likely be small. Downstream wetlands could be affected by sedimentation during construction; however, the implementation of erosion control measures would reduce the likelihood of impacts. Direct impacts to the stream would occur if a storm water outfall structure was located within the streambed.

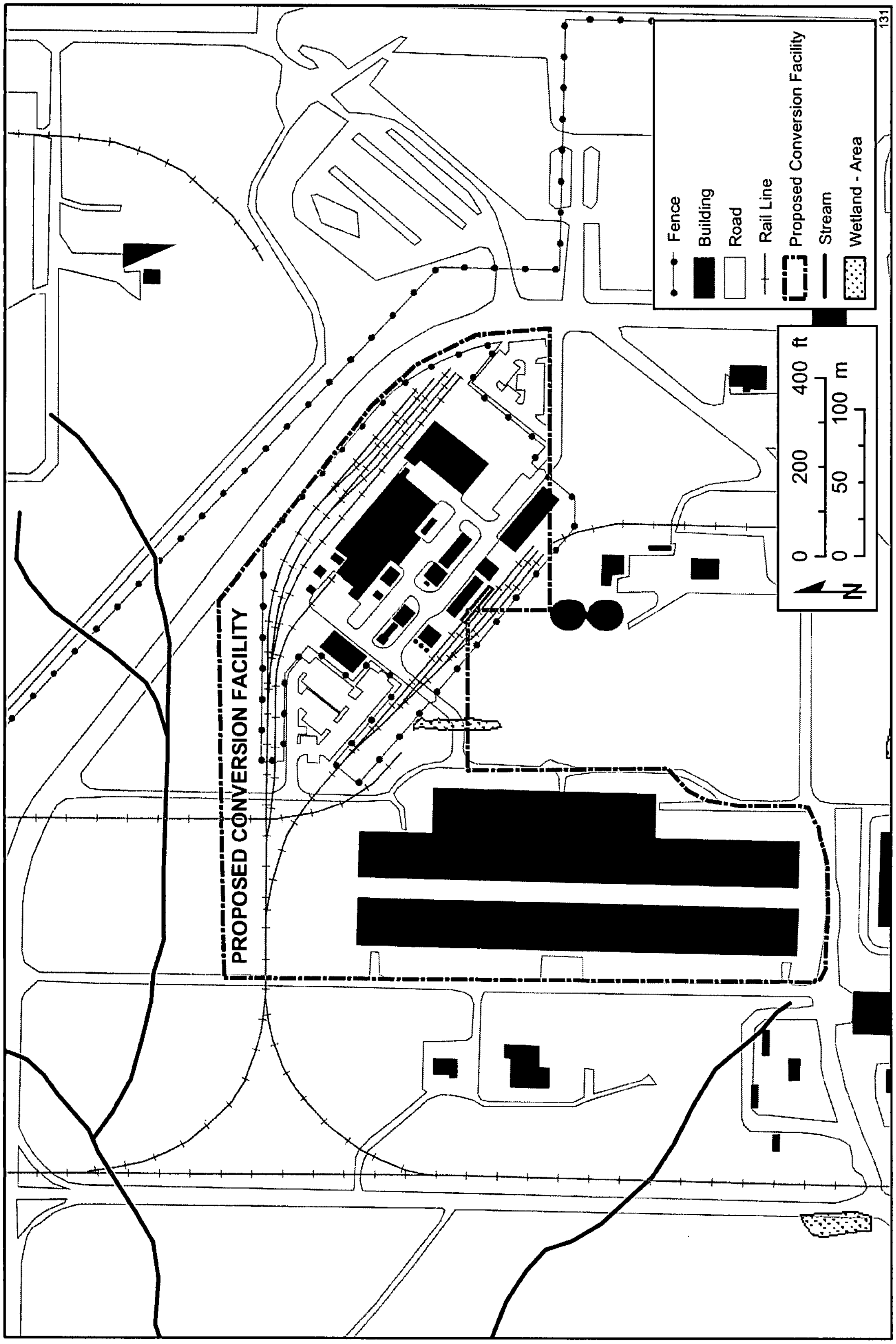

FIGURE 5.2-1 Wetlands within Location A at the Portsmouth Site

Construction of a facility at Location B would not result in direct impacts to wetlands. However, the hydrologic characteristics of wetlands in areas next to and south of this location could be indirectly affected by adjacent construction, possibly resulting in a decreased frequency or duration of inundation or soil saturation. Indirect impacts could be minimized by maintaining a buffer near adjacent wetlands. Downstream wetlands could be affected by sedimentation during construction; however, the implementation of erosion control measures would reduce the likelihood of sediment impacts.

Construction of a facility at Location C would not result in direct impacts to wetlands. However, the hydrologic characteristics of the wetland next to the northwest boundary of this location could be indirectly affected by adjacent construction, possibly resulting in a decreased frequency or duration of inundation or soil saturation. Indirect impacts could be minimized by maintaining a buffer near adjacent wetlands. Placement of a conversion facility next to the drainages along the western margin of Location C could alter the hydrology, including the X-230K Holding Pond, causing greater fluctuations in high and low flows. However, because only a small portion of the watershed would be involved, impacts would likely be small. Downstream wetlands could be affected by sedimentation during construction; however, the implementation of erosion control measures would reduce the likelihood of impacts.

5.2.2.6.4 Threatened and Endangered Species. Construction of a conversion facility at Location A is not expected to result in direct or indirect impacts to any federal- or state-listed species. However, impacts to wooded areas at Location A would occur as a result of the construction of facility access roads and rail lines, and additional woodland habitat could be eliminated unless temporary construction areas were positioned outside Location A. Trees with exfoliating bark, such as shagbark hickory or dead trees with loose bark, can be used by the Indiana bat (federal- and state-listed as endangered) for roosting during the summer. However, the wooded areas at Location A have not been identified as summer habitat. If facility construction required the disturbance of all of Location A, the entire wooded habitat at this location would potentially be eliminated. In addition, impacts to the riparian forest community along the intermittent stream might occur west of Location A, near the point of connection of the new rail line with the existing line east of Perimeter Road. If live or dead trees with exfoliating bark are encountered in construction areas, they should be saved if possible. If necessary, the trees should be cut before April 15 or after September 15. Disturbance due to increased noise, lighting, and human presence during the construction of the new rail line adjacent to the riparian forest habitat along the northern margin of Location A could decrease the quality of this habitat for the Indiana bat. However, Indiana bats that might use habitat near the Portsmouth site would be currently exposed to noise and other effects of human disturbance. Consequently, these effects related to construction activities would be expected to be minor.

Location B does not support habitat for federal- or state-listed species; therefore, construction at this location would not impact listed species. Although impacts to the woodland habitats at Location C could occur, these wooded areas have not been identified as Indiana bat summer habitat. In addition, impacts to the wooded areas at Location C could likely be avoided by facility placement in the northern portion of this location. Because of existing human disturbance in the vicinity of Locations A, B, and C, the construction of a conversion facility would not affect the quality of potential Indiana bat habitat along Little Beaver Creek, the Northwest Tributary Stream, or the wooded area east of the X-100 facility.

5.2.2.7 Waste Management

Potential waste management impacts at Portsmouth during construction were evaluated by determining the types and estimating the volumes of wastes that would be generated. Waste management impacts would not depend on the location of the conversion facility within the site and would therefore be the same for alternative Locations A, B, and C. The estimates are presented in Table 5.2-8 and are compared with projected site generation volumes.

Construction of the conversion facility would generate both hazardous and nonhazardous wastes. Hazardous waste would be sent to off-site permitted contractors for disposal. Nonhazardous waste would be disposed of off site at a state-permitted landfill. No radioactive waste would be generated during the construction phase. Overall, only minimal waste management impacts would result from the construction-generated wastes.

5.2.2.8 Resource Requirements

The resources required for facility construction would not be dependent on the location of the facility. Materials related to construction would include concrete, sand, gravel, steel, and other metals (Table 5.2-9). At this time, no unusual construction material requirements have been identified. The construction resources, except for those that could be recovered and recycled with current technology, would be irretrievably lost. None of the identified construction resources are in short supply, and all should be readily available in the local region.

Small to moderate amounts of specialty materials (i.e., Monel and Inconel) would be required for construction of the conversion facility in quantities that would not seriously reduce the national or world supply. This material would be used throughout the facilities and is used in the generation of HF in the conversion process. The autoclaves and conversion units (process reactors) are long-lead-time procurements with few qualified bidders. Many suppliers are available for the remainder of the equipment.

TABLE 5.2.8 Wastes Generated from Construction Activities for the Conversion Facility at the Portsmouth Site[a]

Waste Category	Volume
Hazardous waste	115 m^3
Nonhazardous waste	
Solids	700 m^3
Wastewater	3.8×10^6 L
Sanitary wastewater	1.1×10^7 L

[a] Total waste generated during a construction period of 2 years. Because data were not available for the UDS conversion facility, data developed for the DUF_6 PEIS (Dubrin et al. 1997) were used.

TABLE 5.2-9 Materials/Resources Consumed during Construction of the Conversion Facility at the Portsmouth Site

Materials/Resources	Total Consumption	Unit	Peak Demand	Unit
Utilities				
Water	4×10^6	gal	1,500	gal/h
Electricity	1,500	MWh	7.2	MWh/d
Solids				
Concrete	9,139	yd^3	NA[a]	NA
Steel	511	tons	NA	NA
Inconel/Monel	33	tons	NA	NA
Liquids				
Fuel	73,000	gal	250	gal/d
Gases				
Industrial gases (propane)	15,000	gal	50	gal/d

[a] NA = not applicable.

5.2.2.9 Land Use

The preferred location for the facility (Location A) covers 26 acres (10 ha) and presently features three structures on a site with more than 150 additional structures. Constructing a conversion facility at Location A would involve very slight modifications of existing land use. The resulting facility would be consistent with the heavy industrialized land use currently found at the Portsmouth site — a consequence of producing enriched uranium and its DUF_6 by-product. As a consequence, no land use impacts are anticipated as a result of constructing a conversion facility at Location A.

Use of either Location B or C considered for the conversion facility would have similar impacts. Location B is larger than the preferred location and covers about 50 acres (20 ha); it currently has two structures within its boundary. Location C also is larger than the preferred location, covering 78 acres (31 ha) and consisting of a grassy field. Land use impacts from construction on Location B would be very like those on Location A, with only slight modifications of existing land use. Land use impacts from construction on Location C would entail greater shifts in land use on the specific tract proposed, but within a site that already is heavily industrialized. In either case, the resulting facility would be consistent with current land use, and, as a result, negligible (for Location C) or no land use impacts are anticipated.

5.2.2.10 Cultural Resources

Construction could potentially impact cultural resources. Currently, the amount of data on cultural resources within the project area at Portsmouth (Locations A, B, and C) is not sufficient to determine whether or not the proposed construction would adversely affect significant resources. Consequently, the possibility of adverse effects on cultural resources cannot be excluded.

Archaeological and architectural surveys were undertaken for Portsmouth in 1996. The findings from these surveys have not been finalized and have not received concurrence from the Ohio SHPO. Past ground disturbance resulting from grading and construction make it unlikely that intact archaeological remains are present at the proposed alternative locations. Preliminary results from the 1996 archaeological survey suggest that these locations are too disturbed to warrant subsurface testing (Anderson 2002). However, unless these findings receive SHPO concurrence, a separate archaeological assessment of the proposed area for the construction would be required to ensure that cultural material is not present and that Section 106 obligations under the NHPA are met. If archaeological resources were encountered and determined to be significant, a mitigation plan would have to be developed and executed in consultation with the Ohio SHPO prior to construction. In general, mitigation of an adverse effect of facility construction on cultural resources could entail site avoidance, monitoring during construction, or excavation/data recovery.

Two of the alternative locations (A and B) include existing structures dating to the Cold War era. It is possible that these structures would be demolished or modified during construction of a new facility. The historical significance of these structures, if any, has yet to be determined. Location A includes three warehouses formerly used to store lithium hydroxide. Location B includes two structures (X-3346 and X-1107F) associated with the Gaseous Centrifuge Enrichment Plant complex. The historical significance of these structures and any other standing structures that would be affected by the proposed action should be evaluated prior to any modification or demolition with respect to their contribution to the significance of the Portsmouth GDP operations during the Cold War. Following the Section 106 consultation process, if these structures were determined to be historically significant, either individually or as contributing members of a historic district, appropriate mitigation activities (e.g., avoidance, data recovery, monitoring) would have to be determined in consultation with the Ohio SHPO and implemented before the facility could be constructed. Location C does not contain standing structures.

No Native American traditional cultural properties have been identified at Portsmouth to date. Government-to-government consultations with Native American groups have been initiated (Appendix G). If the proposed action would result in an adverse effect on any such property identified, appropriate mitigation as determined through continued consultation would have to be undertaken before construction could begin.

5.2.2.11 Environmental Justice

The evaluation of environmental justice impacts associated with construction is based on the identification of high and adverse impacts in other impact areas considered in this EIS, followed by a determination if those impacts would affect minority and low-income populations disproportionately. Analyses of impacts from conversion facility construction under the action alternatives do not indicate the presence of high and adverse impacts for any of the other impact areas considered in this EIS (see Sections 5.2.2.1 through 5.2.2.10). Despite the presence of disproportionately high percentages of both minority and low-income populations within 50 mi (80 km) of the site, no environmental justice impacts from constructing the conversion facility are anticipated for Locations A, B, or C. Similarly, no evidence indicates that minority or low-income populations would experience high and adverse impacts from the proposed construction in the absence of such impacts in the population as a whole.

5.2.3 Portsmouth Site — Operational Impacts

This section discusses the potential environmental impacts during operation of a conversion facility at the three alternative locations within the Portsmouth site. During normal operations, the facility would emit only small amounts of contaminants through air emissions; no contaminated liquid effluents would be produced during the dry conversion process. The operational period would be 18 years, including conversion of the DUF_6 cylinders from ETTP. If the ETTP cylinders were not converted at Portsmouth, the operational period would be 14 years.

5.2.3.1 Human Health and Safety — Normal Facility Operations

5.2.3.1.1 Radiological Impacts. Radiological impacts to involved workers during normal operation of the conversion facility would result primarily from external radiation from the handling of depleted uranium materials. Impacts to noninvolved workers and members of the public would result primarily from trace amounts of uranium compounds released to the environment. Background information on radiation exposure is provided in Chapter 4; details on the methodologies are provided in Appendix F. Impacts to involved workers, noninvolved workers, and the general public would be similar for the three alternative locations.

Radiation exposures of the involved workers in the conversion facility were estimated on the basis of the measurement data on worker exposures in the Framatome ANP, Inc., facility in Richland, Washington. The Framatome facility uses a dry conversion process to convert UF_6 into uranium oxide and has been in operation since 1997. UDS would implement a similar conversion technology in the Portsmouth facility, and the key components would be similar to those of the Framatome ANP facility. Therefore, conditions for potential worker exposures at Portsmouth are expected to be similar to those at Framatome. However, the processing rate of uranium at Portsmouth (38 t [42 tons] of DUF_6 per day) would be greater than that at Framatome (9 t [10 tons] of UF_6 per day). To process more uranium materials, three conversion lines would be installed, and more workers or longer work hours from each worker would be required. On the other hand, the specific activity of the uranium materials handled at Framatome (about 3.5×10^6 pCi/g [Edgar 1994]) is greater than that of depleted uranium (about 4.0×10^5 pCi/g). Consequently, the total radiological activities contained in each key component at Portsmouth would be less than those at Framatome, resulting in a smaller radiation dose rate from each component at Portsmouth. Because the actual worker activities and the activity duration and frequencies are not available for the conversion facility at this time, using worker exposure data from the Framatome facility is expected to provide a reasonable estimate of the potential radiation exposures of the involved workers at the Portsmouth facility. According to UDS (2003a,b), the conversion process would be very automated; therefore, the requirement of working at close distances to radiation sources would be limited. Potential radiation exposures of workers would be monitored by a dosimetry program and would be kept below the regulatory limit. The implementation of ALARA practices would further reduce the potential of exposures.

Potential radiation exposures of the involved cylinder yard workers would result mainly from the following activities: (1) receiving and inspecting ETTP cylinders upon arrival and putting them into storage; (2) regularly maintaining cylinders at the storage yards, including the current inventory of both DUF_6 and non-DUF_6 cylinders and the ETTP cylinders; and (3) preparing and transferring cylinders to the conversion facility. The first activity could last up to 6 years (from 2004 up to December 2009, when all cylinders are required to have been removed from ETTP); however, for the purpose of analysis and to provide bounding estimates of annual impacts, it is assumed to last for only 2 years. The other two activities would last for about 18 years — the operation period of the conversion facility. Under the action alternatives, cylinder maintenance activities during the conversion period would most likely stay the same as those currently implemented, except that the number of depleted uranium cylinders maintained would decrease steadily from the starting level. Therefore, potential radiation exposures caused by maintenance activities were estimated by scaling the current cylinder yard exposure data.

Potential exposures resulting from transferring cylinders to the conversion facility were estimated by using the following assumptions: (1) retrieving each cylinder to transportation equipment would involve two workers each spending half an hour at a distance of 3 ft (1 m) from the cylinder, (2) inspecting a cylinder would require two workers each spending half an hour at a distance of 1 ft (0.30 m) from the cylinder, and (3) each transfer from the cylinder yard to the conversion facility would require two workers for about half an hour at a distance of 6 ft (2 m) from the cylinders. Similar assumptions were used for estimating potential radiation exposures from receiving and placing the ETTP cylinders in storage. After inspection, the cylinder would be transported to the designated cylinder yard for storage. In the cylinder yard, each cylinder would be placed into storage position by two workers. This would take about half an hour at an exposure distance of 3 ft (1 m). All the above assumptions were developed for the purpose of modeling potential radiation exposures; in actuality, inspection, preparation, and transferring activities would probably take less time and involve fewer workers. As a result, radiation doses estimated on the basis of these assumptions are conservative.

Noninvolved workers would be those who would work in the conversion facility but would not perform hands-on activities and those who would work elsewhere on the Portsmouth site. Depending on the location of the conversion facility, the location of the MEI would be different, and the associated radiation exposure might also vary. However, according to the previous analyses in the DUF_6 PEIS and the small uranium emission rate provided by UDS (2003b) for the conversion facility, potential radiation exposures of the noninvolved workers would be very small. An estimate of the bounding exposure, on the basis of the estimated maximum downwind air concentrations, is provided for the MEI in this section. According to the estimated bounding exposure, which is less than 6×10^{-6} mrem/yr, it is anticipated that the potential collective exposure of the noninvolved workers would also be very small and would be less than the product of the bounding MEI dose and the number of the noninvolved workers.

The location of the conversion facility within the Portsmouth site would have very little impact on collective exposures of the off-site public because of the much larger area (a circle with a radius of 50 mi [80 km]) considered for the collective exposures than the area of the Portsmouth site. The estimate of the collective exposure was obtained by using the emission rate (< 0.25 g/yr for uranium) provided in UDS (2003b) and the population distribution information obtained from the 2000 census. The actual location of the off-site public MEI would depend on the selected location of the conversion facility and the site boundary. The potential exposure would be bounded by the exposure associated with the maximum air concentrations, which are the same as those used for estimating the bounding exposure of the noninvolved worker MEI. The bounding exposure of the off-site public MEI would be greater than that of the noninvolved worker MEI because of the longer exposure duration (8,760 h/yr versus 2,000 h/yr) assumed for the off-site public than for the noninvolved workers, and because of consideration of the food ingestion pathway for the off-site public (see Appendix F for more detailed information).

As discussed in Chapter 1 and Appendix B, some portion of the DUF_6 inventory contains TRU and Tc contamination. The TRU materials and most of the Tc material are expected to remain in the emptied cylinders after the withdrawal of DUF_6. A small quantity of Tc might become vaporized and end up in the conversion process equipment, having been converted to technetium oxide. However, airborne emission of Tc is not anticipated because the oxide particles would be captured in the U_3O_8 product. The contribution to the potential external radiation exposures from these contaminants under normal operations were evaluated on the basis of bounding concentrations presented in Appendix B. The dose from these contaminants was estimated and compared with the dose from the depleted uranium and uranium decay products in the DUF_6. It is estimated that under normal operational conditions, the TRU and Tc contaminants would result in a very small contribution to the radiation doses — approximately 0.2% of the dose from the depleted uranium and its decay products.

Estimated potential annual radiation exposures and corresponding LCFs of the various receptors as a result of normal operations of the conversion facility are presented in Table 5.2-10 (impacts would be the same for all three alternative locations). The average individual dose for involved workers in the conversion facility is estimated to be about 75 mrem/yr (UDS 2003b). Collective exposures of the involved workers would depend on the number of workers required in the conversion facility. A total of about 135 involved workers would be required (UDS 2003b). The total collective exposure of the involved workers in the conversion facility would then be about 10.1 person-rem/yr. The estimated average cancer risk for individual workers would be about 3×10^{-5}/yr (1 chance in 33,000 of developing 1 LCF per year).

TABLE 5.2-10 Estimated Radiological Doses and Cancer Risks under Normal Conversion Facility Operations at the Portsmouth Site[a]

	Receptors					
	Involved Workers[b]		Noninvolved Workers[c]		General Public	
Location	Average Dose/Risk (mrem/yr) / (risk/yr)	Collective Dose/Risk (person-rem/yr) / (fatalities/yr)	MEI Dose/Risk[d] (mrem/yr) / (risk/yr)	Collective Dose/Risk (person-rem/yr) / (fatalities/yr)	MEI Dose/Risk[e] (mrem/yr) / (risk/yr)	Collective Dose/Risk[f] (person-rem/yr) / (fatalities/yr)
Radiation doses						
Conversion facility	75	10.1	$< 5.5 \times 10^{-6}$	$< 9.9 \times 10^{-6}$	$< 2.1 \times 10^{-5}$	6.2×10^{-5}
Cylinder yards[g]	510 – 600 (1180)	2.6 – 3.0 (9.4)	–[h]	–	–	–
Cancer risks						
Conversion facility	3×10^{-5}	4×10^{-3}	$< 3 \times 10^{-12}$	$< 5 \times 10^{-9}$	$< 1 \times 10^{-11}$	3×10^{-8}
Cylinder yards[g]	2×10^{-4} (5×10^{-4})	1×10^{-3} (4×10^{-3})	–	–	–	–

a Impacts are reported as best estimates or bounding values. They are the same regardless of the location of the conversion facility.

b Involved workers are those workers directly involved with handling radioactive materials. For the conversion facility, 135 involved workers were assumed. Calculation results are presented as average individual dose and collective dose for the worker population.

c Noninvolved workers include individuals who work at the conversion facility but are not directly involved in handling materials, and individuals who work at the Portsmouth site but not within the conversion facility. The population size of noninvolved workers is about 1,800.

d The noninvolved worker MEI doses are the bounding estimates corresponding to the estimated maximum downwind air concentrations. The exposures would result from inhalation, external radiation, and incidental soil ingestion.

e The general public MEI doses are the bounding estimates corresponding to the estimated maximum downwind air concentrations. The exposure would result from inhalation; external radiation; and ingestion of plant foods, meat, milk, and soil.

f Collective exposures were estimated for the population (about 670,000 persons) within a 50-mi (80 km) radius around the Portsmouth site. The exposure pathways considered were inhalation; external radiation; and ingestion of plant foods, meat, milk, and soil.

g Radiation exposures estimated for cylinder yard workers were obtained by considering maintenance, preparation, and transferring activities, with the assumption of a total of 5 workers every year. These exposures are expected to last for the entire conversion operation period. Results listed in parentheses include radiation exposures resulting from unloading, inspecting, and placing the ETTP cylinders into storage position, in addition to maintaining, preparing, and transferring cylinders. A total of 8 workers is assumed every year. These higher levels of exposures are assumed to last only for the first 2 years.

h A dash indicates that potential air emissions from cylinder maintenance or preparation activities are expected to be negligible. Therefore, no impacts were estimated for the noninvolved workers and the off-site general public.

The average individual dose for workers working at the cylinder yards would vary over the conversion period. For the first 2 years(based on the assumption discussed above), because of receiving, inspecting, and putting the ETTP cylinders into storage position, potential radiation exposures are expected to be greater than those in the following years. It is estimated that handling the arriving cylinders would result in a collective exposure of about 12.3 person-rem. The total person-hours estimated to be required for the handling activities is about 13,000. For the purpose of calculating an average individual exposure, a total of eight workers is assumed. The average individual exposure for the first 2 years is thus estimated to be about 1,180 mrem/yr. Beyond the first 2 years, it is judged that five workers would be sufficient to handle the planned activities. The average individual exposure for the remaining years is estimated to range from about 510 to 600 mrem/yr (the collective dose ranges from 2.5 to 3.0 person-rem/yr). The larger exposure corresponds to the third year of conversion operations, and the smaller exposure corresponds to the last year of operations. The estimated average doses for cylinder yard workers are well below the dose limit of 5,000 mrem/yr set for radiation workers (10 CFR Part 835). The corresponding latent cancer risk for an average worker would be about 5×10^{-4} per year (1 chance in 2,000 of developing 1 LCF per year) or less. UDS has proposed 28 workers for cylinder management activities (UDS 2003b); therefore, the actual average dose to individual workers is likely to be less than the above estimated values.

Because of the small airborne release rates of depleted uranium during normal operations, potential radiation exposures of the noninvolved workers would be very small regardless of where the conversion facility was located within the Portsmouth site. The radiation dose incurred by the MEI was modeled to be less than 6.0×10^{-6} mrem/yr. This small radiation dose would correspond to potential excess latent cancer risks of less than 3×10^{-12} per year (1 chance in 330 billion of developing 1 LCF per year). For comparison, the dose limit set for airborne releases from operations of DOE facilities is 10 mrem/yr (40 CFR 61).

Radiation exposures of the off-site public also would be very small regardless of the location of the conversion facility. The MEI dose was modeled to be less than 3.0×10^{-5} mrem/yr. This dose is much less than the radiation dose limits of 100 mrem/yr (DOE 1990) from all pathways and 10 mrem/yr (40 CFR Part 61) from airborne pathways set to protect the general public from operations of DOE facilities. The corresponding latent cancer risk would be less than 1×10^{-11} per year (1 chance in 100 billion of developing 1 LCF per year). Because of no waterborne discharge of uranium (UDS 2003b), radiation exposure to the off-site public from using surface water near the facility would be negligible.

5.2.3.1.2 Chemical Impacts. Potential chemical impacts to human health from normal operations at the conversion facility would result primarily from exposure to trace amounts of the insoluble uranium compound U_3O_8 and to HF released from the process exhaust stack. Risks from normal operations were quantified on the basis of calculated hazard indices. General information concerning the chemical impact analysis methodology is provided in Chapter 4.

The hazard indices were calculated on the basis of air dispersion modeling, which identified the locations of maximum ground-level concentrations of uranium compounds and HF emitted from the conversion facility. Since the maximum concentration locations were used for modeling both noninvolved worker and general public exposures, the impacts would be the same for the three alternative locations assessed.

Conversion to U_3O_8 would result in very low levels of exposure to hazardous chemicals. No adverse health effects to noninvolved workers or the general public are expected during normal operations. Human health impacts resulting from exposure to hazardous chemicals during normal operations of the conversion facilities are estimated as hazard indices of 3.8×10^{-7} and 4.1×10^{-5} for the noninvolved worker and general public MEI, respectively. The hazard indices for the conversion process would be at least three orders of magnitude lower than the hazard index of 1, which is the level at which adverse health effects might be expected to occur in some exposed individuals.

Impacts to involved workers from exposure to chemicals during normal operations are not expected. The workplace would be monitored to ensure that airborne chemical concentrations were within applicable health standards that are protective of human health and safety. If planned work activities were likely to expose involved workers to chemicals, workers would be provided with appropriate protective equipment, as necessary.

5.2.3.2 Human Health and Safety — Facility Accidents

A range of accidents covering the spectrum from high-frequency/low-consequence events to low-frequency/high-consequence accidents was considered for DUF_6 conversion operations. The accident scenarios considered such events as releases due to cylinder damage, fires, plane crashes, equipment leaks and ruptures, hydrogen explosions, earthquakes, and tornadoes. The accident scenarios considered in the assessment were those identified in the DUF_6 PEIS (DOE 1999a), modified to take into account the specific conversion technology and facility design proposed by UDS (UDS 2003b; Folga 2003). A list of bounding radiological and chemical accidents – that is, those accidents expected to result in the highest consequences in each frequency category should the accident occur – for the UDS conversion facility is provided in UDS (2003b). The bounding accident scenarios and their estimated consequences are discussed below for both radiological and chemical impacts.

5.2.3.2.1 Radiological Impacts. Potential radiation doses from accidents were estimated for noninvolved workers at the Portsmouth site and members of the public within a 50-mi (80-km) radius of the site for both MEIs and the collective populations. Impacts to involved workers under accident conditions would likely be dominated by physical forces from the accident itself; thus, quantitative dose/effect estimates would not be meaningful. For these reasons, the impacts to involved workers during accidents are not quantified in this EIS. However, it is recognized that injuries and fatalities among involved workers would be possible if an accident did occur.

Table 5.2-11 lists the bounding accidents in each frequency category (i.e., the accidents that were found to have the highest consequences) for radiological impacts. The estimated

TABLE 5.2-11 Bounding Radiological Accidents Considered for Conversion Operations at the Portsmouth Site[a]

Accident Scenario	Accident Description	Chemical Form	Amount (lb)	Duration (min)	Release Level[b]
Likely Accidents (frequency: 1 or more times in 100 years)					
Corroded cylinder spill, dry conditions	A 1-ft (0.30 m) hole results during handling, with solid UF_6 forming a 4-ft^2 (0.37-m^2) area on the dry ground.	UF_6	24	60	Ground
U_3O_8 drum spill	A single U_3O_8 drum is damaged by a forklift and spills its contents onto the ground outside the storage facility.	U_3O_8	2.4	30	Ground
Extremely Unlikely Accidents (frequency: 1 time in 10,000 years to 1 time in 1 million years)					
Earthquake	The U_3O_8 storage building is damaged during a design-basis earthquake, and 10% of the stored containers are breached.	U_3O_8	135	30	Stack
Rupture of cylinders – fire	Several cylinders hydraulically rupture during a fire.	UF_6	0 11,500 8,930 3,580	0–12 12 12–30 30–121	Ground
Tornado	A windblown missile from a design-basis tornado pierces a single U_3O_8 container in the storage building.	U_3O_8	1,200	0.5	Ground

[a] Potential accidents in the unlikely and incredible frequency categories would not result in radiological releases, but they are considered in the chemical assessment. The accident assessment considered a spectrum of accidents in four categories: likely, unlikely, extremely unlikely, and incredible.

[b] Ground-level releases were assumed to occur outdoors on concrete pads in the cylinder storage yards. To prevent contaminant migration, cleanup of residuals was assumed to begin immediately after the release was stopped.

radiation doses to members of the public and noninvolved workers (both MEIs and collective populations) for these accidents are presented in Table 5.2-12. The corresponding risks of LCFs associated with the estimated doses for these accidents are given in Table 5.2-13. The doses and risks are presented as ranges (minimum and maximum) because two different atmospheric conditions were considered for each accident. The estimated doses and LCFs were calculated on the basis of the assumption that the accidents would occur, without taking into account the probability of the accident's occurring. The probability of occurrence for each accident is indicated by the frequency category to which it is assigned. For example, accidents in the extremely unlikely category have an estimated probability of occurrence of between 1 in 10,000 and 1 in 1 million per year.

TABLE 5.2-12 Estimated Radiological Doses per Accident Occurrence during Conversion at the Portsmouth Site[a]

		Maximum Dose				Minimum Dose			
		Noninvolved Workers		General Public		Noninvolved Workers		General Public	
Conversion Product/Accident[b]	Frequency Category[c]	MEI (rem)	Population[d] (person-rem)	MEI (rem)	Population (person-rem)	MEI (rem)	Population[d] (person-rem)	MEI (rem)	Population (person-rem)
Corroded cylinder spill, dry conditions	L	7.8×10^{-2}	1.1/1.4/1.1	7.8×10^{-2}	1.2×10^{-1}	3.3×10^{-3}	$(4.4/5.6/4.6) \times 10^{-2}$	3.3×10^{-3}	1.9×10^{-2}
Failure of U_3O_8 container while in transit	L	5.3×10^{-1}	7.3/9.6/7.4	5.3×10^{-1}	5.1×10^{-1}	2.3×10^{-2}	$(3.0/3.8/3.1) \times 10^{-1}$	2.3×10^{-2}	1.2×10^{-1}
Earthquake	EU	30	$(4.0/5.3/4.3) \times 10^{2}$	30	30	1.2	$(1.7/2.1/1.8) \times 10^{-1}$	1.1	6.5
Rupture of cylinders – fire	EU	2.0×10^{-2}	3.9/3.3/5.1	2.0×10^{-2}	23	3.7×10^{-3}	$(2.4/2.5/6.1) \times 10^{-1}$	3.7×10^{-3}	7.3×10^{-1}
Tornado[e]	EU	7.5	100/130/110	7.5	17	7.5	100/130/110	7.5	17

[a] Maximum and minimum doses reflect differences in meteorological conditions at the time of the accident. In general, maximum doses would occur under meteorological conditions of F stability with a 1-m/s (2-mph) wind speed, whereas minimum doses would occur under D stability with a 4-m/s (9-mph) wind speed.

[b] The bounding accident chosen to represent each frequency category is the one that would result in the highest dose to the general public MEI. Health impacts in that row represent that accident only and not the range of impacts among accidents in that category. Absence of an accident in a certain frequency category indicates that the accident would not result in a release of radioactive material.

[c] Accident frequencies: L = likely, estimated to occur one or more times in 100 years of facility operations ($> 10^{-2}$/yr); EU = extremely unlikely, estimated to occur between once in 10,000 years and once in 1 million years of facility operations (10^{-4} to 10^{-6}/yr).

[d] For the noninvolved worker population dose, three estimates are provided, corresponding to Locations A, B, and C within the Portsmouth site.

[e] Meteorological conditions analyzed for the tornado were D stability with a 20-m/s (45-mph) wind speed.

TABLE 5.2-13 Estimated Radiological Health Risks per Accident Occurrence during Conversion at the Portsmouth Site[a]

		Maximum Risk[d] (LCFs)				Minimum Risk[d] (LCFs)			
		Noninvolved Workers		General Public		Noninvolved Workers		General Public	
Conversion Product/Accident[b]	Frequency Category[c]	MEI	Population[d]	MEI	Population	MEI	Population[d]	MEI	Population
Corroded cylinder spill, dry conditions	L	3×10^{-5}	$(0.4/1/0.2) \times 10^{-3}$	3×10^{-5}	3×10^{-5}	1×10^{-6}	$(2/3/2) \times 10^{-5}$	1×10^{-6}	9×10^{-6}
U_3O_8 drum spill	L	2×10^{-4}	$(3/7/2) \times 10^{-3}$	3×10^{-4}	3×10^{-4}	9×10^{-6}	$(1/2/2) \times 10^{-4}$	1×10^{-5}	6×10^{-5}
Earthquake	EU	2×10^{-2}	$(2/2/2) \times 10^{-1}$	2×10^{-2}	2×10^{-2}	4×10^{-4}	$(8/10/9) \times 10^{-3}$	5×10^{-4}	3×10^{-3}
Rupture of cylinders – fire	EU	8×10^{-6}	$(4/3/3) \times 10^{-3}$	8×10^{-6}	1×10^{-2}	1×10^{-6}	$(1/1/3) \times 10^{-4}$	1×10^{-6}	5×10^{-4}
Tornado[e]	EU	3×10^{-3}	$(5/6/5) \times 10^{-2}$	4×10^{-3}	8×10^{-3}	3×10^{-3}	$(5/6/5) \times 10^{-1}$	4×10^{-3}	8×10^{-3}

[a] Maximum and minimum risks reflect differences in meteorological conditions at the time of the accident. In general, maximum risks would occur under meteorological conditions of F stability with a 1-m/s (2-mph) wind speed; minimum risks would occur under D stability with a 4-m/s (9-mph) wind speed. Values shown are the consequences if the accident did occur. The risk of an accident is the consequence (LCFs) times the estimated frequency times 18 years of operations.

[b] The bounding accident chosen to represent each frequency category is the one that would result in the highest risks to the general public MEI. Health impacts in that row represent that accident only and not the range of impacts among accidents in that category. Absence of an accident in a certain frequency category indicates that the accident would not result in a release of radioactive material.

[c] Accident frequencies: L = likely, estimated to occur one or more times in 100 years of facility operations (> 10^{-2}/yr); EU = extremely unlikely, estimated to occur between once in 10,000 years and once in 1 million years of facility operations ($10^{-4} - 10^{-6}$/yr).

[d] For the noninvolved worker population dose, three estimates are provided, corresponding to Locations A, B, and C within the Portsmouth site.

[e] Meteorological conditions analyzed for the tornado were D stability with a 20-m/s (45-mph) wind speed.

The accident assessment took into account the three alternative locations within the Portsmouth site. Because of the close proximity of the alternative locations to the site boundary and the uncertainty associated with both the wind direction at the time of the accident and the exact location of the release point, it was conservatively assumed that both the noninvolved worker MEI and the general public MEI would be located 328 ft (100 m) from accidents with a ground-level release. For accidents with the potential for plume rise due to a fire or for releases from a stack, both the worker and public MEIs were assumed to be located at the point of maximum ground-level concentrations of the released contaminants. As discussed in Chapter 4, the noninvolved worker MEI was assumed to be exposed to the passing plume for 2 hours after the accident, after which time he or she would be evacuated; the public MEI was assumed to remain indefinitely in the path of the passing plume and consume contaminated food grown on site.

The estimated doses and risks to the noninvolved worker and public MEIs are presented in Tables 5.2-12 and 5.2-13. The estimated impacts to the noninvolved worker MEI and public MEI are similar because 99% of the dose is due to the inhalation pathway within the first 2 hours after the accident.

For the off-site public, the location of the conversion facility within the Portsmouth site would have very little impact on collective exposures because the area considered (a circle with a radius of 80 km [50 mi]) would be so much larger than the area of the Portsmouth site. The population dose estimates are based on population distributions from the 2000 census. The collective dose to noninvolved workers, however, would depend on the location of the conversion facility with respect to other buildings within the site. Therefore, for the noninvolved worker population, three estimates are provided in Tables 5.2-12 and 5.2-13, corresponding to Locations A, B, and C within the site.

The postulated accident estimated to have the largest consequence is the extremely unlikely accident caused by an earthquake involving the conversion facility. In this scenario, it is assumed that the U_3O_8 storage building would be damaged during the earthquake and that 10% of the stored containers would be breached. Under conservative meteorological conditions (F stability class with a 1-m/s [2-mph] wind speed) expected to result in the highest possible exposures, it is estimated that the dose to the MEI member of the public and noninvolved worker from this accident would be approximately 30 rem, if it is assumed that the product storage building contained 6 month's worth of production. The RFP for conversion services required the bidders to provide enough capacity to be able to store up to 6 month's worth of inventory on site. The estimated MEI doses are well below levels expected to cause immediate fatalities from radiation exposure (approximately 450 rem) and would result in a lifetime increase in the probability of developing an LCF of about 0.02 (about 1 chance in 50) in the public MEI and about 0.02 (about 1 chance in 50) in the worker MEI.

It is estimated that the collective doses from the U_3O_8 storage building earthquake accident would be 400 to 530 person-rem to the worker population and 30 person-rem to the off-site general population. These collective doses would result in less than 1 additional LCF in the worker population (0.2 LCF) and in the general population (0.02 LCF).

The accident scenario with the second-highest impacts was the extremely unlikely scenario caused by a tornado strike. In this scenario, it is assumed that a windblown missile from a tornado would pierce a single U_3O_8 container in storage. In this hypothetical accident, if bulk bags were used to transport and dispose of the U_3O_8 product, approximately 1,200 lb (550 kg) of U_3O_8 could be released at ground level. Under conservative meteorological conditions, it is estimated that the dose to the MEI and noninvolved worker would be 7.5 rem. The collective doses would be up to 130 person-rem to the worker population and up to 17 person-rem to the general population. If the emptied cylinders rather than the bulk bags were used as U_3O_8 containers, the resulting doses would be approximately half of the above results.

To account for the possible TRU and Tc contamination in some of the cylinders, a ratio of the dose from the TRU and Tc radionuclides at bounding maximum concentrations to the dose from the depleted uranium was calculated (see Appendix B for details). For accidents involving full DUF_6 cylinders, the relative dose contribution from TRU and Tc was found to be less than 0.02% of the dose from the depleted uranium. This approach is conservative because only a fraction of the cylinders in the inventory are contaminated with TRU and because it is expected that the concentration in any one cylinder would be less than the bounding concentrations assumed in the analysis.

The following conclusions may be drawn from the radiological health impact results:

- No cancer fatalities are predicted for any of the accidents.

- The maximum radiological dose to the noninvolved worker and general public MEIs (assuming that an accident occurred) would be about 30 rem. This dose would thus be greater than the 25-rem total effective dose equivalent established by DOE as a guideline for assessing the adequacy of protection of public health and safety from potential accidents (DOE 2000c). Therefore, more detailed analysis during facility design and siting may be necessary.

- The overall radiological risk to noninvolved worker and general public MEI receptors (estimated by multiplying the risk per occurrence [Table 5.2-13] by the annual probability of occurrence by the number of years of operations) would be less than 1 for all of the conversion facility locations.

- The differences in noninvolved worker population impacts among the three locations would be relatively small.

5.2.3.2.2 Chemical Impacts. This section presents the results for chemical health impacts for the highest-consequence accident in each frequency category for conversion operations at the Portsmouth site. The estimated numbers of adverse and irreversible adverse effects among noninvolved workers and the general public were calculated separately for each of the three alternative locations within the site by using 2000 census data for the off-site population. The methodology and assumptions used in the calculations are summarized in Appendix F, Section F.2.

The bounding conversion facility chemical accidents are listed in Table 5.2-14 and cover events that could occur during conversion. Note that an anhydrous NH_3 tank rupture is one of the bounding chemical accidents and the accident expected to cause the greatest impacts. NH_3 is used to produce hydrogen required for the conversion process. Although the use of NH_3 for hydrogen production is part of the UDS facility design, the use of natural gas for hydrogen production, which would eliminate the need for NH_3, is also possible.

The consequences from accidental chemical releases derived from the accident consequence modeling for conversion are presented in Tables 5.2-15 and 5.2-16. The results are presented as the number of people with the potential for (1) adverse effects and (2) irreversible adverse effects. Within each frequency category, the tables present the results for the accident that would affect the largest number of people (total of workers and off-site population). The numbers of noninvolved workers and members of the off-site public represent the impacts if the associated accident occurred. The accident scenarios given in Tables 5.2-15 and 5.2-16 are not identical because an accident with the largest impacts for adverse effects might not lead to the largest impacts for irreversible adverse effects.

The impacts may be summarized as follows:

- The largest impacts would be caused by the following accident scenarios: an HF storage tank rupture; a corroded cylinder spill under wet conditions (i.e., rain and formation of a water pool); an NH_3 tank rupture; and the rupture of several cylinders in a fire. Accidents involving stack emissions would have smaller impacts compared with accidents involving releases at ground level because of the relatively larger dilution and smaller release rates (due to filtration) involved with the stack emissions.

- If the accidents identified in Tables 5.2-15 and 5.2-16 did occur, the number of persons in the off-site population with the potential for adverse effects would range from 0 to around 2,300 (maximum corresponding to an HF tank rupture), and the number of off-site persons with the potential for irreversible adverse effects would range from 0 to around 210 (maximum corresponding to an NH_3 pressurized tank rupture).

- The maximum number of adverse effects among noninvolved workers would occur for Location B for most accident scenarios. For the general public, maximum impacts may occur at Locations A or C, depending on the specific scenario; however, the differences are relatively small among the three locations.

- The greatest number of irreversible adverse effects among the noninvolved workers would occur at Location C for most scenarios and at Location B for the NH_3 tank rupture. Among members of the public, impacts are very similar for all three locations.

TABLE 5.2-14 Bounding Chemical Accidents during Conversion Operations at the Portsmouth Site

Frequency Category/ Accident Scenario	Accident Description	Chemical Form of Release	Release Amount (lb)	Release Duration (min)	Release Level/ Medium
Likely Accidents (frequency: 1 or more times in 100 years)					
Corroded cylinder spill, dry conditions	A 1-ft (0.30-m) hole results during handling, with solid UF_6 forming a 4-ft^2 (0.37-m^2) area on the dry ground.	UF_6	24	60	Ground/ air
Unlikely Accidents (frequency: 1 in 100 years to 1 in 10,000 years)					
Corroded cylinder spill, wet conditions – rain	A 1-ft (0.30-m) hole results during handling, with solid UF_6 forming a 4-ft^2 (0.37-m^2) area on the wet ground .	HF	96	60	Ground/ air
Aqueous HF pipe rupture	An earthquake ruptures an aboveground pipeline transporting aqueous HF, releasing it to the ground.	HF	910[a]	10	Ground/ air
Anhydrous NH3 line leak	An NH_3 fill line is momentarily disconnected, and NH_3 is released at grade.	NH_3	255	1	Ground/ air
Extremely Unlikely Accidents (frequency: 1 in 10,000 years to 1 in 1 million years)					
Corroded cylinder spill, wet conditions – water pool	A 1-ft (0.30-m) hole results during handling, with solid UF_6 forming a 4-ft^2 (0.37-m^2) area into a 0.25-in. (0.64-cm)-deep water pool.	HF	147	60	Ground/ air
Rupture of cylinders – fire	Several cylinders hydraulically rupture during a fire.	UF_6	0 11,500 8,930 3,580	0 to 12 12 12 to 30 30 to 121	Ground/ air
Incredible Accidents (frequency: less than 1 in 1 million years)					
Aqueous HF (70%) tank rupture	Large seismic or beyond-design-basis event causes rupture of a filled HF storage tank.	HF	F1: 8,710[b] D4: 25,680[b]	120	Ground/ air
Anhydrous NH_3 tank rupture	Large seismic or beyond-design-basis event causes rupture of a filled anhydrous NH_3 storage tank.	NH_3	29,500	20	Ground/ air

[a] The estimate assumes that 10% of the spill evaporates, with the remainder absorbed into the soil. It should be noted that the soil/groundwater assessment conservatively assumed that 100% of the spill is absorbed into the soil.

[b] The two separate atmospheric conditions considered would cause different amounts to be released. These release amounts were computed based on evaporation rates estimated by assuming 77°F (25°C; F-1 conditions) and 95°F (35°C; D-4 conditions).

TABLE 5.2-15 Consequences of Chemical Accidents during Conversion at the Portsmouth Site: Number of Persons with the Potential for Adverse Effects[a]

		Maximum No. of Persons per Location[d]												Minimum No. of Persons per Location[d]											
		Noninvolved Worker						General Public						Noninvolved Workers						General Public					
		MEI[e]			No. Affected			MEI[e]			No. Affected			MEI[e]			No. Affected			MEI[e]			No. Affected		
Accident[b]	Freq. Cat.[c]	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
Corroded cylinder spill, dry conditions	L	Yes	Yes	Yes	4	22	48	No	No	Yes[f]	0	0	0	Yes	Yes	Yes	0	0	0	No	No	No	0	0	0
Corroded cylinder spill, wet conditions – rain	U	Yes	Yes	Yes	490	480	480	Yes	Yes	Yes	13	13	14	Yes	Yes	Yes	0	14	0	No	No	No	0	0	0
Rupture of cylinders – fire	EU	Yes	Yes	Yes	540	660	450	Yes	Yes	Yes	650	600	570	Yes	Yes	Yes	110	110	160	Yes	Yes	Yes	5	5	5
HF tank rupture	I	Yes	Yes	Yes	660	920	330	Yes	Yes	Yes	2,200	2,000	2,300	Yes	Yes	Yes	600	800	330	Yes	Yes	Yes	29	30	33
NH_3 tank rupture	I	Yes	Yes	Yes	810	1,400	1,100	Yes	Yes	Yes	1,700	1,500	1,500	Yes	Yes	Yes	580	880	850	Yes	Yes	Yes	21	21	24

a Values shown are the consequences if the accident did occur. The risk of an accident is the consequence (number of persons) times the estimated frequency, times 18 years of operations. The estimated frequencies are as follows: L = likely, 0.1; U = unlikely, 0.001; EU = extremely unlikely, 0.00001; I = incredible, 0.000001.

b The bounding accident chosen to represent each frequency category is the one in which the largest number of people (workers plus off-site population) would be affected. Health impacts in that row represent that accident only and not the range of impacts among accidents in that category.

c Accident frequencies: L = likely, estimated to occur one or more times in 100 years of facility operations ($> 10^{-2}$/yr); U = unlikely, estimated to occur between once in 100 years and once in 10,000 years of facility operations (10^{-2} to 10^{-4}/yr); EU = extremely unlikely, estimated to occur between once in 10,000 years and once in 1 million years of facility operations (10^{-4} to 10^{-6}/yr); I = incredible, estimated to occur less than one time in 1 million years of facility operations ($< 10^{-6}$/yr).

d Maximum and minimum values reflect differences in assumed meteorological conditions at the time of the accident. In general, the maximum risks would occur under meteorological conditions of F stability with a 1-m/s (2-mph) wind speed; the minimum risks would occur under D stability with a 4-m/s (9-mph) wind speed.

e At the MEI location, the determination is either "Yes" or "No" for potential adverse effects to an individual.

f MEI locations were evaluated at 100 m (328 ft) from ground-level releases for workers and at the location of highest off-site concentration for members of the general public; the population risks are 0 because the worker and general public population distributions for the site were used, which did not show receptors at the MEI locations.

TABLE 5.2-16 Consequences of Chemical Accidents during Conversion at the Portsmouth Site: Number of Persons with the Potential for Irreversible Adverse Effects[a]

		Maximum No. of Persons per Location[d]												Minimum No. of Persons per Location[d]											
		Noninvolved Worker						General Public						Noninvolved Workers						General Public					
		MEI[e]			No. Affected			MEI[e]			No. Affected			MEI[e]			No. Affected			MEI[e]			No. Affected		
Conversion Product/Accident[b]	Freq. Cat.[c]	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
Conversion to U_3O_8																									
Corroded cylinder spill, dry conditions	L	Yes[f]	Yes	Yes	0	0	0	No	No	No	0	0	0	Yes	Yes	Yes	0	0	0	No	No	No	0	0	0
Corroded cylinder spill, wet conditions – rain	U	Yes	Yes	Yes	97	120	130	Yes	Yes	Yes	0	0	0	Yes	Yes	Yes	0	0	0	No	No	No	0	0	0
Corroded cylinder spill, wet conditions – water pool	EU	Yes	Yes	Yes	170	170	190	Yes	Yes	Yes	0	0	1	Yes	Yes	Yes	0	0	0	No	No	No	0	0	0
NH_3 tank rupture[g]	I	Yes	Yes	Yes	810	1,400	1,100	Yes	Yes	Yes	200	210	210	Yes	Yes	Yes	400	370	50	Yes	Yes	Yes	2	2	4

[a] The values shown are the consequences if the accident did occur. The risk of an accident is the consequence (number of persons) times the estimated frequency, times 18 years of operations. The estimated frequencies are as follows: L = likely, 0.1; U = unlikely, 0.001; EU = extremely unlikely, 0.00001; I = incredible, 0.000001.

[b] The bounding accident chosen to represent each frequency category is the one in which the largest number of people (workers plus off-site population) would be affected. Health impacts in that row represent that accident only and not the range of impacts among accidents in that category.

[c] Accident frequencies: L = likely, estimated to occur one or more times in 100 years of facility operations ($> 10^{-2}$/yr); U = unlikely, estimated to occur between once in 100 years and once in 10,000 years of facility operations (10^{-2} to 10^{-4}/yr); EU = extremely unlikely, estimated to occur between once in 10,000 years and once in 1 million years of facility operations (10^{-4} to 10^{-6}/yr); I = incredible, estimated to occur less than one time in 1 million years of facility operations ($< 10^{-6}$/yr).

[d] Maximum and minimum values reflect differences in assumed meteorological conditions at the time of the accident. In general, the maximum risks would occur under meteorological conditions of F stability with a 1-m/s (2-mph) wind speed; the minimum risks would occur under D stability with a 4-m/s (9-mph) wind speed.

[e] At the MEI location, the determination is either "Yes" or "No" for potential adverse effects to an individual.

[f] MEI locations were evaluated at 100 m (328 ft) from ground-level releases for workers and at the location of highest off-site concentration for members of the general public; the population risks are 0 because the worker and general public population distributions for the site were used, which did not show receptors at the MEI locations.

[g] Under D-stability, 4-m/s (9-mph) meteorological conditions (minimum no. of persons affected), an aqueous HF tank rupture would have higher consequences to noninvolved workers than would the NH_3 tank rupture, resulting in about 150 to 200 more irreversible adverse effects at all three proposed locations. However, under F-stability, 1-m/s (2-mph) meteorological conditions (maximum no. of persons affected), the NH_3 tank rupture would have the maximum consequences to noninvolved workers and the general public.

- If the accidents identified in Tables 5.2-15 and 5.2-16 did occur, the number of noninvolved workers with the potential for adverse effects would range from 0 to around 1,400 (maximum corresponding to an NH_3 tank rupture), and the number of noninvolved workers with the potential for irreversible adverse effects would range from 0 to around 1,400 (maximum also corresponding to an NH_3 tank rupture).

- For the most severe accidents in each frequency category, the noninvolved worker MEI and the public MEI would have the potential for both adverse effects and irreversible adverse effects. The likely accidents for each conversion option (frequency of more than 1 chance in 100 per year) would result in no potential adverse or irreversible adverse effects for the general public.

- The maximum risk was computed as the product of the consequence (number of people) times the frequency of occurrence (occurrences per year) times the number of years of operations (18 years). These risk values are conservative because the numbers of people affected were based on the following assumptions: (1) occurrence of very low wind speed and moderately stable meteorological conditions that would result in the maximum reasonably foreseeable plume size (i.e., F stability and a 1-m/s [2-mph] wind speed) and (2) steady or nonmeandering wind direction, lasting up to 3 hours and blowing toward locations that would lead to the maximum number of individuals exposed for noninvolved workers or for the general population. The results indicate that the maximum risk values would be less than 1 for all accidents except the following:

  – *Potential Adverse Effects:*

    Corroded cylinder spill, dry conditions (L, likely), workers

    Assuming the accident occurred once every 10 years, 7, 40, and 90 workers would potentially experience adverse effects at Locations A, B, and C, respectively, over the entire 18-year operational period.

    Corroded cylinder spill, wet conditions – rain (U, unlikely), workers

    Assuming the accident occurred once every 1,000 years (frequency = 10^{-3}/yr), about 9 workers would potentially experience adverse effects over the 18-year operational period at any of the three alternative locations.

  – *Potential Irreversible Adverse Effects:*

    Corroded cylinder spill, wet conditions – rain (U, unlikely), workers

    Assuming the accident occurred once every 1,000 years (frequency = 10^{-3}/yr), about 2 workers would potentially experience an irreversible adverse health effect over the 18-year operational period at all three locations.

The number of fatalities that could potentially be associated with the estimated irreversible adverse effects was also calculated. Previous analyses indicated that exposure to HF and uranium compounds, if sufficiently high, could result in death to 1% or fewer of the persons experiencing irreversible adverse effects (Policastro et al. 1997). Similarly, it was estimated that exposure to NH_3 could result in death to about 2% of the persons experiencing irreversible adverse effects (Policastro et al. 1997). Therefore, if the corroded cylinder spill, wet conditions – rain accident occurred (Table 5.2-16), about one fatality might be expected among the noninvolved workers at any of the three locations: A, B, or C. However, this accident is classified as an unlikely accident, meaning that it is estimated to occur between once in 100 years and once in 10,000 years of facility operation. Assuming that it would occur once every 1,000 years, the risk of fatalities among the noninvolved workers from this accident over the 18-year operational period would be less than 1 ($1 \times 0.0001 \times 18 = \approx 0.02$). (See Section 4.3 for discussion on the interpretation of risk numbers that are less than 1.)

Similarly, if the higher-consequence accident in the extremely unlikely frequency category (corroded cylinder spill, wet conditions – water pool) in Table 5.2-16 occurred, approximately 2 fatalities might be expected among the noninvolved workers, irrespective of the location chosen. However, because of the low frequency of this accident, the risk of a fatality over the lifetime of the conversion facility would be about 0.0004, assuming a frequency of 0.00001 per year.

For the NH_3 tank rupture accident, which belongs to the incredible frequency category (frequency of less than 0.000001 per year), the expected numbers of fatalities among the noninvolved workers would be about 16, 28, and 22 for Locations A, B, and C, respectively. However, the risk of a fatality would be much less than 1 at any of the locations (0.0001 at Location A, 0.0003 at Location B, and 0.0002 at Location C, assuming a frequency of 5×10^{-7} per year) over the facility lifetime. Among the general public, 4 fatalities might be expected if the same accident occurred. However, because of the low frequency of the accident, the risk of fatalities would be much less than 1 (about 0.00004).

Even though the risks are relatively low, the consequences for a few of the accidents are considered to be high. These high-consequence accidents are generally associated with the storage of anhydrous NH_3 and aqueous HF on site. The consequences can be reduced or mitigated through design (e.g., by limiting tank capacity), operational procedures (e.g., by controlling accessibility to the tanks), and emergency response actions (e.g., by sheltering, evacuation, and interdiction of contaminated food materials following an accident). For example, UDS is proposing to reduce the size of the anhydrous NH_3 storage tanks from 9,200 to 3,300 gal (35,000 to 12,000 L). This change would reduce the consequences of an NH_3 release accident. However, to conservatively estimate the consequences of an anhydrous NH_3 tank rupture and preserve process flexibility, this analysis retained the assumption of a 9,200-gal (35,000-L) tank size.

5.2.3.2.3 Physical Hazards. The risk of on-the-job fatalities and injuries to conversion facility workers was calculated by using industry-specific statistics from the BLS, as reported by the National Safety Council (2002). Annual fatality and injury rates from the BLS manufacturing industry division were used for the 18-year operations phase, assuming ETTP cylinders are processed there. Operation of the conversion facility is estimated to require approximately 175 FTEs per year. No on-the-job fatalities are predicted during the conversion facility operational phase. It is estimated, however, that about 142 injuries would occur (Table 5.2-4).

5.2.3.3 Air Quality and Noise

5.2.3.3.1 Air Quality Impacts. Three alternative locations (Locations A, B, and C) were considered for air quality impacts. Detailed information on facility boundaries and the orientations and locations of buildings and stacks is currently available for the preferred Location A only. For Locations B and C, the layout of the facility for Location A was assumed to be placed in the middle of the other two locations.

At the conversion facility, air pollutants would be emitted from four point sources: the boiler stack, backup generator stack, conversion building stack, and HF processing building stack. UDS is proposing to use electrical heating in the conversion facility, but it is evaluating other options. If natural gas was chosen, furnaces or boilers could be used. To assess bounding air quality impacts, a boiler option was analyzed because it would result in more emissions than furnaces or electric heat. The boiler could be used to generate process steam and building heat, and a backup generator would be used to provide emergency electricity. Primary emission sources for criteria pollutants and VOCs would be the boiler and the emergency generator. The conversion building stack would release uranium, fluoride, criteria pollutants, and VOCs in minute amounts, while the HF processing building stack would release fluorides into the atmosphere. Although nitrogen would be used as a purge gas in the process, its use would not generate additional NO_x emissions because of the absence of oxygen in contact with the nitrogen stream at high temperatures. Annual total stack emission rates during operations are given in the Engineering Support Document (Folga 2003); these emission rates are presented in Table 5.2-17. Other sources during operations would include vehicular traffic to and from the facility, associated with cylinder transfer, commuting, and material delivery. Parking lots and access roads to the facility would be paved with asphalt or concrete to minimize fugitive dust emissions. In addition, fugitive emissions would include those from storage tanks, silos, cooling towers, etc., but in negligible amounts.

The modeling results for concentration increments of SO_2, NO_2, CO, PM_{10}, $PM_{2.5}$, and HF due to emissions from the proposed facility operations are summarized in Table 5.2-18. The results are maximum modeled concentrations at or beyond the conversion facility boundary. The total concentrations (modeled concentration increments plus background concentrations) are also presented in the table for comparison with applicable NAAQS and SAAQS.

Because of low emissions during operations, all air pollutant concentration increments would be well below applicable standards. As shown in Table 5.2-18, the estimated maximum concentration increments due to operation of the proposed facility would amount to about 16% of the applicable standard for 3-hour average SO_2. These concentration increments are primarily

TABLE 5.2-17 Annual Point Source Emissions of Criteria Pollutants, Volatile Organic Compounds, Uranium, and Fluoride from Operation of the Conversion Facility at the Portsmouth Site

	Emission Rate[a]			
Pollutant	Boiler[b]	Backup Generator	Conversion Building Stack	HF Processing Building Stack
SO_2	0.01	0.17	9.7×10^{-4}	–[c]
NO_x	2.09	1.20	2.5×10^{-2}	–
CO	1.25	0.17	4.0×10^{-2}	–
VOC	0.08	0.17	1.2×10^{-2}	–
PM_{10}[d]	0.11	0.07	6.8×10^{-3}	–
Uranium	–	–	< 0.25 g/yr	–
Fluoride	–	–	<0.005 ppm[e]	< 0.05 ppm[f]

a Tons/yr unless otherwise noted.

b Boiler emissions were estimated on the basis of annual natural gas usage given in Table 5.2-22.

c A dash indicates no or negligible emissions.

d $PM_{2.5}$ emissions are assumed to be the same as PM_{10} emissions.

e Annual emission is about 0.8 kg (1.8 lb) as HF.

f Annual emission is about 55.8 kg (123 lb) as HF.

due to a backup generator, which is located next to the conversion building and the site boundaries and within the building cavity/wake region. However, the generator would be operating on an intermittent basis; thus, air quality impacts would be limited to the period of its operation. The maximum total concentrations, except for $PM_{2.5}$, would be about 64%, well below their applicable standards. However, it is estimated that total $PM_{2.5}$ concentration would be approaching (91%) or above (161%) the standard. However, concentration increments from operations are predicted to account for only 2.8% of the standard. As previously mentioned, the annual average $PM_{2.5}$ concentration at most statewide monitoring stations would either approach or exceed the standard.

The air quality impacts would be limited to the immediate vicinity of the site boundaries. For example, maximum predicted concentrations at the nearest residence would be about 11% of

TABLE 5.2-18 Maximum Air Quality Impacts Due to Emissions from Activities Associated with Operation of the Conversion Facility at the Portsmouth Site

		Concentration (μg/m³)						
							Percent of NAAQS/SAAQS[d]	
Location	Pollutant	Averaging Time	Maximum Increment[a]	Background[b]	Total[c]	NAAQS and SAAQS	Increment	Total
A	SO_2	3 hours	127	307	434	1,300	9.8	33.4
		24 hours	57.1	110	167	365	15.6	45.8
		Annual	0.08	18.7	18.8	80	0.1	23.5
	NO_2	Annual	0.6	54.7	55.3	100	0.6	55.3
	CO	1 hour	245	13,400	13,600	40,000	0.6	34.1
		8 hours	84.9	4,780	4,860	10,000	0.8	48.6
	PM_{10}	24 hours	11.8	64	75.8	150	7.8	50.5
		Annual	0.03	32	32.0	50	0.1	64.1
	$PM_{2.5}$	24 hours	1.7	57.5	59.2	65	2.6	91.1
		Annual	0.03	24.1	24.1	15	0.2	161
	HF[e]	12 hours	0.07	0.45	0.52	3.68	1.9	14.3
		24 hours	0.05	0.37	0.42	2.86	1.8	14.8
		1 week	0.02[f]	0.21	0.23	1.64	1.1	13.9
		1 month	0.01	0.14	0.14	0.82	0.9	17.6
		Annual	0.003	0.07	0.07	400	0.001	0.02
B	SO_2	3 hours	161	307	468	1,300	12.4	36.0
		24 hours	47.8	110	158	365	13.1	43.2
		Annual	0.06	18.7	18.8	80	0.1	23.5
	NO_2	Annual	0.5	54.7	55.2	100	0.5	55.2
	CO	1 hour	258	13,400	13,700	40,000	0.6	34.1
		8 hours	86.7	4,780	4,870	10,000	0.9	48.7
	PM_{10}	24 hours	14.8	64	78.8	150	9.8	52.5
		Annual	0.03	32	32.0	50	0.1	64.1
	$PM_{2.5}$	24 hours	1.9	57.5	59.4	65	2.8	91.3
		Annual	0.03	24.1	24.1	15	0.2	161
	HF[e]	12 hours	0.07	0.45	0.52	3.68	1.8	14.1
		24 hours	0.05	0.37	0.42	2.86	1.6	14.6
		1 week	0.02[f]	0.21	0.23	1.64	1.0	13.8
		1 month	0.01	0.14	0.14	0.82	0.6	17.4
		Annual	0.003	0.066	0.07	400	0.001	0.02

TABLE 5.2-18 (Cont.)

			Concentration (μg/m^3)					
							Percent of NAAQS/SAAQS[d]	
Location	Pollutant	Averaging Time	Maximum Increment[a]	Background[b]	Total[c]	NAAQS and SAAQS	Increment	Total
C	SO_2	3 hours	208	307	515	1,300	16.0	39.6
		24 hours	45.3	110	155	365	12.4	42.6
		Annual	0.08	18.7	18.8	80	0.1	23.5
	NO_2	Annual	0.6	54.7	55.3	100	0.6	55.3
	CO	1 hour	260	13,400	13,700	40,000	0.7	34.2
		8 hours	88.1	4,780	4,870	10,000	0.9	48.7
	PM_{10}	24 hours	14.2	64	78.2	150	9.5	52.1
		Annual	0.04	32	32.0	50	0.1	64.1
	$PM_{2.5}$	24 hours	1.7	57.5	59.2	65	2.5	91.0
		Annual	0.04	24.1	24.1	15	0.2	161
	HF[e]	12 hours	0.15	0.45	0.61	3.68	4.1	16.5
		24 hours	0.11	0.37	0.48	2.86	3.7	16.7
		1 week	0.04[f]	0.21	0.25	1.64	2.2	15.0
		1 month	0.01	0.14	0.15	0.82	1.3	18.1
		Annual	0.006	0.066	0.07	400	0.001	0.02

[a] Data represent the maximum concentration increments estimated, except that the fourth- and eighth-highest concentration increments estimated are listed for 24-hour PM_{10} and $PM_{2.5}$.

[b] See Table 3.1-3 for criteria pollutants and DOE (2002b) for highest weekly and annual HF. Background HF for other averaging times was estimated based on highest weekly annual background concentrations.

[c] Total equals the maximum modeled concentration increment plus background concentration.

[d] The values in the next-to-last column are maximum concentration increments as a percent of NAAQS and SAAQS. The values presented in the last column are total concentrations as a percent of NAAQS and SAAQS.

[e] State HF standards in Ohio are not available, so Kentucky standards were used for comparative purposes.

[f] Estimated by interpolation.

the highest concentration. It is also expected that potential impacts from the proposed facility operations on the air quality of nearby communities would be insignificant.[4]

The maximum 3-hour, 24-hour, and annual SO_2 concentration increments predicted to result from the proposed facility operations would be about 63% of the applicable PSD

[4] Formerly, the general public had access to the existing fenced gaseous diffusion plant boundaries. However, since the September 11, 2001, terrorist attack, site access for the general public has been restricted indefinitely to the DOE property boundaries.

increments (Table 3.2-3). The maximum predicted increments in annual average NO_2 concentrations due to the proposed facility operations would be about 3% of the applicable PSD increments. The 24-hour and annual PM_{10} concentration increases predicted to result from the proposed operations would be about 49% of the applicable PSD increments. The predicted concentration increment at a receptor located 30 mi (50 km) from the proposed facility (the maximum distance for which the Industrial Source Complex [ISC3] short-term model [EPA 1995] could reliably estimate concentrations) in the direction of the nearest Class I PSD area (Otter Creek Wilderness Area, West Virginia) would be far less than 0.5% of the applicable PSD increments. Concentration increments at this wilderness area, which is located about 177 mi (285 km) west of Portsmouth, would be negligible.

Concentration increments for the two remaining criteria pollutants, Pb and O_3, were not modeled. As a direct result of the phase-out of leaded gasoline in automobiles, average Pb concentrations in urban areas throughout the country have decreased dramatically. It is expected that emissions of Pb from the proposed facility operations would be negligible and would therefore have no adverse impacts on Pb concentrations in surrounding areas. Contributions to the production of O_3, a secondary pollutant formed from complex photochemical reactions involving O_3 precursors, including NO_x and VOCs, cannot be accurately quantified. As discussed in Section 3.1.3.2, Pike County, including the Portsmouth site, is currently in attainment for O_3 (40 CFR 81.336). The O_3 precursor emissions from the proposed facility stacks would make up about 0.7% and 3.8% of the year 2001 combined Portsmouth DOE and USEC emissions of NO_x and VOCs, respectively (see Table 3.1-2). These emission levels would be negligible in absolute terms (compared with statewide emissions). As a consequence, the cumulative impacts of potential releases from Portsmouth facility operations on regional O_3 concentrations would not be of any concern.

Maximum HF air quality impacts are also listed in Table 5.2-18. State HF standards in Ohio are not available; thus, Kentucky standards were used for comparative purposes. The estimated maximum short-term ($\leq$1 month) HF concentration increment and total concentrations would be about 4.1% and 18.1% of the state standard, respectively, which are still well below the standards. The annual average concentration increment and total concentration would be several orders of magnitude lower than the HF air quality standard.

In summary, except for annual average $PM_{2.5}$, total concentrations of criteria pollutants would be well below their respective standards. Total maximum estimated concentrations of criteria pollutants, except $PM_{2.5}$, would be less than 64% of NAAQS and SAAQS. Predicted total concentrations of 24-hour and annual average $PM_{2.5}$ would be near or above their respective standards, respectively; however, their concentration increments associated with site operations would account for only about 2.8% of the standards. In particular, the annual average $PM_{2.5}$ concentration at most statewide monitoring stations would either approach or exceed the standard.

Accidents. Among chemicals released due to accidents, HF is the only one subject to an ambient air quality standard (the state of Ohio does not have ambient air quality standards for HF, so those for the state of Kentucky were used for comparison purposes). Most accidental releases would occur over a short duration, about 2 hours at most. The passage time of an elevated-concentration plume for any receptor location would be a little longer than its release duration. The HF concentration in the plume's path would exceed the 12-hour or 24-hour ambient standard for the HF tank rupture accident scenario; however, when concentrations are averaged over a year, the annual ambient air quality standard would not be exceeded. Therefore, potential impacts of accidental releases on ambient air quality would be short-term and limited to along the plume path, and long-term impacts would be negligible.

5.2.3.3.2 Noise Impacts. Many noise sources associated with operation would be inside the buildings. The highest noise levels are expected inside the conversion facility in the area of the powder receiver vessels, with measured readings at 77 to 79 dB(A), and in the area of the dry conversion, with a reading of 72 to 74 dB(A) (UDS 2003b). Ambient facility noise levels, measured in various processing areas (inside buildings) for continuous operations of a facility at Richland, Washington, ranged from 70 to 79 dB(A). Major outdoor noise sources associated with operation would include the cooling tower, trucks and heavy equipment moving cylinders, and traffic moving to and from the facility, which are typical industrial noise sources. Heavy equipment and truck traffic would be intermittent, so noise levels would be low except when the equipment was moving or operating. For noise impact analyses, a continuous noise source during operation was assumed to be about 79 dB(A) at a distance of 15 m (50 ft), on the basis of the highest noise level measured inside buildings at the Richland facility (UDS 2003b).[5]

The nearest residence, located about 0.9 km (0.6 mi) south-southeast of Location B and just off DOE's southern boundary, was selected as the receptor for the analysis of potential noise impacts. Noise levels decrease about 6 dB per doubling of distance from the point source because of the way sound spreads geometrically over an increasing distance. The estimated noise level would result in about 43 dB(A) at the nearest residence. This level would be about 49 dB(A) as DNL, if 24-hour continuous operation is assumed. The 49-dB(A) estimate is just below the EPA guideline of 55 dB(A) as DNL for residential zones (see Section 3.1.3.4), which was established to prevent interference with activity, annoyance, and hearing impairment. If other attenuation mechanisms, such as ground effects or air absorption, are considered, noise levels at the nearest residence would considerably decrease. If only ground effects are considered (HMMH 1995), more than 10 dB(A) of attenuation would occur at the nearest residence, which would result in about 39 dB(A) as DNL, well below the EPA guideline.

Most trains would blow their whistle loud enough to ensure that all motorists and pedestrians nearby would be aware of an approaching train. These excessive noises could disturb those who live or work near the train tracks. Typical noise levels of train whistles would range from 95 to 115 dB(A) at a distance of 30 m (100 ft), comparable to noise levels of low-flying aircraft or emergency vehicle sirens (DOT 2003a). The total number of shipments (railcars) associated with facility operations would be less than 5,000. This would be equivalent to about one train per week, assuming five railcars per train. Accordingly, the noise level from train

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5 The noise level from one of the continuous outdoor noise sources, a cooling tower, to be used at this size of facility would be less than 79 dB(A) at a distance of 15 m (50 ft).

operations would be high along the rail tracks and particularly near the crossings. However, noise impacts would be infrequent and of short duration.

In general, facility operations produce less noise than construction activities. For all three alternative locations, except for intermittent vehicular traffic and infrequent rail traffic, the noise level at the nearest residence would be somewhat higher than the ambient background level discussed in Section 3.1.3.4, and it would be barely distinguishable from the background level, depending on the time of the day. In conclusion, noise levels generated by plant operation would have minor impacts on the residence located nearest to the proposed facility and would be well below the EPA guideline limits for residential areas.

5.2.3.4 Water and Soil

Operating a conversion facility at Portsmouth could disturb land, use water, and produce liquid wastes. Impacts on surface water, groundwater, and soil resources are discussed below. Because no site-specific impacts to water and soil were identified, impacts at alternative Locations A, B, and C would be the same.

5.2.3.4.1 Surface Water. Impacts from operating a conversion facility at Portsmouth would be independent of the location selected at Portsmouth; all of the water needed would be withdrawn from the system of on-site and off-site wells. Because all of the water needed for operating a conversion plant at Portsmouth would be obtained from groundwater wells, there would be no impacts on surface water resources.

During facility operations, about 4,000 to 8,000 gal/d (15,140 to 30,280 L/d) of sanitary wastewater would be processed. There would also be about 3,000 gal/d (11,400 L/d) of process wastewater produced during normal operations. This water would not contain any radionuclides. Another 23,000 gal/d (87,100 L/d) (8.4 million gal/yr [31.8 million L/yr]) of wastewater would be produced by cooling tower blowdown, and 36,000 gal/d (136,300 L/d) of wastewater would be produced if HF neutralization was required. These wastewaters would not contain any radionuclides and could be disposed of to the existing process wastewater treatment system at Portsmouth, or discharged under a NPDES permit, or treated and reused at the conversion facility. Disposition of these wastewaters is under evaluation.

Discharge effluent would be treated prior to discharge. The existing water treatment plant processes about 4,533 million gal (17,160 million L) of wastewater per year. The additional wastewater produced by a conversion plant would be a maximum of about 0.2% of the current treatment volume. Once in surface water, the effluent would be diluted. At Portsmouth, effluent discharge would go to Little Beaver Creek or the Scioto River. If released at a constant rate, the approximately 30,000 gal/d (114,000 L/d) of wastewater would flow at about 21 gal/min (80 L/min). This small increase in flow would produce negligible impacts to Little Beaver Creek, Big River Creek, and the Scioto River. Because the release water would be treated, impacts to water quality would also be negligible, even without the additional dilution expected (45 for Little Beaver Creek).

Accidents. An earthquake could rupture an aboveground HF pipeline that would carry liquid HF from the conversion building to the HF storage building at a rate of 10 gal/min (38 L/min). Approximately 910 lb (410 kg) of liquid HF would be released. Because response and cleanup would occur within a relatively short time after the release (i.e., days or weeks), the HF would have little time to migrate into the soil, and very little would be transported by runoff to nearby surface waters. Removal of the contaminated soil would prevent any contamination of surface water or groundwater resources. Therefore, there would be no impacts on surface water or groundwater from this accident. A similar quick response and cleanup would minimize impacts for an HF spill to the ground during transfer to railcars.

5.2.3.4.2 Groundwater. All operational water needs at the Portsmouth site would be satisfied by using groundwater resources. Peak potable and nonpotable water use for the Portsmouth plant would be about 33 million gal/yr (125 million L/yr). An additional 1.1 million gal (4.2 million L) of process water per year would be required. If this water was withdrawn at a constant rate, the withdrawal would represent an increase of about 0.8% of the current water use and 0.3% of the existing capacity. Impacts from this rate of extraction would be small.

In addition, the quality of groundwater beneath the selected location could be affected by infiltrating contaminated surface water from spills. Indirect contamination could result from the dissolution and mobilization of exposed chemicals by precipitation and subsequent infiltration of the contaminated runoff into the surficial aquifers. By following good engineering and operating practices (e.g., covering chemicals to prevent interaction with rain, promptly and thoroughly cleaning up any spills, and providing retention basins to catch and hold any contaminated runoff), impacts on groundwater quality would be minimized.

Accidents. An earthquake could rupture the aboveground HF pipeline that would carry liquid HF from the conversion building to the HF storage building. Because of rapid response and cleanup times, the travel distance of the released HF would be small. Removal of the contaminated soil would prevent any contamination of underlying groundwater resources. Therefore, there would be no impacts on groundwater from this type of accident. A similar quick response and cleanup would minimize impacts for an HF spill to the ground during transfer to railcars.

5.2.3.4.3 Soils. Normal operations of a conversion facility at the Portsmouth site would have no direct impacts on soil at all three alternative locations.

Accidents. The only accidents identified that could potentially affect soil would be an HF pipeline rupture and an HF spill to the ground during transfer to railcars. Because mitigation would be initiated rapidly and because the volume of HF released would be small (910 lb [410 kg]), impacts on soil would be negligible.

5.2.3.5 Socioeconomics

The socioeconomic analysis covers the effects on population, employment, income, regional growth, housing, and community resources in the ROI around the Portsmouth site. Impacts from operations, which are the same for all three alternative locations, are summarized in Table 5.2-19.

The potential socioeconomic impacts from operations would be relatively small. Operational activities would create about 160 direct jobs annually and about 160 more indirect jobs in the ROI. A conversion facility would produce about $13 million in personal income annually during operations.

It is estimated that about 220 people would move to the area at the beginning of operations. However, in-migration would have only a marginal effect on population growth and would require about 1% of vacant owner-occupied housing during facility operations. No significant impact on public finances would occur as a result of in-migration, and fewer than five new local public service employees would be required to maintain existing levels of service in the various local public service jurisdictions in Pike and Scioto Counties.

TABLE 5.2-19 Socioeconomic Impacts from Operation of the Conversion Facility at the Portsmouth Site[a]

Impact Area	Operation
Employment	
Direct	160
Total	320
Income (millions of 2002 $)	
Direct	5.8
Total	12.9
Population (no. of new ROI residents)	220
Housing (no. of units required)	80
Public finances (% impact on fiscal balance)	
Cities in Pike County[b]	0.2
Pike County	0.1
Schools in Pike County[c]	0.2
Cities in Scioto County[d]	0.2
Scioto County	0.2
Schools in Scioto County[e]	0.2
Public service employment (no. of new employees)	
Pike County	
Police officers	0
Firefighters	0
General	1
Physicians	0
Teachers	1
Scioto County	
Police officers	0
Firefighters	0
General	1
Physicians	0
Teachers	1
No. of new staffed hospital beds	
Pike County	1
Scioto County	1

a Impacts are shown for the first year of operations (2006).

b Includes impacts that would occur in the cities of Waverly and Piketon.

c Includes impacts that would occur in Waverly and Pike County school districts.

d Includes impacts that would occur in the City of Portsmouth.

e Includes impacts that would occur in New Boston, Portsmouth, Wheelersburg, and Scioto County school districts.

5.2.3.6 Ecology

5.2.3.6.1 Vegetation. A portion of the conversion product released from the process stack of the conversion facility would become deposited on the soils surrounding the site. Uptake of uranium-containing compounds could cause adverse effects to vegetation. Deposition of uranium compounds on soils, resulting from atmospheric emissions, would result in soil uranium concentrations considerably below the lowest concentration known to produce toxic effects in plants. Because there would not be a release of process effluent from the facility to surface waters, impacts to vegetation along nearby streams would not occur. Therefore, toxic effects on vegetation due to uranium uptake would be expected to be negligible.

5.2.3.6.2 Wildlife. Noise generated by the operation of a conversion facility at Location A and disturbance from human presence would likely result in a minor disturbance to wildlife in the vicinity. Movement of railcars along the new rail line west of the facility might potentially render the adjacent riparian forest habitat unsuitable for some species. In addition, the rail line might impede the movement of some small wildlife species.

During operations, ecological resources in the vicinity of the conversion facility would be exposed to atmospheric emissions from the boiler stack, cooling towers, and process stack; nevertheless, emission levels are expected to be extremely low. The highest average air concentration of uranium compounds would result in a radiation exposure to the general public (nearly 100% due to inhalation) of 2.07×10^{-5} mrem/yr, well below the DOE guideline of 100 mrem/yr (DOE 2002f). Wildlife species are less sensitive to radiation than humans. (DOE guidelines require an absorbed dose limit to terrestrial animals of less than 0.1 rad/d [DOE 2002f].) Therefore, impacts on wildlife due to radiation effects are expected to be negligible. Toxic effect levels of chronic inhalation of uranium are many orders of magnitude greater than expected emissions. Therefore, toxic effects on wildlife as a result of inhalation of uranium compounds are also expected to be negligible.

The maximum annual average air concentration of HF that would result from operation of a conversion facility would be 0.0028 $\mu g/m^3$. Toxic effect levels of chronic inhalation of HF are many orders of magnitude greater than expected emissions. Therefore, toxic effects on wildlife from HF emissions are expected to be negligible.

Impacts to wildlife from the operation of a conversion facility at Locations B or C would be similar to impacts at Location A. Noise and human presence would likely result in a minor disturbance to wildlife in the vicinity.

5.2.3.6.3 Wetlands. Liquid process effluents would not be discharged to surface waters during the operation of the conversion facility (Section 5.2.3.4). Surface water sources are also not expected to be used to meet water requirements during operations. Changes in groundwater as a result of the withdrawal of groundwater for facility operations would be small to negligible (Section 5.2.2.4). Therefore, except for potential local indirect impacts near the facility, impacts to regional wetlands due to changes in groundwater or surface water levels or flow patterns are not expected to occur. As a result, adverse effects on wetlands or aquatic communities from effluent discharges or water use are not expected.

Storm water runoff from conversion facility parking areas and other paved surfaces might carry contaminants commonly found on these surfaces to local streams. Biota in receiving streams might be affected by these contaminants, resulting in reduced species diversity or changes in community composition. Storm water discharges from the conversion facility would be addressed under a new or existing NPDES permit for industrial facility storm water discharge. The streams near Locations A, B, and C currently receive runoff and associated contaminants from various roadways on the Portsmouth site, and their biotic communities are likely indicative of developed areas.

5.2.3.6.4 Threatened and Endangered Species. Impacts to federal- or state-listed species during operation of a conversion facility at Location A are not expected. However, although the wooded areas at Location A have not been identified as summer roosting habitat for the Indiana bat (federal- and state-listed as endangered), disturbances from increased noise, lighting, and human presence due to facility operation and the movement of railcars along the new rail line west of the facility might decrease the quality of the adjacent riparian forest habitats for use by Indiana bats. However, Indiana bats that might currently be using habitat near the Portsmouth site would already be exposed to noise and other effects of human disturbance due to operation of the site, including vehicle traffic. In addition, Indiana bats have been observed to tolerate increased noise levels (U.S. Fish and Wildlife Service [USFWS] 2002). Consequently, disturbance effects related to conversion facility operation are expected to be minor. The operation of a conversion facility at Location C might similarly decrease the quality of wooded areas at that location for Indiana bat summer habitat, although these locations have also not been identified as containing Indiana bat habitat. Location B does not support habitat suitable to the Indiana bat.

5.2.3.7 Waste Management

Operations at the conversion facility would generate radioactive, hazardous, and nonhazardous waste, as shown in Table 5.2-20. Waste volumes generated would be the same for all three alternative locations. The total waste volumes for 18 years of operation would be 772 yd^3 (590 m^3) of LLW and 98 yd^3 (74 m^3) of hazardous waste. These volumes would result in low impacts on site annual projected volumes. If ETTP cylinders were not processed at Portsmouth, the waste volumes would be reduced by 26 yd^3 (20 m^3) of LLW, 5 yd^3 (4 m^3) of hazardous waste, and 125 yd^3 (96 m^3) of nonhazardous solid waste.

CaF_2 would be produced in the U_3O_8 conversion process and is assumed to have a low uranium content. It is currently unknown whether this CaF_2 could be sold (e.g., as feedstock for commercial production of anhydrous HF) or whether the low uranium content would force disposal. If CaF_2 disposal is necessary, it could be either as a nonhazardous solid waste (provided that authorized limits have been established in accordance with DOE Order 5400.5

[DOE 1990] and its associated guidance) or as LLW. The nonhazardous solid waste generation estimate for conversion to U_3O_8, as shown in Table 5.2-20, is based on the assumption that CaF_2 would be disposed of as nonhazardous solid waste at a rate of approximately 13 yd^3/yr (10 m^3/yr). This represents a negligible impact to the annual site generation rate for this waste type. If CaF_2 was disposed of as LLW, it would represent less than 1% of the projected site annual LLW load.

If the HF was not marketable, neutralization of HF to CaF_2 would produce approximately 3,745 yd^3/yr (2,860 m^3/yr) of CaF_2. This volume represents approximately 89% and 4% of nonhazardous solid waste and LLW, respectively, of the projected annual generation volumes for Portsmouth. It is unknown whether CaF_2 LLW would be considered DOE waste if the conversion was conducted by a private commercial enterprise. If CaF_2 could be sold, the nonhazardous solid waste or LLW management impacts would be lower.

TABLE 5.2-20 Wastes Generated from Operation of the Conversion Facility at the Portsmouth Site

Waste Category	Annual Volume[a]
LLW	
Combustible waste	26 m^3
Noncombustible	6.4 m^3
Others	<1.0 m^3
Total[b]	33 m^3
Hazardous waste[c]	4.1 m^3
Nonhazardous waste	
Solids[d]	144 m^3
Sanitary wastewater	5.5×10^6 L

[a] Represents annual volume generated from Portsmouth cylinders only.

[b] Includes LLW from high-efficiency particulate air (HEPA) filters and laboratory acids and residues. The total volume of LLW from ETTP cylinders is about 20 m^3 (26 yd^3).

[c] Includes the total volume of hazardous waste from ETTP cylinders of 4 m^3 (5 yd^3).

[d] Includes CaF_2 generation from the conversion process. The total volume of nonhazardous waste from ETTP cylinders is about 95 m^3 (125 yd^3).

Source: UDS (2003b).

The U_3O_8 produced from the conversion process would generate about 4,700 yd^3/yr (3,570 m^3/yr) of LLW. This volume is about 5% of the annual site-projected volume for LLW and constitutes a low impact on site LLW management.

Current UDS plans are to leave the heels in the emptied cylinders, fill them with the depleted U_3O_8 product, and dispose of them at either Envirocare or NTS. This approach is expected to meet the waste acceptance criteria of the disposal facilities and eliminate the potential for generating TRU waste (see Appendix B for additional information concerning TRU and PCB contamination). However, it is possible that the heels could be washed from the emptied cylinders if it was decided to reuse the cylinders for other purposes. In this case, the TRU in the heels of some cylinders at the maximum postulated concentrations could also result in the generation of some TRU waste at the conversion facility (see Appendix B). It is estimated that up to 30% (or 244 drums) of the heels could contain enough TRU to qualify this material as TRU waste if it was disposed of as waste. In this case, it is estimated that a volume of about 2.6 yd^3/yr (2.0 m^3/yr) of TRU and 6.0 yd^3/yr (4.4 m^3/yr) of LLW would be generated.

In addition, a small quantity of TRU could be entrained in the gaseous DUF_6 during the cylinder emptying operations and carried out of the cylinders. These contaminants would be captured in the filters between the cylinders and the conversion equipment. The filters would be monitored and replaced routinely to prevent buildup of TRU. The spent filters would be disposed of as LLW. It is estimated that the amount of LLW generated in the form of spent filters would be about 1 drum per year for a total of 18 drums (drums are 55 gal [208 L] in size) for the duration of the conversion operations (see Appendix B). This converts to a total volume of 5.0 yd^3 (3.7 m^3) of LLW. In the unlikely event that small amounts of TRU waste are generated from the conversion facility, the waste would be managed in accordance with DOE's policy for TRU waste, which includes the packaging and transport of these wastes to the Waste Isolation Pilot Plant (WIPP) in New Mexico for disposal.

TABLE 5.2-21 Materials Consumed Annually during Normal Conversion Facility Operations at the Portsmouth Site[a]

Chemical	Quantity (tons/yr)
Solid	
Lime (CaO)[b]	14
Liquid	
Ammonia (99.95% minimum NH_3)	510
Potassium hydroxide (KOH)	6
Gas	
Nitrogen (N_2)	7,800

[a] Material estimates are based on conceptual-design-status facility design data (UDS 2003b). A number of studies are planned to evaluate design alternatives, the results of which may affect the above materials needs.

[b] Assuming lime is used only for potassium hydroxide regeneration. If HF neutralization is required, the annual lime requirement would be approximately 7,000 tons/yr (6,350 t/yr).

5.2.3.8 Resource Requirements

Resource requirements during operations would not depend on the location of the conversion facility. Facility operations would consume electricity, fuel, and miscellaneous chemicals that are generally irretrievable resources. Estimated annual consumption rates of operating materials are provided in Table 5.2-21. The total quantity of commonly used materials is not expected to be significant and would not affect their local, regional, or national availability. In general, facility operational resources required are not considered rare or unique.

Operation of the facility could include the consumption of fossil fuels used to generate steam and heat and electricity (Table 5.2-22). Energy would also be expended in the form of diesel fuel and gasoline for cylinder transport equipment and transportation vehicles. The existing infrastructure at the site appears to be sufficient to supply the required utilities.

5.2.3.9 Land Use

Because the preferred location (Location A) for the facility already contains structures, operations would be generally consistent with current land use. As a consequence, no land use impacts are anticipated as a result of operating the facility and cylinder storage pad.

TABLE 5.2-22 Utilities Consumed during Conversion Facility Operations at the Portsmouth Site[a]

Utility	Annual Average Consumption	Unit	Peak Demand[b]	Unit
Electricity	31,084	MWh	6.2	MW
Liquid fuel	3,000	gal	NA[c]	NA
Natural gas[d,e]	4.0×10^7	scf[f]	180	scfm[f]
Process water	30×10^6	gal	215	gal/min
Potable water	3×10^6	gal	350	gal/min

a Utility estimates are based on facility conceptual-design-status data (UDS 2003b). A number of studies are planned to evaluate design alternatives, the results of which may affect the above utility needs.

b Peak demand is the maximum rate expected during any hour.

c NA = not applicable.

d Standard cubic feet measured at 14.7 psia and 60°F (16°C).

e The current facility design uses electrical heating. However, an option of using natural gas is being evaluated.

f scf = standard cubic feet; scfm = standard cubic feet per minute.

Alternative Locations B and C would have impacts similar to those at the preferred Location A during operations. Both locations occur on a site developed for the production of enriched uranium (and its DUF_6 by-product); as a consequence, operations would be generally consistent with current land use.

5.2.3.10 Cultural Resources

The routine operation of a DUF_6 conversion facility at Portsmouth is unlikely to adversely affect cultural resources at all three alternative locations because no ground-disturbing activities are associated with facility operation.

Air emissions or chemical releases from the facility were evaluated to determine their potential to affect significant cultural resources, predominantly historic structures, in the surrounding area. On the basis of the analysis of air emissions presented in Section 5.2.3.3, there would be only a negligible contribution of $PM_{2.5}$ within 150 m (500 ft) of the facility. This would not result in an adverse effect to cultural resources.

Accidental radiological and chemical releases, including HF, uranium compounds, and NH_3, would be possible, although unlikely, during the operation of the plant (Section 5.2.3.2). HF emissions are not projected to exceed secondary standards beyond site boundaries and would have no effect on cultural resources. Any release of uranium compounds would be as PM and could affect building surfaces in close proximity to the facility. NH_3 releases would be gaseous and would quickly disperse, although some surface deposits could occur. Careful washing of building surfaces could be required to remove such deposits if any contamination was detected following an accidental release.

5.2.3.11 Environmental Justice

The evaluation of environmental justice impacts is predicated on the identification of high and adverse impacts in other impact areas considered in this EIS, followed by a determination if those impacts would affect minority and low-income populations disproportionately. Analyses of impacts from operating the proposed facilities do not indicate high and adverse impacts for any of the other impact areas considered in this EIS (see Sections 5.2.3.1 through 5.2.3.10). Despite the presence of disproportionately high percentages of both minority and low-income populations within 50 mi (80 km) of the Portsmouth site, no environmental justice impacts are anticipated at any of the three alternative locations because of the lack of high and adverse impacts. Similarly, no evidence exists indicating that minority or low-income populations would experience high and adverse impacts from operating the facility or storage pad in the absence of such impacts in the population as a whole.

5.2.4 Cylinder Preparation Impacts at ETTP

Transporting the cylinders at ETTP to Portsmouth could result in potential environmental impacts at ETTP from the preparation of the cylinders for shipment. As described in Chapter 2, some of the DUF_6 cylinders in storage no longer meet DOT requirements for the shipment of radioactive materials. It is currently unknown exactly how many cylinders do not meet DOT requirements, although current estimates are that 1,700 cylinders are DOT-compliant. Before transportation, cylinders would have to be prepared to meet the requirements. As described in Chapter 2, for the purposes of this EIS, environmental impacts were evaluated for three options for preparing cylinders for shipment: use of cylinder overpacks, cylinder transfer and obtaining a DOT exemption.

An overpack is a container into which a cylinder would be placed for shipment. The overpack would be designed, tested, and certified to meet all DOT shipping requirements. The overpack would be suitable to contain, transport, and store the cylinder contents regardless of cylinder condition. According to UDS (2003b), the use of cylinder overpacks is considered the most likely approach for shipping noncompliant cylinders.

The cylinder transfer option would involve the transfer of the DUF_6 from noncompliant cylinders to cylinders that meet all DOT requirements. If selected, this option would likely require the construction of a cylinder transfer facility at ETTP. Currently, there are no plans or proposals to build or use a cylinder transfer facility to prepare DUF_6 cylinders for shipment. If such a decision were made, additional NEPA review would be conducted. The use of a cylinder transfer facility for cylinder preparation is considered much less likely than the use of overpacks, because the former approach would be more resource intensive and costly and would generate additional contaminated emptied cylinders requiring treatment and disposal.

The third option is to obtain an exemption from DOT that would allow the DUF_6 cylinders to be transported either "as is" or following repairs. The primary finding that DOT would have to make to justify granting an exemption is this: the proposed alternative would have to achieve a safety level that would be at least equal to the level required by the otherwise applicable regulation or, if the otherwise applicable regulation did not establish a required safety level, would be consistent with the public interest and adequately protect against the risks to life and property that are inherent when transporting hazardous materials in commerce. It is likely that some type of compensatory measures during the transportation would have to be employed to justify the granting of an exemption. No specific measures were evaluated in this EIS. However, because the granting of an exemption would be based on a demonstration of equivalent safety, the transportation impacts for this option would be similar to those presented for the overpack and cylinder transfer options. Therefore, transportation impacts for the exemption option are not presented separately in this section.

The site-specific impacts of preparing both compliant and noncompliant cylinders (using overpacks and cylinder transfer) for shipment at ETTP were evaluated in Appendix E of the DUF_6 PEIS (DOE 1999a). In that evaluation, it was assumed for ETTP that the total number of cylinders not meeting DOT requirements ranged from 2,342 to 4,683 (50% to 100% of the ETTP DUF_6 inventory); correspondingly, from 0 to 2,342 compliant cylinders would require preparation for shipment.

The following paragraphs summarize the impacts from the cylinder preparation activities at ETTP as presented in Appendix E of the DUF_6 PEIS (DOE 1999a). The site-specific impacts from operation of a transfer facility at ETTP were evaluated on the basis of the assumption that the facility would be located at the center of the site, since no proposal exists for such a facility and no specific location has been proposed. For the same reasons, the site-specific impacts from construction were not evaluated. Therefore, an additional NEPA review might be required to construct a cylinder transfer facility if a decision was made to do so in the future.

5.2.4.1 Cylinder Overpack Option

For normal operations, the PEIS analysis concluded that the potential on-site impacts from preparing compliant cylinders and from placing noncompliant cylinders into overpacks would be small and limited to involved workers. No impacts to the off-site public or the environment would occur, since no releases are expected and no construction activities would be required. The only equipment required would be similar to the equipment currently used during routine cylinder handling and maintenance activities.

It is estimated that at ETTP, the total collective dose to involved workers would range from 42 to 85 person-rem (resulting in less than 0.03 LCF) for overpacking operations and from 0 to 27 person-rem (resulting in less than 0.01 LCF) for preparation of compliant cylinders. The total collective dose to workers preparing all the ETTP cylinders would range from 69 to

85 person-rem (resulting in less than 0.03 LCF). This dose to workers would be incurred over the duration of the cylinder preparation operations (annual doses can be estimated by dividing the total dose by the duration of the operation in years). It should be noted that the assumptions used in the PEIS for estimating worker exposure were very conservative, with the purpose of bounding potential exposures. In practice, cylinder preparation activities, such as inspecting, unstacking, and loading cylinders, would involve fewer workers and be of shorter duration, resulting in significantly lower worker exposures than the estimates presented here.

The PEIS also evaluated the potential for accidents during cylinder preparation operations. The types of accident considered were the same as those considered for the continued storage of cylinders under the no action alternative in this EIS, such as spills from corroded cylinders during wet and dry conditions and vehicle accidents causing cylinders to be involved in fires. The consequences of such accidents are described under the no action alternative in Section 5.1.

5.2.4.2 Cylinder Transfer Facility Option

A summary of environmental parameters associated with the construction and operation of a cylinder transfer facility with various throughputs is presented in Table 5.2-23. In the PEIS, it was assumed that the ETTP transfer facility would process 320 cylinders per year, requiring about 15 years to transfer 4,683 cylinders. Although the three facility sizes shown in Table 5.2-23 have vastly different throughputs (ranging over a factor of 5), the differences in the environmental parameters among them are relatively small because of economies of scale. If transfer operations at ETTP occurred over a shorter period of time than 15 years, a larger facility would be required, with environmental parameters similar to those listed for the 1,600-cylinder/yr facility or the 960-cylinder/yr facility.

TABLE 5.2-23 Summary of Environmental Parameters for a Cylinder Transfer Facility at ETTP

	Facility Size (annual throughput)		
Affected Parameter	1,600 Cylinders	960 Cylinders	320 Cylinders
Disturbed land area (acres)	21	14	12
Paved area (acres)	15	10	8
Construction water (million gal/yr)	10	8	6.5
Construction wastewater (million gal/yr)	5	4	3.3
Operations water (million gal/yr)	9	7	6
Operations wastewater (million gal/yr)	7.1	5.7	4.4
Radioactive release (Ci/yr)	0.00078	0.00063	0.00049

Source: Appendix E in DOE (1999a).

For the cylinder transfer option, impacts during construction and normal operations would generally be small and limited primarily to involved workers. It is estimated that at ETTP, the total collective dose to involved workers would range from 410 to 480 person-rem (resulting in less than 0.2 LCF) for cylinder transfer operations, and it would range from 0 to 27 person-rem (resulting in less than 0.01 LCF) for preparing compliant cylinders. The total collective dose to workers preparing all the ETTP cylinders would range from 437 to 480 person-rem (resulting in less than 0.2 LCF). This dose to workers would be incurred over the duration of the cylinder preparation operations (annual doses can be estimated by dividing the total dose by the duration of the operation in years).

In the PEIS, the size of the transfer facility was estimated to be less than about 20 acres (8 ha); such a facility would likely be constructed in a previously disturbed area. Some small off-site releases of hazardous and nonhazardous materials could occur, although such releases would have negligible impacts on the off-site public and the environment. Construction activities could temporarily impact air quality; however, all criteria pollutants concentrations would be within applicable standards.

Impacts on cultural resources would be possible if a transfer facility was built at ETTP. Depending on the location chosen, the K-25 Main Plant Historical District, significant archaeological resources, or traditional cultural properties could be adversely affected. The ORR CRMP has been approved by the Tennessee SHPO. It includes procedures for determining the effect of an undertaking on cultural resources, consulting with the Tennessee SHPO and Native American groups, and mitigating adverse effects (Souza et al. 2001). These procedures, including additional surveys and any necessary mitigation, would have to be completed before any ground-disturbing activities for construction of a new facility could begin.

5.2.5 Transportation

The action alternatives involve transportation of DUF_6 and non-DUF_6 cylinders from ETTP to Portsmouth, in addition to transportation of the conversion products to a disposal site or to commercial users. The ETTP cylinders are expected to be shipped by truck and the conversion products by rail. However, a viable option is to ship some ETTP cylinders via rail and the conversion products by truck. For purposes of this EIS, transportation of all cargo is considered for both truck and rail modes of transport. In a similar fashion, conversion products declared to be wastes are expected to be sent to Envirocare of Utah for disposal; another viable option is to send the products to NTS. Thus, both options are evaluated. If not used as disposal containers for depleted U_3O_8 products, the emptied heel cylinders would be crushed and shipped in 20-ft (6-m) cargo containers, approximately 10 to a container. However, up to 10% of these cylinders might not meet Envirocare acceptance criteria and would be shipped as-is to NTS for disposal (UDS 2003b).

As discussed in Appendix F, Section F.3, the impacts of transportation were calculated in three areas: (1) collective population risks during routine conditions and accidents (Section 5.2.5.1), (2) radiological risks to MEIs during routine conditions (Section 5.2.5.2), and

(3) consequences to individuals and populations after the most severe accidents involving a release of radioactive or hazardous chemical material (Section 5.2.5.3).

5.2.5.1 Collective Population Risk

The collective population risk is a measure of the total risk posed to society as a whole by the actions being considered. For a collective population risk assessment, the persons exposed are considered as a group, without specifying individual receptors. The collective population risk is used as the primary means of comparing various options. Collective population risks are calculated for both vehicle- and cargo-related causes for routine transportation and accidents. Vehicle-related risks are independent of the cargo in the shipment and include risks from vehicular exhaust emissions and traffic accidents (fatalities caused by physical trauma).

5.2.5.1.1 ETTP Cylinders. The total collective population risks for shipment of the entire ETTP inventory to Portsmouth are presented in Table 5.2-24 for DUF_6 and non-DUF_6 cylinders. Annual impacts would depend on the duration of the shipping campaign and can be computed by dividing the total risk by the campaign duration. No fatalities are expected as a result of the shipping campaign because all estimated collective fatality risks would be much less than 0.5. The estimated radiation doses from the shipments are much less than levels expected to cause an appreciable increase in the risk of cancer in crew members and the public. The highest fatality risks are from vehicle-related causes, with the risks for truck shipments being higher than for rail.

The highest radiological risks would be for routine transport by general train (0.03 crew LCFs) followed by truck (0.01 crew LCFs). In RADTRAN (Neuhauser and Kanipe 1992), rail crew risks are calculated for railcar inspectors in rail yards. During transport, members of the rail crew are assumed to be shielded completely by the locomotive(s) and any intervening railcars. The radiological risks from accidents are approximately 10 times lower than those for routine transport. No chemical impacts would occur under normal transport conditions because the package contents are assumed to remain confined. Chemical accident risks for the entire shipping campaign would be negligible for any transport option. No adverse effects (3.6×10^{-6} or less) or irreversible adverse effects (2.6×10^{-6} or less) are expected.

5.2.5.1.2 Ammonia. Anhydrous NH_3 would be transported to the conversion facility for generation of hydrogen, which is used in the conversion process. Collective population risks associated with the transport of NH_3 to the site are shown in Table 5.2-25 for three different distances between the origin of NH_3 and the site. When a distance of 620 mi (1,000 km) from the site is assumed and average accident rates and population densities are used, the number of adverse effects that are expected among the crew and the population along the transportation route would be about 5 for the truck option and about 1 for the rail option. For the same distance, less than 1 irreversible adverse effect or fatality would be expected for either transportation mode. As expected, the risks would be smaller for distances of less than 620 mi (1,000 km) and higher for greater distances.

TABLE 5.2-24 ETTP UF_6 Cylinder Shipments to Portsmouth

	DUF_6		Non-DUF_6	
Mode	Truck	Rail[a]	Truck	Rail[a]
Shipment summary				
Number of shipments	4,900	1,225	503	181
Total distance traveled (km)	2,380,000	872,000	244,000	129,000
Cargo-related[b]				
Radiological impacts				
Dose risk (person-rem)				
Routine crew	26	82	3.5	17
Routine public				
Off-link	0.28	1.2	0.11	0.25
On-link	0.82	0.046	0.32	0.0094
Stops	7.8	1.4	3.1	0.29
Total	8.9	2.6	3.5	0.55
Accident[c]	0.24	0.022	0.0011	5.2×10^{-5}
Latent cancer fatalities[d]				
Crew fatalities	0.01	0.03	0.001	0.007
Public fatalities	0.005	0.001	0.002	0.0003
Chemical impacts				
Adverse effects	3.6×10^{-6}	9.9×10^{-8}	0	0
Irreversible adverse effects	2.6×10^{-6}	7.6×10^{-8}	0	0
Vehicle-related[e]				
Emission fatalities	0.2	0.01	0.02	0.002
Accident fatalities	0.069	0.029	0.007	0.0043

[a] Risks are presented on a railcar basis. One shipment is equivalent to one railcar.

[b] Cargo-related impacts are impacts attributable to the radioactive or chemical nature of the material being transported.

[c] Dose risk is a societal risk and is the product of accident probability and accident consequence.

[d] Latent cancer fatalities are calculated by multiplying dose by the ICRP Publication 60 health risk conversion factors of 4×10^{-4} fatal cancers per person-rem for workers and 5×10^{-4} for the public (ICRP 1991).

[e] Vehicle-related impacts are impacts independent of the cargo in the shipment.

TABLE 5.2-25 Collective Population Transportation Risks for Shipment of Anhydrous NH_3 to the Portsmouth Conversion Facility

	Distance to Conversion Facility (km)		
Mode	250	1,000	5,000
Truck Option			
Shipment summary			
Number of shipments	704	704	704
Total distance (km)	176,000	704,000	3,520,000
Cargo-related[a]			
Chemical impacts			
Adverse effects	1.3	5.3	26
Irreversible adverse effects	0.19	0.77	3.9
Vehicle related[b]			
Emission fatalities	0.02	0.07	0.3
Accident fatalities	0.0026	0.01	0.052
Rail Option			
Shipment summary			
Number of shipments	352	352	352
Total distance (km)	88,000	352,000	1,760,000
Cargo-related[a]			
Chemical impacts			
Adverse effects	0.29	1.2	5.8
Irreversible adverse effects	0.041	0.17	0.83
Vehicle-related[b]			
Emission fatalities	0.0009	0.004	0.02
Accident fatalities	0.0069	0.028	0.14

[a] Cargo-related impacts are impacts attributable to the radioactive or chemical nature of the material being transported.

[b] Vehicle-related impacts are impacts independent of the cargo in the shipment.

5.2.5.1.3 Conversion Products. The transportation assessment for the shipment of depleted uranium conversion products for disposal considers several options. The proposed disposal site is the Envirocare facility. (A small number of empty cylinders may require disposal at NTS.) For shipments to Envirocare, rail is evaluated as the proposed mode and truck is evaluated as an alternative. In addition, NTS is considered as an alternative disposal site. For this alternative, both truck and rail modes are evaluated, although neither is currently proposed.

For assessment of the rail option to NTS, it is assumed that a rail spur would be built in the future to provide rail access to NTS. Currently, the nearest rail terminal is about 70 mi (113 km) from NTS. If a rail spur was not available in the future and if NTS was selected as the disposal site, shipments could be made by truck, or rail could be used with an intermodal transfer to trucks at some place near NTS. (Transportation impacts for the intermodal option would be slightly greater than those presented for rail assuming NTS rail access, but less than those presented for the truck alternative.) If a rail spur to NTS was built, the impacts would require additional NEPA review.

Estimates of the collective population risks for shipment of the U_3O_8, emptied cylinders, and CaF_2 to Envirocare over the entire 18-year operational period are presented in Table 5.2-26, by assuming the U_3O_8 product is shipped in bulk bags. As an option, risks for the shipment of these materials to NTS are provided in Table 5.2-27. No radiological LCFs, traffic fatalities, or emission fatalities are expected for rail transport under either option. If the truck option was used, about 1 traffic fatality would occur and up to 7 fatalities from vehicle emissions might occur over the project period. No LCFs are expected.

If the emptied DUF_6 cylinders were refilled with the U_3O_8 product and used to transport the product to the disposal facility, as proposed, the risks shown in Tables 5.2-26 and 5.2-27 for transportation of emptied cylinders would not be applicable, and the risks associated with transportation of CaF_2 would be the same. The risks of transporting the U_3O_8 product in cylinders would be about the same as the sum of the risks for transporting the product in bulk bags plus the risk of shipping the crushed cylinders for the truck option (Table 5.2-28), assuming two refilled cylinders per truck. If one cylinder per truck were shipped, routine risks to the crew and vehicle-related risks would approximately double because the number of shipments would double. If the rail option was used, the risks would be slightly higher for the cylinder refill option, primarily because the quantity of U_3O_8 shipped in a single railcar would be less under the cylinder refill option than under the bulk bag option, and the number of shipments would be proportionally higher.

The risks for shipping the HF co-product are presented in Table 5.2-29 for representative shipment distances of 250, 1,000, and 5,000 km (155, 620, and 3,100 mi) by using average accident rates and population densities. For shipment distances up to 5,000 km (3,100 mi), 1 traffic fatality might be expected for shipment of the HF by either truck or rail and up to 4 emission fatalities could occur for shipment by truck, with none expected for rail shipments. For chemical risks, approximately 1 irreversible adverse effect is estimated for both truck and rail transport. Thus, no chemical fatalities are expected because approximately 1% of the cases with irreversible adverse effects are expected to result in fatality (Policastro et al. 1997). Table 5.2-30 presents the risks associated with the shipment of CaF_2 to either Envirocare or NTS should the HF be neutralized and disposed of as waste. Shipment of the CaF_2 to either Envirocare or NTS would have similar impacts, approximately 10 and 0 emission fatalities for truck or rail, respectively, and about 1 traffic fatality if shipped by truck.

The results of the transportation analysis discussed above indicate that the largest impact during normal transportation conditions would be associated with vehicle exhaust and fugitive dust emissions (unrelated to the cargo). Health risks from cardiovascular and pulmonary diseases have been linked to incremental increases in particulate concentrations in air. However, estimating the health risks associated with vehicle emissions is subject to a great deal of

TABLE 5.2-26 Collective Population Transportation Risks for Shipment of Conversion Products to Envirocare as the Primary Disposal Site, Assuming the U_3O_8 Is Disposed of in Bulk Bags

	U_3O_8		Emptied Cylinders				CaF_2	
	Portsmouth to Envirocare		Portsmouth to Envirocare[a]		Portsmouth to NTS[b]		Portsmouth to Envirocare	
Mode	Truck (option)	Rail (proposed)[c]	Truck (option)	Rail (proposed)[c]	Truck (proposed)	Rail (option)[c]	Truck (option)	Rail (proposed)[c]
Shipment summary								
Number of shipments	8,846	2,212	2,007	1,004	2,232	558	15	4
Total distance (km)	25,860,000	7,315,000	5,866,000	3,320,000	7,504,000	2,240,000	43,850	13,230
Cargo-related[d]								
Radiological impacts								
Dose risk (person-rem)								
Routine crew	150	350	35	88	79	170	NA[e]	NA
Routine public								
Off-link	2.6	12	0.7	2.9	1.2	3.9	NA	NA
On-link	7.2	0.31	1.9	0.077	3.0	0.12	NA	NA
Stops	60	5.4	16	1.3	23	2.7	NA	NA
Total	70	17	19	4.3	27	6.6	NA	NA
Accident[f]	28	9.3	0.24	0.075	0.02	0.0062	NA	NA
Latent cancer fatalities[g]								
Crew fatalities	0.06	0.1	0.01	0.04	0.03	0.07	NA	NA
Public fatalities	0.05	0.01	0.009	0.002	0.01	0.003	NA	NA
Chemical impacts								
Adverse effects	0.0009	0.0003	NA	NA	NA	NA	NA	NA
Irreversible adverse effects	0.0001	0.00009	NA	NA	NA	NA	NA	NA
Vehicle-related[h]								
Emission fatalities	5	0.2	1	0.1	2	0.05	0.008	0.0005
Accident fatalities	0.53	0.24	0.12	0.11	0.13	0.061	0.0009	0.00043

[a] Emptied cylinders are crushed and shipped 10 per cargo container, with 1 container per truck or 2 containers per railcar.

[b] Cylinders assumed not to meet waste acceptance criteria for Envirocare. Shipped "as-is" one per truck or four per railcar.

[c] Risks are presented on a railcar basis. One shipment is equivalent to one railcar. For assessment purposes, it was assumed that rail access to NTS would be available in the future.

[d] Cargo-related impacts are impacts attributable to the radioactive or chemical nature of the material being transported.

[e] NA = not applicable.

[f] Dose risk is a societal risk and is the product of accident probability and accident consequence.

[g] Latent cancer fatalities were calculated by multiplying the dose by the ICRP Publication 60 health risk conversion factors of 4×10^{-4} fatal cancers per person-rem for workers and 5×10^{-4} for the public (ICRP 1991).

[h] Vehicle-related impacts are impacts independent of the cargo in the shipment.

TABLE 5.2-27 Collective Population Transportation Risks for Shipment of Conversion Products to NTS as an Optional Disposal Site, Assuming the U_3O_8 Is Disposed of in Bulk Bags

	U_3O_8		Emptied Cylinders				CaF_2	
	Portsmouth to NTS		Portsmouth to NTS[a]		Portsmouth to NTS[b]		Portsmouth to Envirocare	
Mode	Truck (option)	Rail (option)[c]	Truck (option)	Rail (option)[c]	Truck (option)	Rail (option)[c]	Truck (option)	Rail (option)[c]
Shipment summary								
Number of shipments	8,846	2,212	2,007	1,004	2,232	558	15	4
Total distance (km)	29,740,000	8,879,000	6,748,000	4,030,000	7,504,000	2,240,000	43,850	13,230
Cargo-related[d]								
Radiological impacts								
Dose risk (person-rem)								
Routine crew	180	410	41	100	79	170	NA[e]	NA
Routine public								
Off-link	3.6	9.2	0.96	2.3	1.2	3.9	NA	NA
On-link	9.0	0.28	2.4	0.069	3.0	0.12	NA	NA
Stops	69	6.4	18	1.6	23	2.7	NA	NA
Total	82	16	22	3.9	27	6.6	NA	NA
Accident[f]	20	7.5	0.18	0.053	0.02	0.0062	NA	NA
Latent cancer fatalities[g]								
Crew fatalities	0.07	0.2	0.02	0.04	0.03	0.07	NA	NA
Public fatalities	0.05	0.01	0.01	0.002	0.01	0.003	NA	NA
Chemical impacts								
Adverse effects	0.001	0.0004	NA	NA	NA	NA	NA	NA
Irreversible adverse effects	0.0002	0.0001	NA	NA	NA	NA	NA	NA
Vehicle-related[h]								
Emission fatalities	6	0.2	1	0.09	2	0.05	0.008	0.0005
Accident fatalities	0.53	0.24	0.12	0.11	0.13	0.061	0.0009	0.00043

a Cylinders are crushed and shipped 10 per cargo container, with 1 container per truck or 2 containers per railcar.

b Cylinders assumed not to meet waste acceptance criteria for Envirocare. Shipped "as-is" one per truck or four per railcar.

c Risks are presented on a railcar basis. One shipment is equivalent to one railcar. For assessment purposes, it was assumed that rail access to NTS would be available in the future.

d Cargo-related impacts are impacts attributable to the radioactive or chemical nature of the material being transported.

e NA = not applicable.

f Dose risk is a societal risk and is the product of accident probability and accident consequence.

g Latent cancer fatalities were calculated by multiplying the dose by the ICRP Publication 60 health risk conversion factors of 4×10^{-4} fatal cancers per person-rem for workers and 5×10^{-4} for the public (ICRP 1991).

h Vehicle-related impacts are impacts independent of the cargo in the shipment.

TABLE 5.2-28 Collective Population Transportation Risks for Shipment of U_3O_8 Conversion Products in Emptied Cylinders

	Portsmouth to Envirocare (proposed)			Portsmouth to NTS (option)		
	Truck (option)			Truck (option)		
Mode	1 cylinder	2 cylinders	Rail (proposed)	1 cylinder	2 cylinders	Rail[a] (option)
Shipment summary						
Number of shipments	21,000	10,500	4,200	21,000	10,500	4,200
Total distance (km)	61,380,000	30,690,000	13,890,000	70,600,000	35,300,000	16,860,000
Cargo-related[b]						
Radiological impacts						
Dose risk (person-rem)						
Routine crew	330	180	520	390	210	600
Routine public						
Off-link	4.5	4.5	19	6.1	6.2	15
On-link	12	12	0.52	15	15	0.46
Stops	100	100	8.8	120	120	10
Total	120	120	29	140	140	26
Accident	31	31	10	21	21	8
Latent cancer facilities						
Crew fatalities	0.1	0.07	0.2	0.2	0.08	0.2
Public fatalities	0.07	0.08	0.02	0.08	0.08	0.02
Chemical impacts						
Adverse effects	0.0008	0.0008	0.0004	0.0009	0.0009	0.0005
Irreversible adverse effects	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Vehicle-related[c]						
Emission fatalities	10	5	0.5	10	7	0.4
Accident fatalities	1.3	0.63	0.45	1.3	0.63	0.46

[a] For assessment purposes, it was assumed that rail access to NTS would be available in the future.

[b] Cargo-related impacts are impacts attributable to the radioactive or chemical nature of the material being transported.

[c] Vehicle-related impacts are impacts independent of the cargo in the shipment.

uncertainty. The estimates presented in this EIS were based on very conservative health risk factors presented in Biwer and Butler (1999) and should be considered an upper bound. For perspective, in a recently published EIS for a geologic repository at Yucca Mountain, Nevada, (DOE 2002h), the same risk factors were used for vehicle emissions; however, they were adjusted to reduce the amount of conservatism in the estimated health impacts. As reported in the Yucca Mountain EIS, the adjustments resulted in a reduction in the emission risks by a factor of about 30.

TABLE 5.2-29 Collective Population Transportation Risks for Shipment of the HF Conversion Co-Product from the Portsmouth Site to Commercial Users

	49% HF			70% HF		
Mode	250 km	1,000 km	5,000 km	250 km	1,000 km	5,000 km
Truck Option						
Shipment summary						
Number of shipments	5,792	5,792	5,792	2,417	2,417	2,417
Total distance (km)	1,448,000	5,792,000	28,960,000	604,250	2,417,000	12,085,000
Cargo-related[a]						
Chemical impacts						
Adverse effects	0.13	0.54	2.7	0.50	2.0	10
Irreversible adverse effects	0.011	0.045	0.23	0.040	0.16	0.81
Vehicle-related[b]						
Emission fatalities	0.1	0.5	3	0.06	0.2	1
Accident fatalities	0.022	0.086	0.43	0.0090	0.036	0.18
Rail Option						
Shipment summary						
Number of shipments	1,159	1,159	1,159	484	484	484
Total distance (km)	289,750	1,159,000	5,795,000	121,000	484,000	2,420,000
Cargo-related[a]						
Chemical impacts						
Adverse effects	0.19	0.74	3.7	0.48	1.9	9.7
Irreversible adverse effects	0.012	0.047	0.23	0.04	0.16	0.79
Vehicle-related[b]						
Emission fatalities	0.003	0.01	0.06	0.001	0.005	0.02
Accident fatalities	0.023	0.091	0.45	0.0095	0.038	0.19

[a] Cargo-related impacts are impacts attributable to the radioactive or chemical nature of the material being transported.

[b] Vehicle-related impacts are impacts independent of the cargo in the shipment.

5.2.5.2 Maximally Exposed Individuals during Routine Conditions

During the routine transportation of radioactive material, specific individuals may be exposed to radiation in the vicinity of a shipment. RISKIND (Yuan et al. 1995) has been used to estimate the risk to these individuals for a number of hypothetical exposure-causing events. The receptors include transportation crew members, inspectors, and members of the public exposed during traffic delays, while working at a service station, or while living near an origin or a destination site. The assumptions about exposure are given in Biwer et al. (2001). The scenarios for exposure are not meant to be exhaustive; they were selected to provide a range of

TABLE 5.2-30 Collective Population Transportation Risks for Shipment of CaF_2 for the Neutralization Option

Parameter	Truck (option)	Rail (proposed)[a]
Number of shipments	13,559	3,390
Portsmouth to Envirocare option		
Total distance (km)	39,630,000	11,210,000
Emission fatalities	7	0.4
Accident fatalities	0.81	0.37
Portsmouth to NTS option		
Total distance (km)	45,590,000	13,610,000
Emission fatalities	10	0.3
Accident fatalities	0.82	0.37

[a] Risks are presented on a railcar basis. One shipment is equivalent to one railcar.

representative potential exposures. Doses were assessed and are presented in Table 5.2-31 on a per-event basis for the shipments of all radioactive materials.

On a per-shipment basis, the radiological risks to an MEI during routine transportation would be slightly higher for non-DUF_6 shipments than for depleted uranium shipments because a higher external dose rate is assumed. The highest potential routine radiological exposure to an MEI, with an LCF risk of 3×10^{-7}, would be for a person stopped in traffic near a rail shipment of non-DUF_6 cylinders from ETTP for 30 min at a distance of 3 ft (1 m). There is also the possibility for multiple exposures. For example, if an individual lived near the Portsmouth site and all shipments of U_3O_8 were made by rail in bulk bags, the resident could receive a combined dose of approximately 2.4×10^{-5} rem if present for all shipments (calculated as the product of about 2,200 shipments and an estimated exposure per shipment of 1.1×10^{-8} rem). The individual dose would increase by a factor of 2 approximately if the U_3O_8 product was shipped in refilled cylinders. This dose is still very low, however — more than 6,000 times lower than the individual average annual exposure of 0.3 rem from natural background radiation.

5.2.5.3 Accident Consequence Assessment

Whereas the collective accident risk assessment considers the entire range of accident severities and their related probabilities, the accident consequence assessment assumes that an accident of the highest severity category has occurred. The consequences, in terms of committed dose (rem) and LCFs for radiological impacts and in terms of adverse affects and irreversible adverse effects for chemical impacts, were calculated for both exposed populations and

TABLE 5.2-31 Estimated Radiological Impacts to the MEI from Routine Shipment of Radioactive Materials from the Portsmouth Conversion Facility

Material	Mode	Inspector	Resident	Person in Traffic	Person at Gas Station	Person near Rail Stop
Routine Radiological Dose from a Single Shipment (rem)						
DUF_6	Truck	6.3×10^{-5}	5.4×10^{-9}	2.3×10^{-4}	7.5×10^{-6}	NA[a]
	Rail	1.1×10^{-4}	1.5×10^{-8}	2.6×10^{-4}	NA	9.3×10^{-7}
Non-DUF_6	Truck	1.4×10^{-4}	2.0×10^{-8}	5.0×10^{-4}	2.7×10^{-5}	NA
	Rail	1.8×10^{-4}	2.5×10^{-8}	5.0×10^{-4}	NA	1.6×10^{-6}
Depleted U_3O_8 (in bulk bags)[b]	Truck	4.0×10^{-5}	3.1×10^{-9}	1.6×10^{-4}	4.4×10^{-6}	NA
	Rail	9.3×10^{-5}	1.1×10^{-8}	2.7×10^{-4}	NA	6.9×10^{-7}
Crushed heel cylinders[c]	Truck	5.3×10^{-5}	5.7×10^{-9}	1.6×10^{-4}	7.7×10^{-6}	NA
	Rail	6.6×10^{-5}	9.4×10^{-9}	1.7×10^{-4}	NA	6.1×10^{-7}
Heel cylinders[d]	Truck	6.8×10^{-5}	5.4×10^{-9}	2.7×10^{-4}	7.5×10^{-6}	NA
	Rail	1.5×10^{-4}	2.0×10^{-8}	4.0×10^{-4}	NA	1.3×10^{-6}
Routine Radiological Risk from a Single Shipment (lifetime risk of a LCF)[e]						
DUF_6	Truck	3×10^{-8}	3×10^{-12}	1×10^{-7}	4×10^{-9}	NA
	Rail	6×10^{-8}	8×10^{-12}	1×10^{-7}	NA	5×10^{-10}
Non-DUF_6	Truck	9×10^{-8}	1×10^{-11}	3×10^{-7}	1×10^{-8}	NA
	Rail	9×10^{-8}	1×10^{-11}	3×10^{-7}	NA	8×10^{-10}
Depleted U_3O_8 (in bulk bags)[b]	Truck	2×10^{-8}	2×10^{-12}	8×10^{-8}	2×10^{-9}	NA
	Rail	5×10^{-8}	6×10^{-12}	1×10^{-7}	NA	4×10^{-10}
Crushed heel cylinders[c]	Truck	3×10^{-8}	3×10^{-12}	8×10^{-8}	4×10^{-9}	NA
	Rail	3×10^{-8}	5×10^{-12}	8×10^{-8}	NA	3×10^{-10}
Heel cylinders[d]	Truck	3×10^{-8}	3×10^{-12}	1×10^{-7}	4×10^{-9}	NA
	Rail	7×10^{-8}	1×10^{-11}	2×10^{-7}	NA	6×10^{-10}

[a] Not applicable.

[b] Per-shipment doses and LCFs would be approximately the same for the cylinder refill option.

[c] Crushed heel cylinders are shipped 10 per cargo container, with 1 container per truck or 2 containers per railcar.

[d] Cylinders assumed not to meet waste acceptance criteria for Envirocare. Shipped "as-is," one per truck or four per railcar.

[e] LCFs were calculated by multiplying the dose by the ICRP Publication 60 health risk conversion factors of 4×10^{-4} fatal cancers per person-rem for workers and 5×10^{-4} for the public (ICRP 1991).

individuals in the vicinity of an accident. Tables 5.2-32 and 5.2-33 present the radiological and chemical consequences, respectively, to the population from severe accidents involving shipment of DUF_6, depleted U_3O_8, emptied heel cylinders, anhydrous NH_3, and aqueous HF.

Because the average uranium content of each non-DUF_6 cylinder shipment is much less than that of a DUF_6 cylinder shipment (the *total* amount of UF_6 in the non-DUF_6 cylinders is approximately 25 t [28 tons], compared with approximately 12 t [13 tons] in *each* DUF_6 cylinder), a separate accident consequence assessment was not conducted for non-DUF_6 cylinder shipments. The potential impacts of the highest-consequence accidents for non-DUF_6 cylinder shipments would be much less than those presented in Tables 5.2-32 and 5.2-33 for DUF_6 shipments.

The nuclear properties of DUF_6 are such that the occurrence of a nuclear criticality is not a concern, regardless of the amount of DUF_6 present. However, criticality is a concern for the handling, packaging, and shipping of enriched UF_6. For enriched UF_6, criticality control is accomplished by employing, individually or collectively, specific limits on uranium-235 enrichment, mass, volume, geometry, moderation, and spacing for each type of cylinder. The amount of enriched UF_6 that may be contained in an individual cylinder and the total number of cylinders that may be transported together are determined by the nuclear properties of enriched UF_6. Spacing of cylinders of enriched UF_6 in transit during routine and accident conditions is ensured by use of regulatory approval packages that provide protection against impact and fire. Consequently, because of these controls and the relatively small number of shipments containing enriched UF_6, the occurrence of an inadvertent criticality is not considered to be credible and therefore is not analyzed in the accident consequence assessment in this EIS.

No LCFs are expected for accidents involving heel cylinders; however, up to 3 or 60 LCFs might occur following a severe urban rail accident involving a railcar of U_3O_8 or DUF_6, respectively. Severe rail accidents could have higher consequences than truck accidents because each railcar would carry more material than each truck. The highest consequences were estimated on the basis of the assumption that the accident occurred in an urban area under stable weather conditions (such as at nighttime).

In a highly populated urban area, it is estimated that about 3 million people could be exposed to small amounts of uranium as it was dispersed by the wind. Among those exposed, it is estimated that approximately 60 LCFs could occur in the urban population in addition to those occurring from all other causes. For comparison, in a population of 3 million people, approximately 700,000 are expected to die of cancer from all causes. The occurrence of a severe rail accident in an urban area under stable weather conditions are expected to be rare. The consequences of cylinder accidents occurring in rural environments, during unstable weather conditions (typical of daytime) or involving a truck shipment, were also assessed. The consequences of all other accident conditions are estimated to be considerably less than those described above for the severe urban rail accident.

A comparison of Tables 5.2-32 and 5.2-33 indicates that severe accidents involving chemicals transported to and from the conversion facility site could have higher consequences

TABLE 5.2-32 Potential Radiological Consequences to the Population from Severe Transportation Accidents[a]

		Neutral Meteorological Conditions			Stable Meteorological Conditions		
Material	Mode	Rural	Suburban	Urban[b]	Rural	Suburban	Urban[b]
Radiological Dose (person-rem)							
DUF_6	Truck	590	580	1,300	15,000	15,000	32,000
	Rail	2,400	2,300	5,200	60,000	58,000	130,000
Depleted U_3O_8 (in bulk bags)	Truck	250	250	550	630	610	1,400
	Rail	1,000	990	2,200	2,500	2,400	5,400
Depleted U_3O_8 (1 cylinder)	Truck	120	110	250	280	280	620
	Rail	290	280	630	710	690	1,500
Depleted U_3O_8 (2 cylinders)	Truck	230	230	500	570	550	1,200
	Rail	580	560	1,300	1,400	1,400	3,100
Crushed heel cylinders[c]	Truck	2.5	0.67	1.5	4.4	1.2	2.6
	Rail	5.0	1.3	3.0	8.7	2.3	5.2
Heel cylinders[d]	Truck	0.25	0.067	0.15	0.44	0.12	0.26
	Rail	1.0	0.27	0.60	1.7	0.47	1.0
Radiological Risk (LCF)[e]							
DUF_6	Truck	0.3	0.3	0.6	7	7	20
	Rail	1	1	3	30	30	60
Depleted U_3O_8 (in bulk bags)	Truck	0.1	0.1	0.3	0.3	0.3	0.7
	Rail	0.5	0.5	1	1	1	3
Depleted U_3O_8 (1 cylinder)	Truck	0.06	0.06	0.1	0.1	0.1	0.3
	Rail	0.1	0.1	0.3	0.4	0.3	0.8
Depleted U_3O_8 (2 cylinders)	Truck	0.1	0.1	0.3	0.3	0.3	0.6
	Rail	0.3	0.3	0.6	0.7	0.7	2
Crushed heel cylinders[c]	Truck	0.001	0.0003	0.0007	0.002	0.0006	0.001
	Rail	0.002	0.0007	0.001	0.004	0.001	0.003
Heel cylinders[d]	Truck	0.0001	3×10^{-5}	7×10^{-5}	0.0002	6×10^{-5}	0.0001
	Rail	0.0005	0.0001	0.0003	0.0009	0.0002	0.0005

[a] National average population densities were used for the accident consequence assessment, corresponding to densities of 6 persons/km^2, 719 persons/km^2, and 1,600 persons/km^2 for rural, suburban, and urban zones, respectively. Potential impacts were estimated for the population within a 50-mi (80-km) radius, assuming a uniform population density for each zone.

[b] It is important to note that the urban population density generally applies to a relatively small urbanized area — very few, if any, urban areas have a population density as high as 1,600 persons/km^2 extending as far as 50 mi (80 km). The urban population density corresponds to approximately 32 million people within the 50-mi (80-km) radius, well in excess of the total populations along the routes considered in this assessment.

[c] Crushed heel cylinders are shipped 10 per cargo container, with 1 container per truck or 2 containers per railcar.

[d] Cylinders assumed not to meet waste acceptance criteria for Envirocare. Shipped "as-is," one per truck or four per railcar.

[e] LCFs were calculated by multiplying the dose by the ICRP Publication 60 health risk conversion factors of 4×10^{-4} fatal cancers per person-rem for workers and 5×10^{-4} for the public (ICRP 1991).

TABLE 5.2-33 Potential Chemical Consequences to the Population from Severe Transportation Accidents[a]

Chemical Effect	Mode	Neutral Meteorological Conditions			Stable Meteorological Conditions		
		Rural	Suburban	Urban[b]	Rural	Suburban	Urban[b]
Number of Persons with the Potential for Adverse Health Effects							
DUF_6	Truck	0	2	4	6	760	1,700
	Rail	4	420	940	110	13,000	28,000
Depleted U_3O_8 (in bulk bags)	Truck	0	1	1	0	12	28
	Rail	0	3	9	0	47	103
Depleted U_3O_8 (in cylinders)	Truck (1 cylinder)	0	0	1	0	6	13
	Truck (2 cylinders)	0	1	1	0	11	26
	Rail	0	2	5	0	27	58
Anhydrous NH_3	Truck	6	710	1,600	55	6,600	15,000
	Rail	10	1,100	2,500	90	11,000	24,000
49% HF	Truck	0.35	42	93	3.4	400	900
	Rail	0.99	120	270	7.3	880	1,900
70% HF	Truck	2.8	340	760	44	5,200	12,000
	Rail	9.3	1,100	2,500	110	14,000	30,000
Number of Persons with the Potential for Irreversible Adverse Health Effects[c]							
DUF_6	Truck	0	1	2	0	1	3
	Rail	0	1	3	0	2	4
Depleted U_3O_8 (in bulk bags)	Truck	0	0	0	0	5	10
	Rail	0	0	0	0	17	38
Depleted U_3O_8 (in cylinders)	Truck (1 cylinder)	0	0	0	0	2	5
	Truck (2 cylinders)	0	0	0	0	4	8
	Rail	0	1	1	0	10	22
Anhydrous NH_3	Truck	0.8	100	200	10	1,000	3,000
	Rail	1	200	400	20	2,000	5,000
49% HF	Truck	0.025	3.0	6.6	0.25	30	66
	Rail	0.081	9.7	22	0.62	74	160
70% HF	Truck	0.23	27	60	2.0	240	540
	Rail	0.77	92	210	6.7	800	1,800

Footnotes on next page.

TABLE 5.2-33 (Cont.)

[a] National average population densities were used for the accident consequence assessment, corresponding to densities of 6 persons/km^2, 719 persons/km^2, and 1,600 persons/km^2 for rural, suburban, and urban zones, respectively. Potential impacts were estimated for the population within a 50-mi (80-km) radius, assuming a uniform population density for each zone.

[b] It is important to note that the urban population density generally applies to a relatively small urbanized area — very few, if any, urban areas have a population density as high as 1,600 persons/km^2 extending as far as 50 mi (80 km). The urban population density corresponds to approximately 32 million people within the 50-mi (80-km) radius, well in excess of the total populations along the routes considered in this assessment.

[c] The potential for irreversible adverse effects from chemical exposures. Exposure to HF or uranium compounds is estimated to result in fatality to approximately 1% or less of those persons experiencing irreversible adverse effects (Policastro et al. 1997). Exposure to anhydrous NH_3 is estimated to result in fatality to approximately 2% of those persons experiencing irreversible adverse effects (Policastro et al. 1997).

than radiological accidents. For example, a severe rail accident involving transportation of anhydrous NH_3 to a site in an urban area under stable meteorological conditions could lead to 5,000 irreversible adverse effects. Among the individuals experiencing these irreversible effects, there could be close to 100 fatalities (about 2% of the irreversible adverse effects [Policastro et al. 1997]). Similarly, a 70% aqueous HF rail accident under the same conservative assumptions could result in approximately 1,800 irreversible adverse effects and 18 fatalities. As indicated in Table 5.2-33, the consequences would be considerably less if the accident occurred in a less populated area under neutral meteorological conditions. Consequences would also be less if a truck was involved in the accident rather than a railcar, because the truck would carry less material than a railcar.

Accidents for which consequences are provided in Tables 5.2-32 and 5.2-33 are extremely rare. For example, the average accident rate for interstate-registered heavy combination trucks is approximately 3.0×10^{-7} per kilometer (Saricks and Tompkins 1999). The conditional probability that a given accident would be a severe accident is on the order of 0.06 in rural and suburban areas and about 0.007 in urban areas (NRC 1977). Therefore, the frequency of a severe accident per kilometer of travel in an urban area is about 2×10^{-9}. For shipment of NH_3 to the site, the total distance traveled is estimated to be about 435,000 mi (700,000 km) if the NH_3 is transported from a location 620 mi (1,000 km) away from the conversion site (Table 5.2-25). The fraction of the distance traveled in urban areas is generally less than 5% (DOE 2002g, Table 6.10). If 5% is assumed, the total distance traveled in urban areas would be about 22,000 mi (35,000 km). On the basis of these assumptions, the probability of a severe NH_3 accident occurring in an urban area is about 7×10^{-5}. In general, stable weather conditions occur only about one-third of the time, resulting in a probability for the most severe anhydrous NH_3 accident listed in Table 5.2-33 of about 2×10^{-5} (or a 1-in-50,000 chance of occurrence) during the 18-year operational period. This means that such an accident is expected to occur about once every 900,000 years. Similarly, the severe aqueous 70% HF transportation truck accident is expected to occur about once in every 250,000 or more years of operation (i.e., it has about a 1-in-10,000 chance of occurring over the 18-year operational period).

The probability of a rail accident involving anhydrous NH_3 or 70% HF is even less than 2×10^{-5} or 1×10^{-4}, respectively, over the 18-year operational period, because the accident rates for railcars are lower (generally by about a factor of 5, see Table 6 in Saricks and Tompkins [1999]) and the total distance traveled by train is less (generally by about a factor of 2 to 4) for shipments of the same quantity of material over the same distance (because the railcar capacity is larger than the truck capacity). The conditional probability of a severe rail accident is about the same as that of a severe truck accident (about 0.05 in rural and suburban areas and about 0.008 in urban areas). Therefore, the probabilities of severe rail accidents over the same operational period are about 10 to 20 times less than the severe truck accidents.

Conservative estimates of consequences to the MEI located 100 ft (30 m) away from the accident site along the transportation route are also made for shipment of DUF_6 cylinders, depleted U_3O_8, emptied heel cylinders (assuming they are not used as containers for depleted U_3O_8), anhydrous NH_3, and aqueous HF. The results for radiological impacts are shown in Table 5.2-34. Under the conservative assumptions described above for consequences to the population, it is estimated that the MEI could receive a dose of up to 3.7 rem in accidents involving DUF_6 cylinders and up to 1.3 rem in accidents involving emptied cylinders. However, for shipment of the depleted U_3O_8 product by train, the MEI dose could be as high as 670 rem if the product was shipped in bulk bags and 380 rem if it was shipped in emptied DUF_6 cylinders. For shipment by truck, the MEI dose would be 170 rem with bulk bags and 150 rem with refilled cylinders (two per truck). The dose received by the individual would decrease quickly as the person's distance from the accident site increased. For example, at a distance of 328 ft (100 m), the dose would be reduced by a factor of about 6 (to about 110 rem and 60 rem for train accidents with bulk bags and refilled cylinders, respectively, and to about 28 rem and 25 rem for truck accidents with bulk bags and refilled cylinders, respectively). If the person was located at a distance of 100 ft (30 m) and if the accident occurred under the most severe conditions described above, the individual could suffer acute and potentially lethal consequences from both radiation exposure and the chemical effects of uranium. At 328 ft (100 m) or farther from the accident, the MEI would not be expected to suffer acute effects. However, the chance of the MEI developing a latent cancer would increase by about 10% for the train accident and about 3% for the truck accident under those conditions. For accidents involving DUF_6 cylinders, anhydrous NH_3, and aqueous HF, the MEI would likely experience an irreversible health effect or death, depending on the severity of the accident, weather conditions, and distance at the time of the accident.

Even though the risks are relatively low, the consequences of a few of the transportation accidents are considered to be high. These high-consequence accidents are generally associated with the transportation of anhydrous NH_3 to the site and aqueous HF and depleted U_3O_8 from the site. The consequences can be reduced or mitigated through design (e.g., by limiting the quantity of material per vehicle), operational procedures (e.g., by judicial selection of routes and times of travel, increased protection and tracking of transport vehicles), and emergency response actions (e.g., by sheltering, evacuation, and interdiction of contaminated food materials following an accident.)

TABLE 5.2-34 Potential Radiological Consequences to the MEI from Severe Transportation Accidents Involving Shipment of Radioactive Materials

	Neutral Meteorological Conditions		Stable Meteorological Conditions	
Mode	Dose (rem)	Radiological Risk (LCF)[a]	Dose (rem)	Radiological Risk (LCF)[a]
DUF_6				
Truck	0.43	0.0002	0.91	0.0004
Rail	1.7	0.0009	3.7	0.002
Depleted U_3O_8 (in bulk bags)				
Truck	11	0.005	170[b]	0.08
Rail	42	0.02	670[b]	0.3
Depleted U_3O_8 (1 cylinder)				
Truck	4.8	0.002	76	0.04
Rail	12	0.006	190	0.09
Depleted U_3O_8 (2 cylinders)				
Truck	9.6	0.005	150[b]	0.08
Rail	24	0.01	380[b]	0.2
Crushed heel cylinders[c]				
Truck	0.28	0.0001	0.63	0.0003
Rail	0.55	0.0003	1.3	0.0006
Heel cylinders[d]				
Truck	0.028	1×10^{-5}	0.063	3×10^{-5}
Rail	0.11	6×10^{-5}	0.25	0.0001

[a] LCFs were calculated by multiplying the dose by the ICRP Publication 60 health risk conversion factors of 4×10^{-4} fatal cancers per person-rem for workers and 5×10^{-4} for the public (ICRP 1991).

[b] See text for discussion. Because of the conservative assumptions made in deriving the numbers in this table, the MEI is likely to receive a dose that is less than shown here. However, if the doses were as high as those shown in the table, the MEI could develop acute radiation effects. The individual might also suffer from chemical effects due to uranium intake.

[c] Crushed heel cylinders are shipped 10 per cargo container, with 1 container per truck or 2 containers per railcar.

[d] Shipped "as is," one cylinder per truck or four cylinders per railcar.

5.2.5.4 Historical Safety Record of Anhydrous NH_3 and HF Transportation in the United States

Anhydrous NH_3 is routinely shipped commercially in the United States for industrial and agricultural applications. Information provided in the DOT *Hazardous Material Incident System (HMIS) Database* (DOT 2003b) for 1990 through 2002 indicates that 2 fatalities and 19 major injuries to the public or to transportation or emergency response personnel occurred as a result of anhydrous NH_3 releases during truck and rail operations. These fatalities and injuries occurred during transportation or loading and unloading operations. Over that period, truck and rail NH_3 spills resulted in more than 1,000 and 6,000 evacuations, respectively. Five very large spills, greater than 10,000 gal (38,000 L), occurred; however, these spills were en route derailments from large rail tank cars. The two largest spills, both around 20,000 gal (76,000 L), occurred in rural or lightly populated areas of Texas and Idaho and resulted in 1 major injury. The Idaho spill in 1990 required the evacuation of 200 people. For highway shipments, 1 truck transport and 3 loading/unloading accidents occurred that involved large anhydrous NH_3 spills of between 4,000 and 8,000 gal (15,000 and 30,000 L). The 1 en route truck accident involving the largest truck spill (in Iowa on May 3, 1996) resulted in 1 fatality and the evacuation of 40 people. The other 3 large truck shipment spills occurred during loading/unloading operations but did not result in any fatalities. However, one of the spills involved a major injury and required the evacuation of 14 people in addition to the treatment of 26 with minor injuries.

Over the past 30 years, the safety record for transporting anhydrous NH_3 has significantly improved as a result of several factors. Hazardous compressed gas truck shipment loading and unloading operations require strict conformance with DOT standards for safety valve design and specifications, in addition to requirements on the installation of measuring and sampling devices. Federal rules governing the transportation of hazardous materials (49 CFR 173) require that valves installed for tank venting, loading, and unloading operations must be "of approved design, made of metal not subject to rapid deterioration by the lading, and must withstand the tank test pressure without leakage." The MC331 compressed gas tanker trucks, which would most likely be used to ship anhydrous NH_3 to the DUF_6 conversion facility, must be equipped with check valves to prevent the occurrence of a large spill (e.g., a spill from a feed line disconnection during a loading operation). These valves are typically located near the front end of a MC331 tanker truck and close to the driver's cab. Although not specifically required by DOT regulations, excess flow valves may be installed to prevent a catastrophic spill in the event that the driver is unable to reach the manual check valve to cut off flow from a failed feed line or loading tank valve. Safety measures contributing to the improved safety record over the past 30 years include the installation of protective devices on railcars, fewer derailments, closer manufacturer supervision of container inspections, and participation of shippers in the Chemical Transportation Emergency Center.

Most of the HF transported in the United States is anhydrous HF, which is more hazardous than the aqueous HF. Since 1971, which is the period covered by DOT records (DOT 2003b), no fatal or serious injuries to the public or to transportation or emergency response personnel have occurred as a result of anhydrous HF releases during transportation. Over the period 1971 to 2003, 11 releases from railcars were reported to have no evacuations or injuries associated with them. The only major release (estimated at 6,400 lb [29,000 kg] of HF) occurred in 1985 and resulted in approximately 100 minor injuries. Another minor HF release during transportation occurred in 1990. The safety record for transporting HF has improved in the past 10 years for the same reasons discussed above for NH_3.

5.2.6 Impacts Associated with HF and CaF_2 Conversion Product Sale and Use

During the conversion of the DUF_6 inventory to depleted uranium oxide, products having some potential for reuse would be produced. These products would include HF and CaF_2, which are commonly used as commercial materials. An analysis of impacts associated with their potential reuse has been included as part of this EIS. Areas examined include the characteristics of these materials as produced within the conversion process, the current markets for these products, and the potential socioeconomic impacts within the United States if the products were sold. Because there would be some residual radioactivity associated with these materials, a description of the DOE process for authorizing release of materials for unrestricted use (referred to as "free release") and a bounding estimate of the potential human health effects of such free release were included in the analysis. Details on the analysis are presented in Appendix E and are summarized below.

One of the chemicals produced during conversion would be an aqueous HF acid-water solution of 55% strength. The predominant markets for HF acid call for 49% and 70% HF solutions; consequently, this product would be further processed to yield these strengths. In the preferred design, a small amount of solid CaF_2 would also be produced.

Table 5.2-35 gives the approximate quantities of HF and CaF_2 that would be produced annually in the preferred designs. The quantities are based on the assumption that there would be a viable economic market for the aqueous HF produced. If such a market did not exist, UDS proposes that it would convert all of the HF to CaF_2 and then either sell this product or dispose of it as LLW or solid waste. The approximate quantity of CaF_2 produced in this scenario would be 8,800 t (9,700 tons) at the Portsmouth site.

Because it is expected that the UDS-produced HF and CaF_2 would contain small amounts of volumetrically distributed residual radioactive material, neither could be sold for unrestricted use, and CaF_2 could not be disposed of as solid waste, unless DOE established authorized limits for radiological contamination in HF and CaF_2. UDS would be required to apply for appropriate authorized limits, according to whether HF and CaF_2 were sold, or CaF_2 was disposed of as solid

TABLE 5.2-35 Products from DUF_6 Conversion (t/yr)

Product	Portsmouth	Paducah	Total
Depleted uranium oxide	10,800	14,300	25,100
HF acid (55% solution)	8,200	11,000	19,300
CaF_2	18	24	42

waste. In this context, authorized limits would be the maximum concentrations of radioactive contaminants allowed to remain volumetrically distributed within the HF or CaF_2. The dose analysis presented in this EIS was not conducted to establish authorized limits.

The potential, bounding exposure rate for a hypothetical worker working in close proximity to an HF storage tank was estimated to be 0.034 mrem/yr on the basis of very conservative assumptions. Similar bounding estimates of the exposure rate to a worker in close proximity to a CaF_2 handling process yielded 0.23 mrem/yr. The radiation sources contributing to the bounding exposure rate for HF were external radiation and inhalation. For CaF_2, in addition to external radiation and inhalation, the bounding exposure also resulted from an assumed incidental ingestion. Given more realistic exposure conditions, the potential dose would be much smaller than the bounding estimates. Potential exposures to product users would be much smaller than those to workers. Detailed discussions on the assumptions for bounding exposure are provided in Appendix E.

Socioeconomic impact analyses were conducted to evaluate the impacts of the introduction of the UDS-produced HF or CaF_2 into the commercial marketplace. The current aqueous HF acid producers have been identified as a potential market for the aqueous HF acid (UDS 2003b), with UDS-produced aqueous HF replacing some or all of current U.S. production. The impact of HF sales on the local economy in which the existing producers were located and on the U.S. economy as a whole would likely be minimal.

No market for the 22,000 t (24,000 tons) of CaF_2 that might be produced in the proposed conversion facilities at Paducah and Portsmouth has been identified (UDS 2003a). Should such a market be found, the impact of CaF_2 sales on the U.S. economy would likely be minimal.

In the event that no market for either HF or CaF_2 is established, the HF would be neutralized in a process that would produce additional CaF_2. It is likely that the CaF_2 would be disposed of as waste. This would require shipping it to an approved solid waste or LLW disposal facility. While disposal activities would produce a small number of transportation jobs and might lead to additional jobs at the waste disposal facility, the impact of these activities in the transportation corridors, at the waste disposal site(s), and on the U.S. economy would be minimal.

5.2.7 Impacts If ETTP Cylinders Are Shipped to Paducah Rather Than to Portsmouth

Current DOE plans call for the cylinders at ETTP to be shipped to Portsmouth. However, the option of sending the ETTP cylinders to Paducah instead is considered in this section.

If the ETTP DUF_6 cylinders were shipped to Paducah, the Portsmouth conversion plant would operate for 14 years rather than 18 years to convert the Portsmouth inventory. Potential impacts associated with transportation to and conversion of the ETTP cylinders at Paducah are evaluated in detail in the site-specific Paducah conversion facility EIS (DOE/EIS-0359). Facility construction impacts would be the same as discussed in Section 5.2.2. The annual operational impacts would be the same as described in Section 5.2.3 because the facility throughput would be the same; however, impacts would occur over only a 14-year period rather than 18 years. In addition, the radiation doses to cylinder yard workers handling the ETTP cylinders, described in Section 5.2.2.1, would not be incurred.

5.2.8 Potential Impacts Associated with the Option of Expanding Conversion Facility Operations

As discussed in Section 2.2.7, several reasonably foreseeable activities could result in a future decision to increase the conversion facility throughput or extend the operational period at one or both of the conversion facility sites. Specifically, the throughput of the facility could be increased through process improvements or a fourth process line could be added at Portsmouth. The facility also could be operated beyond the currently planned 18-year period in order to process additional DUF_6 that might be transferred to DOE at some time in the future (such as DUF_6 generated by USEC or another commercial enrichment facility). In addition, it is possible that DUF_6 cylinders could be transferred from Paducah to Portsmouth to facilitate conversion of the entire inventory, particularly if DOE assumes responsibility for additional DUF_6 at Paducah and not at Portsmouth.

To account for these future possibilities and provide future planning flexibility, this section includes an evaluation of the environmental impacts associated with expanding conversion facility operations at Portsmouth, either by increasing throughput or by extending operations. In addition, potential environmental impacts associated with possible Paducah-to-Portsmouth cylinder shipments are also evaluated in this section.

5.2.8.1 Potential Impacts Associated with Increasing Plant Throughput

The throughput of the Portsmouth facility could be increased either by process efficiency improvements or by adding an additional (fourth) process line. DOE believes that higher throughput rates can be achieved by improving the efficiency of the planned equipment (DOE 2004b). The conversion contract provides significant incentives to the conversion contractor to improve efficiency. For example, the current facility designs are based on an assumption that the conversion plant would have an 84% on-line availability (percent of time system is on line and operational). However, on the basis of Framatome's experience at the Richland plant, the on-line availability is expected to be at least 90%. Therefore, there is additional capacity expected to be realized in the current design.

If the plant throughput was marginally increased by process improvements, the environmental impacts during operations could increase for some areas but still would be similar to those discussed in Section 5.2.3 for the base design. For example, annual radiation doses to workers and the public from site emissions might increase in proportion to throughput. Slight variations in plant throughput are not unusual from year to year because of operational factors (e.g., equipment maintenance or replacement) and are generally accounted for by the conservative nature of the impact calculations. As discussed in Section 5.2.3, the estimated annual impacts during operations are well within applicable guidelines and regulations, with collective and cumulative impacts being quite low.

In contrast to process efficiency improvements, the addition of a fourth process line at the Portsmouth facility would require the installation of additional plant equipment and would result in a nominal 33% increase in throughput when compared with the current base design. The plant capacity would be similar to the capacity planned for the Paducah site (evaluated in DOE/EIS-0359). This throughput increase would reduce the time necessary to convert the Portsmouth and ETTP DUF_6 inventories by about 5 years.

The potential environmental impacts associated with a 33% increase in throughput (for example, by the addition of a fourth conversion process line) at Portsmouth are discussed below by technical discipline. In general, the potential impacts are discussed relative to the operational impacts presented previously in Section 5.2.3 for the base design facility (i.e., three process lines). The construction impacts presented in Section 5.2.2 for three process lines were already based on a process building large enough to accommodate a fourth process line.

A parametric analysis was conducted for conversion facilities of different sizes as part of the PEIS (DOE 1999a). As discussed in Appendix K of the PEIS, potential environmental impacts resulting from the construction and operation of a conversion facility were estimated for throughputs ranging from 7,000 to 28,000 t/yr (7,716 to 30,865 tons/yr) of DUF_6. In comparison, the throughput of the Portsmouth conversion facility is 13,500 t/yr (14,881 tons/yr) with three process lines and 18,000 t/yr (19,842 tons/yr) when a 33% increase is assumed — well within the range analyzed in the parametric study conducted for the PEIS.

The results presented in Appendix K of the PEIS indicated that some impacts would not vary with throughput (e.g., certain accident consequences), whereas other impacts would. However, it was found that in most cases, impacts would not increase in direct proportion with throughput because of economies of scale. For example, if the throughput increased by 33%, the expected increase in the impacts generally would be less than 33%. In spite of this less than one-to-one relationship, in some cases, the analyses that follow conservatively assume that impacts would increase in the same proportion as throughput.

In addition, DOE analyzed the impacts of a larger conversion facility with four process lines at Paducah in a separate EIS (DOE/EIS-0359). The resource requirements, environmental releases, and product and waste generation rates would be the same irrespective of where the facility was constructed. In addition, some of the impacts (e.g., the involved worker doses) would also be same. Whenever applicable, the results from the Paducah conversion facility EIS were used in the evaluation of impacts for the expanded capacity conversion facility option at Portsmouth in the following sections.

5.2.8.1.1 Human Health and Safety — Normal Operations. In general, a 33% increase in throughput at Portsmouth would result in an annual increase in the radiation exposure of workers and members of the public. However, it is expected that the cumulative doses for conversion of the entire inventory of Portsmouth and ETTP DUF_6 would be the same, regardless of the annual throughput or number of process lines. This is because the higher annual doses associated with increased throughput would be offset by a shorter operational duration.

When an increase in the annual radiation dose to individual involved workers of 33% (proportional to the throughput increase) is assumed, the maximum annual individual worker doses would be approximately 100 mrem/yr to workers in the conversion facility and approximately 800 mrem/yr to cylinder yard workers (on the basis of results presented in Table 5.2-10). These doses would remain well below applicable regulatory limits and below levels expected to cause appreciable health effects. The annual collective dose to involved workers would increase from approximately 10.1 person-rem/yr to 10.7 person-rem/yr (on the basis of the involved worker doses estimated for the Paducah conversion facility [DOE 2004a]).

It is estimated that the annual airborne emissions of uranium would be the same for the Portsmouth conversion facility (three process lines) and the Paducah conversion facility (four process lines) (UDS 2003b). Therefore, annual doses to off-site members of the public and noninvolved workers from uranium emissions would be expected to be the same as presented in Table 5.2-10. However, even if it was assumed that emissions would increase 33% proportionally with throughput, the estimated dose to the MEI public and noninvolved workers would be much less than 1×10^{-4} mrem/yr. This dose is much less than the radiation dose limits of 100 mrem/yr (DOE 1990) from all pathways and 10 mrem/yr (40 CFR Part 61) from airborne pathways set to protect the general public from operations of DOE facilities.

Potential chemical exposures would also remain well below levels expected to cause health effects, even with a 33% increase in throughput. Human health impacts resulting from exposure to hazardous chemicals during normal operations of the conversion facilities are estimated as hazard indices of 5×10^{-6} and 5.4×10^{-5} for the noninvolved worker and general public MEI, respectively. The hazard indices for the conversion process would be at least three orders of magnitude lower than the hazard index of 1, which is the level at which adverse health effects might be expected to occur in some exposed individuals.

5.2.8.1.2 Human Health and Safety — Facility Accidents. As discussed in Section 5.2.3, there is a risk of on-the-job fatalities and injuries to conversion facility workers because of the industrial nature of the work environment. This risk is directly related to the amount of labor required (measured in terms of full-time equivalent employees). UDS estimated that there would be the same number of workers employed in the conversion facility at Paducah (four process lines) and at Portsmouth (three process lines) (UDS 2003b). Therefore, when it is assumed that the total amount of labor required to convert the Portsmouth and ETTP DUF_6 inventories would be the same regardless of throughput (e.g., whether three or four process lines were used), the risks from physical hazards if the throughput was increased 33% would be the same as those described in Section 5.2.3 for the base design. No on-the-job fatalities are predicted during the conversion facility operational phase. It is estimated, however, that about 142 injuries would occur over the life of the project (Table 5.2-4). Therefore, if the processing time was reduced by 5 years, about 40 fewer on-the-job injuries would be expected.

In general, for accidents involving the release of radioactive or hazardous materials, the consequences and risks if the throughput was increased by 33% would be the same as those discussed in Sections 5.2.3.2.1 and 5.2.3.2. This is because most of the bounding accidents would involve a limited amount of material that would be at risk under accident conditions, regardless of the facility throughput. For example, the consequences of accidents involving cylinders do not depend on the facility throughput. Similarly, the HF and NH_3 storage tanks would be the same size regardless of the facility throughput; therefore the consequences of a tank rupture would be the same.

The one exception would be the bounding radiological accident involving an earthquake that affects 6 months' worth of conversion product storage (an extremely unlikely accident). If the throughput was increased 33% (for instance, by adding a fourth process line), the amount of uranium oxide in storage could be 33% greater than the amount under the base design. Therefore, the amount of material potentially released would be 33% greater than that shown in Table 5.3-11. The resulting consequences (Tables 5.2-12 and 5.2-13) would also increase by 33%. However, because of the low probability of such an accident, the overall accident risk (calculated as the product of the accident consequence and the accident probability) would remain the same as discussed in Section 5.2.3.2.1; that is, no fatalities would be expected.

Although the estimated frequencies of some accidents could increase somewhat in association with an increased throughput, this increase would not be large enough to change the frequency category designations of the accidents given in Section 5.2.3. Any small increase in the annual frequency of some accidents would be offset by the reduced operational period of the facility. Therefore, the overall probability of occurrence of the accidents over the operational periods would be about the same. As a result, the total accident risk would not change.

5.2.8.1.3 Air Quality and Noise. If the throughput was increased 33% at the Portsmouth facility, emissions of criteria pollutants would increase in negligible amounts. However, emissions of HF would increase by 33% as a result of the increase in throughput. Potential impacts of criteria pollutants on ambient air quality would remain almost the same as presented in Table 5.2-18. In other words, total (background plus project increment) concentrations would be well below their applicable standards, except for $PM_{2.5}$, which would approach or exceed the standards because of the regionally high background concentrations (similar to the case with three process lines). The background data used are the maximum values from the last 5 years of monitoring at the nearest monitoring location (operated by the OEPA) to the site, located about 20 mi (32 km) away in the town of Portsmouth. On the basis of these values, exceedance of the annual $PM_{2.5}$ standard would be unavoidable, because the background concentration already exceeds the standard (background is 24.1 $\mu g/m^3$, in comparison with the standard of 15 $\mu g/m^3$).

The potential impacts of HF on ambient air quality would increase by about 33%, with estimated maximum HF concentration increments and total concentrations remaining well below their state standards: about 6% and 20% for the standards, respectively.

With respect to noise, a throughput increase of 33% is estimated to result in an increase in the noise level within the conversion facility of about 1 dB. This increase would attenuate significantly while passing through the conversion building walls. Accordingly, noise levels at the nearest residence would be almost the same as those for three processing lines, which would be below the EPA guideline of 55 dB(A).

5.2.8.1.4 Water and Soil. Increasing the throughput 33% at Portsmouth (for example, by increasing the number of process lines from three to four) would increase the quantity of process water needed for operations from 30 million gal/yr (114 million L/yr) to 37 million gal/yr (141 million L/yr), the same amount of process water needed at the Paducah facility. Groundwater withdrawn from wells for average use would still represent an increase of less than 1% of the current water use at the facility and 0.3% of the existing well capacity. Such impacts would remain small. No additional impacts to surface water or soils would be expected.

5.2.8.1.5 Socioeconomics. The socioeconomic impacts of a 33% increase in throughput at Portsmouth would be minimal. There could be a slight increase in capital and material expenditures if an additional process line was constructed (estimated to be $5.6 million by the OIG), with a corresponding increase in labor expenditures to install the necessary equipment and facilities. However, as would be the case with capital expenditures associated with a three-process-line facility, it is assumed that there would be no local vendors or a limited number of them for the required specialized equipment, with a large majority of capital expenditures being made outside the ROI at the Portsmouth site. The impact of capital expenditures for an additional process line would therefore be minimal in the ROI.

Wage and salary spending associated with the installation of additional process line equipment would produce impacts in the ROI. The size of these impacts would depend on the size of the additional labor force required and the timing of the corresponding labor expenditures. However, since the additional process-line installation would most likely require no increase or only a small increase in the size of the overall labor force beyond that required for the three-process-line facility, the relative impact of the additional wage and salary expenditures in the ROI would likely be small. No additional impacts on local housing or local public services and education would be expected.

Operation of the facility with the additional process line would not require any increase in employment at the Portsmouth site. Impacts of operating the additional process line would be limited to any increase in expenditures on materials that might be made in the ROI. These expenditures would be unlikely to differ significantly from those associated with a three-process-line facility, meaning that the local impacts of the additional process line are also likely to be minimal.

A 33% increase in the throughput at Portsmouth would reduce the operational period of the facility by approximately 5 years. Consequently, positive socioeconomic impacts associated with employment of the conversion facility workforce would last approximately 13 years, compared to 18 years under the base design.

5.2.8.1.6 Ecology. Because a 33% increase in throughput at Portsmouth would not require the disturbance of any areas beyond those disturbed for the base design facility, and because the emissions would remain well below levels expected to have adverse effects on vegetation and biota, no impacts to ecological resources would be expected.

5.2.8.1.7 Waste Management. Over the life of the project, the total amounts of conversion products and waste (including low level, hazardous, and non-hazardous waste) generated at the conversion facility for conversion of the Portsmouth and ETTP DUF_6 inventories would be the same regardless of the annual facility throughput. However, the annual amounts of waste produced, provided in Table 5.2-20, would increase by approximately 33% as a result of the higher plant throughput when compared with that of the base design. This annual increase would not be expected to appreciably increase the annual impacts to waste management capabilities discussed in Section 5.2.3.7. As noted in Section 5.2.3.7, in the event that the HF was not marketable and it was neutralized to CaF_2, the site's projected generation of nonhazardous waste would increase substantially (increasing by approximately 90% with three process lines and 120% with four process lines, assuming the CaF_2 was determined to be a nonhazardous waste).

5.2.8.1.8 Resource Requirements. A 33% increase in annual throughput at Portsmouth could require an increase of up to 33% in the quantities of materials required for operations, as shown in Table 5.2-21. As noted in Section 5.2.3.8, the material resources required during operations are not considered rare or unique, and the total quantities required would not affect their local, regional, or national availability. Therefore, negligible impacts on resource requirements would be expected if the throughput was increased 33% at the Portsmouth facility.

5.2.8.1.9 Land Use. A 33% increase in the annual throughput at Portsmouth would not increase the amount of land required for the conversion facility and would not alter the current or proposed site land use. The base design facility is already large enough to accommodate a fourth process line if one is required. Therefore, no impacts on land use would occur.

5.2.8.1.10 Cultural Resources. A 33% increase in the annual throughput at Portsmouth is unlikely to adversely affect cultural resources at all three alternative locations because no ground-disturbing activities would be associated with the throughput increase. In addition, facility air emissions would be well below levels that would adversely affect cultural resources.

5.2.8.1.11 Environmental Justice. As discussed in Section 5.2.3.11, the evaluation of environmental justice impacts is predicated on the identification of high and adverse impacts in other impact areas considered in this EIS, followed by a determination of whether those impacts would affect minority and low-income populations disproportionately. Analyses of impacts from operating the conversion facility with an increased throughput do not indicate high and adverse impacts for any of the other impact areas considered. Despite the presence of disproportionately high percentages of low-income populations within 50 mi (80 km) of the Portsmouth site, no environmental justice impacts are anticipated at any of the three alternative locations because of the lack of high and adverse impacts.

5.2.8.1.12 Transportation. The transportation impacts presented in Section 5.2.5 for the base design (three process lines) are cumulative totals for the shipment of all materials associated with the conversion of the Portsmouth and ETTP DUF_6 inventories. Therefore, the overall transportation impacts would be the same regardless of whether or not the annual throughput was increased 33%. However, the annual number of shipments would increase 33%. The annual transportation impacts can be estimated by dividing the collective population impacts presented in Section 5.2.5 by the shipping campaign duration. Thus, annual impacts would be greater if the throughput was increased 33% because the inventory would be converted and transported at a higher rate, but the total impacts would be the same as for the three-process-line base design.

5.2.8.1.13 Cumulative Impacts. The potential cumulative impacts at the Portsmouth site from operation of the conversion facility are discussed in Section 5.3 for the base design, a three-process-line facility. As discussed in that section, the cumulative impacts, including the proposed action and other current or reasonably foreseeable activities at the site, are within regulatory limits and generally well below levels expected to cause adverse environmental impacts (with the exception of $PM_{2.5}$ concentrations, which might exceed standards because of the regionally high background level). Because the incremental impacts of increasing the throughput by 33% at the Portsmouth facility would not significantly increase the potential environmental impacts from the conversion facility, as discussed above, the cumulative impacts would be the same as those discussed in Section 5.3.

5.2.8.1.14 Decontamination and Decommissioning. Potential environmental impacts associated with the D&D of the conversion facility after the facility is closed are discussed in Section 5.9 for the three-process-line base design. If the throughput was increased by adding a fourth process line, additional process equipment would require D&D. This would be expected to result in a potential increase in the radiation dose to involved workers and an increase in the amount of LLW generated, when compared with a three-process-line facility. However, there is a large amount of uncertainty concerning D&D activities because they will not likely occur for 15 to 20 years, and the activities required would be very dependent on the operational history of the facility. Thus, the D&D impacts presented in Section 5.9 are considered representative of both a three- and a four-process-line facility. As noted in Section 5.9, additional NEPA review would likely need to be performed before D&D occurred. It is also expected that such a review would be based on the actual condition of the facilities and a more definite identification of the resulting waste materials.

5.2.8.1.15 Other Issues and Impacts. Sections 5.4 through 5.8 of this EIS discuss mitigation, unavoidable adverse impacts, irreversible and irretrievable commitment of resources, the relationship between short-term use of the environment and long-term productivity, and pollution prevention and waste minimization. The discussion in these sections would also apply if the throughput of the Portsmouth facility was increased 33%.

5.2.8.2 Potential Impacts Associated with Extending the Plant Operational Period

As noted above, the Portsmouth conversion facility is currently being designed to process the Portsmouth and ETTP DUF_6 cylinder inventories over 18 years. There are no current plans to operate the conversion facilities beyond this period. However, with routine facility and equipment maintenance and periodic equipment replacements or upgrades, it is believed the conversion facility could be operated safely beyond this time period to process additional DUF_6 for which DOE might assume responsibility.

The estimated annual environmental impacts during conversion facility operations were presented and discussed previously in Section 5.2.3; these impacts are expected to continue each year for the planned 18 years of operations at Portsmouth. If operations were extended beyond 18 years and if the operational characteristics (e.g., estimated releases of contaminants to air and water) of the facility remained unchanged, the annual impacts would be expected to be essentially the same as those presented in Section 5.2.3. However, continued operations would result in the impacts being incurred over a greater number of years. The total radiation dose to the workers and the public would increase in proportion to the number of additional years that the facility operated. Although the annual frequency of accidents would remain unchanged, the overall probability of a severe accident would increase proportionately with the additional operational time period. In addition, the total quantities of depleted uranium and secondary waste products requiring disposal would increase proportionately, as would the amount of HF or CaF_2 produced. As discussed in Section 5.2.3, the estimated annual impacts during operations are within applicable guidelines and regulations, with collective and cumulative impacts being quite low. This would also be expected during extended operations.

5.2.8.3 Potential Impacts Associated with Possible Future Paducah-to-Portsmouth Cylinder Shipments

As noted above, it is possible that in the future, DUF_6 cylinders could be transferred from Paducah to Portsmouth to facilitate conversion of the entire inventory, particularly if DOE assumes responsibility for additional DUF_6 at Paducah. At this time, it is uncertain whether such transfers would take place and how many cylinders would be transferred if such a decision was made. Therefore, for comparative purposes, this section provides estimates of the potential impacts from transporting 1,000 DUF_6 cylinders from Paducah to Portsmouth by either truck or rail. Shipment of 1,000 cylinders per year roughly corresponds to the annual base design throughput of the Portsmouth conversion facility.

The transportation assessment methodology discussed in Appendix F, Section F.3, was used to estimate the collective population risk for shipment of 1,000 cylinders between Paducah and Portsmouth by both truck and rail. It was assumed that only compliant cylinders that met DOT requirements would be shipped between the sites. The estimated highway and rail route distances between the sites are 395 mi (636 km) and 478 mi (769 km), respectively. The estimated collective risks are provided in Table 5.2-36. No cargo-related or vehicle-related fatalities are expected for the shipment of 1,000 cylinders per year between the sites.

The estimated consequences of severe accidents and the potential impacts to MEIs would be the same as those presented and described in Section 5.2.5 for the shipment of ETTP cylinders.

5.3 CUMULATIVE IMPACTS

5.3.1 Issues and Assumptions

The CEQ guidelines for implementing NEPA define cumulative effects as the impacts on the environment resulting from the incremental impacts of an action when added to other past, present, and reasonably foreseeable future actions (40 CFR 1508.7). Cumulative effects include other actions regardless of what agency (federal or nonfederal), organization, or person undertakes them. Noteworthy cumulative impacts can result from individually minor, but collectively significant, effects of all actions.

The activities considered in this cumulative analysis comprise those that might affect environmental conditions at or near the Portsmouth site, including activities occurring on the site itself and activities occurring nearby whose impacts could affect the site. A summary of impacts associated with various actions is presented in Table 5.3-1 for impacts associated with most of the technical areas assessed in this EIS. When possible, these summaries are quantitative;

TABLE 5.2-36 Annual Transportation Impacts for the Shipment of DUF_6 Cylinders from Paducah to Portsmouth, Assuming 1,000 DUF_6 Cylinders Shipped per Year

				Cargo-Related			Vehicle-Related	
				Radiological Risk (LCF)[a]				
Route	Mode	No. of Shipments	Total Distance (10^6 mi)	Crew	Public	Irreversible Adverse Effects	Latent Emission Fatalities	Accident Fatalities
Paducah to Portsmouth								
	Truck	1,000	0.395	0.002	0.001	5×10^{-7}	0.1	0.01
	Rail[b]	250	0.12	0.007	0.0003	2×10^{-8}	0.008	0.006

[a] The lifetime risk of an LCF for an individual was estimated from the calculated doses by using a dose-to-risk conversion factor of 0.0005 fatality per person-rem for members of the general public, as recommended in ICRP Publication 60 (ICRP 1991). The approximate corresponding dose received for each radiological fatality risk listed in this table may be obtained by multiplying the fatality risk by 2,000 (i.e., 1 ÷ 0.0005).

[b] Assumes four DUF_6 cylinders per railcar.

TABLE 5.3-1 Cumulative Impacts of DUF_6 Activities and Other Past, Present, or Reasonably Foreseeable Future Actions at the Portsmouth Site

Impact Category	Existing Conditions	Impacts of DUF_6 Management[a]: No Action	Impacts of DUF_6 Management[a]: Action Alternatives[b]	Impacts of Other Actions[c]	Cumulative Impacts[d]: No Action	Cumulative Impacts[d]: Action Alternatives[b]
Radiological, off-site population						
Public, collective dose (person-rem)	3.6	0.03[e]	1.1×10^{-3}	16.1[f]	19.7	19.7
Public, number of LCFs[g]	2×10^{-3}	2×10^{-5}	6×10^{-7}	8×10^{-3}	1×10^{-2}	1×10^{-2}
Off-site MEI, annual dose (mrem/yr)[h]	2.0	0.1	2.1×10^{-5}	0.5–0.9	3.0	2.5
Radiological, worker population						
Worker, collective dose (person-rem)	27.2	207.0[e]	245.4	NA[f,i,j]	234.2	267.2
Worker, number of LCFs[k]	1×10^{-2}	8×10^{-2}	1×10^{-1}	NA[i,j]	9×10^{-2}	1×10^{-1}
Transportation[l]						
Number of truck shipments	600[m]	0	7,800[n]	3,900	4,500	12,300
Number of rail shipments	0	0	3,300[n]	3,500	3,500	6,800
Annual MEI dose, truck (mrem/yr)	7.4×10^{-4} [o]	0	2.8×10^{-3}	4.2×10^{-3}	4.9×10^{-3}	7.7×10^{-3}
Annual MEI dose, rail (mrem/yr)	0	0	1.9×10^{-3}	4.3×10^{-3}	4.3×10^{-3}	6.2×10^{-3}
Air quality (nonattainment)	None[p]	None	None	None[q]	None[p]	PM (PM_{10} and $PM_{2.5}$) above SAAQS during construction; annual $PM_{2.5}$ above SAAQS during operation[r]
Water and soil						
Surface water quality (exceedance)	None	None	Negligible	None	Negligible	Negligible
Groundwater quality (exceedance)	7 parameters[s]	None	Small	None	7 parameters[s]	7 parameters[s]
Soil (exceedance)	None	None	None	None	None	None
Ecology (adverse impacts)	Negligible	Negligible	Negligible to minor	Negligible	Negligible	Negligible to minor
Land use (changes from current)	None	None	None	None	None	None

TABLE 5.3-1 (Cont.)

Impact Category	Existing Conditions	Impacts of DUF_6 Management[a]: No Action	Impacts of DUF_6 Management[a]: Action Alternatives[b]	Impacts of Other Actions[c]	Cumulative Impacts[d]: No Action	Cumulative Impacts[d]: Action Alternatives[b]
Cultural resources (adverse impacts)	None	None	Unlikely	Unlikely	Unlikely	Unlikely
Environmental justice (impacts)	None	None	None	None	None	None

a Based on results presented in Sections 5.1 and 5.2 of this EIS. No action impacts were considered over 40 years. Proposed action impacts were considered for both construction (over 2 years) and operation (over 18 years), with calculations shown including whichever had the greatest impacts.

b For purposes of estimating cumulative impacts, all three facility locations would yield identical environmental consequences and, as a result, are not presented in separate columns.

c Includes impacts of current UF_6 management activities by DOE and USEC (DOE 1999a); waste management activities (DOE 1997a) and continued storage of cylinders under the no action alternative; converting the Portsmouth GDP to standby (DOE 2001c); reindustrialization of the Portsmouth GDP (DOE 2001b); and current environmental restoration activities that have proceeded to the point that their consequences can be defined: X-749 Contaminated Materials Disposal Facility, Quadrant I Groundwater Investigative Area, X-701C Neutralization Pit/X-701A Lime House Removal, X-720 Neutralization Pit, X-740 Waste Oil Handling Facility (with associated phytoremediation), X-701B in situ chemical oxidation, X-326 L-cage Glove Box, X-744G Glove Box, X-623 Groundwater Treatment Facility, and X-624 Groundwater Treatment Facility (DOE 2002d). Future actions include construction and operation of a gas centrifuge enrichment facility at Portsmouth (U.S. Energy Research and Development Administration [ERDA] 1977).

d Cumulative impacts represent the sum of the impacts of the DUF_6 management alternatives and other past, present, and reasonably foreseeable future actions.

e Estimated for 18 years, to enable comparison with proposed action.

f No dose estimates given for surrogate reuse activities for Portsmouth in the assessment of impacts from reindustrialization (DOE 2001b), apart from suggesting that the magnitude would be similar to the estimated public dose (which is estimated at 0.02% of the DOE limit for public exposure).

g Assumes 0.0005 LCF/person-rem.

h Cumulative impacts assume all facilities operate simultaneously and are located at the same point.

i No worker dose given for possible enrichment facility or Lead Cascade test facility for enrichment, thus cumulative figures will be slightly low; the individual dose would still be monitored to remain under 5 rem/person annually.

j NA = Not available.

k Includes both facility workers and noninvolved workers; assumes 0.0004 LCF/person-rem.

l Concerns shipments of radioactive materials; all estimates of numbers of shipments rounded upward to nearest hundred.

TABLE 5.3-1 (Cont.)

[m] Assumes monthly average of 1 LLW shipment and 0.67 LLMW shipment from USEC, and 1 LLW shipment from DOE activities (Coriell 2003; Hawk 2003; Kelly 2003), rounded upward to the nearest hundred for the 18-yr duration of shipments.

[n] Estimates for transportation under the action alternatives consider the proposed mode of transport of radiological materials, to or from Portsmouth when such a mode has been specified. In the cases of transporting DUF_6 and non-DUF_6 from ETTP, this analysis assumes truck transport (in the absence of a proposed mode) since trucks would result in the greatest impacts to an MEI.

[o] Actual shipments are monitored to ensure external dose is below regulatory limits; calculations here reflect estimates based on empirical data recorded in DOE complex of 1.6×10^{-8} rem to public from passing truck shipment (DOE 1997a).

[p] Although currently classified as an attainment area, measured concentrations for both O_3 and $PM_{2.5}$ (of regional concern) currently are higher than state and national air quality standards.

[q] Air impacts are not discussed for the enrichment facility (see ERDA 1977).

[r] $PM_{2.5}$ exceedance is primarily due to higher background concentrations, already above the standards

[s] Drinking water standards exceeded for alpha activity, americium, beta activity, beryllium, chloroethane, TCE, and uranium.

however, some are, by necessity, qualitative. For technical areas without data that can be aggregated, this analysis evaluates potential cumulative impacts in a qualitative manner as systematically as possible. When it is not appropriate for estimates of impacts to be accumulated, they are not included in the table. For example, it is not appropriate to accumulate chemical impacts (anticipated to be extremely small under the alternatives considered in this EIS) because hazard index estimates are not expected to be additive for different materials and conditions.

5.3.2 Portsmouth Site

Past, ongoing, and future actions at the Portsmouth site include continued waste management activities (DOE 1997a), waste disposal activities (DOE 2002d), environmental restoration activities (DOE 2002d), industrial reuse of sections of the site (DOE 2001b), consolidation of reusable uranium from other sites in the DOE complex (DOE 2003c), continued management of DUF_6 cylinders by USEC and DOE, and other DUF_6 management activities considered in this EIS (see also DOE 1999a). Uranium enrichment activities at Portsmouth were discontinued early in 2002 (see DOE 2001c). However, in late 2002, Portsmouth was identified as the future location of USEC's Lead Cascade test enrichment facility (NRC 2004). Table 5.3-1 identifies the anticipated cumulative impacts that could result from the construction and operation of a DUF_6 conversion facility at the Portsmouth site, as well as impacts from continued management of DUF_6 at the Portsmouth site under the no action alternative.

One action that is considered in this analysis to be reasonably foreseeable and that deserves special mention is the future development of a permanent uranium enrichment facility at the Portsmouth site. In January 2004, USEC announced that it had selected Portsmouth as the site of the American Centrifuge Facility. This cumulative assessment assumes that the facility would use existing gas centrifuge technology. The assessment further assumes that the impacts of such a facility would be the same as those outlined in a 1977 analysis of environmental consequences for such an action (ERDA 1977). (The facility proposed in 1977 was never completed.)

Together with the alternatives assessed in Sections 5.1 and 5.2 of this EIS, the cumulative analysis (the final two columns of Table 5.3.1) includes the following:

- *No Action Alternative:* The cumulative impacts of no action include impacts of UF_6 generation and management activities by USEC and DOE (management only) (DOE 1999a) and continued, long-term storage of cylinders under the no action alternative; waste management activities at the Portsmouth site (DOE 1997a; see also DOE 2002d); conversion of the Portsmouth GDP to standby (DOE 2001b); construction, operation, and D&D of the Lead Cascade test uranium enrichment facility at Portsmouth (NRC 2004); construction, operation, and D&D of a uranium enrichment facility at the Portsmouth site (ERDA 1977); consolidation of reusable uranium in the DOE complex at the Portsmouth site (DOE 2003c); and current environmental restoration activities that have proceeded to the point that their consequences can be defined (DOE 2002d).

- *Proposed Action Alternatives:* The cumulative impacts of the proposed action alternatives include impacts related to the preferred alternative, including the impacts of constructing an additional storage pad and facility to convert DUF_6 to U_3O_8 by using UDS technology; conversion of DUF_6 currently stored at the Portsmouth and ETTP sites to U_3O_8 at the proposed facility; waste management activities at the Portsmouth site (DOE 1997a; see also DOE 2002d); conversion of the Portsmouth GDP to standby (DOE 2001c); construction, operation, and D&D of the Lead Cascade test uranium enrichment facility at Portsmouth (NRC 2004); construction, operation and D&D of a uranium enrichment facility at the Portsmouth site (ERDA 1977); consolidation of reusable uranium in the DOE complex at the Portsmouth site (DOE 2003c); and environmental restoration activities that have proceeded to the point that their consequences can be defined (DOE 2002d).

The results of the cumulative analysis are summarized in Table 5.3-1. The first data column of the table summarizes existing conditions at the site, as presented in Section 3.1 of this EIS. The second and third data columns of the table, in turn, summarize the results of the assessment of impacts of alternatives presented in Sections 5.1 and 5.2 of this EIS. The fourth data column summarizes aggregated impacts of past, present, and reasonably foreseeable future actions at the Portsmouth site, while the final two columns present cumulative impacts under the no action and proposed action alternatives. Transporting cylinders currently stored at the ETTP site to Portsmouth is considered as part of the proposed action.

5.3.2.1 Radiological Releases — Normal Operations

For both the no action alternative and the action alternatives, impacts to human health and safety could result from radiological facility operations and accidents. As shown in Table 5.3-1, cumulative collective radiological exposure to the off-site population would be well below the maximum DOE dose limit of 100 mrem/yr to the off-site MEI for both alternatives and below the limit of 25 mrem/yr specified in 40 CFR 190 for uranium fuel cycle facilities. Annual radiological doses to individual involved workers would be monitored to maintain exposure below the regulatory limits.

5.3.2.2 Accidental Releases — Radiological and Chemical Materials

For both the no action alternative and the action alternatives, doses and consequences of releases of radiological materials were considered for a range of accidents from *likely* (occurring an average of 1 or more times in 100 years) to *extremely rare* (occurring an average of less than 1 time in a million years). Because of the low probability of two accidents happening at the same time, the consequences of these accidents are not considered to be cumulative. The probability of even *likely* accidents occurring at the same time is very low, even for the most frequently expected accidents — the likelihood of this co-occurrence being the product of their individual probabilities (1 in 100 years multiplied by 1 in 100 years equals 1 in 10,000 years [$0.01 \times 0.01 =$

0.0001]). Moreover, in the event that two facility accidents from the *likely* category occurred at the same time, the consequences for the public would be low.

5.3.2.3 Transportation

The number of shipments of DUF_6, non-DUF_6, U_3O_8, crushed heel cylinders, and heel cylinders associated with the action alternatives at the Portsmouth site would involve rail and truck transport. Calculations prepared for cumulative impacts, which are based on analytical results presented in Section 5.2.5, consider proposed transport modes for the various materials or items moved. Results indicate a total of 12,300 truck shipments and 6,800 rail shipments, with radiological impacts presented as an annual dose to the MEI. Radiological impacts resulting from transportation of all materials under both modes would be very small, as would the cumulative impacts.

5.3.2.4 Chemical Exposure — Normal Operations

Impacts associated with chemical exposure are expected to be very small under the alternatives considered in this EIS. As noted previously, the calculation of cumulative impacts is not possible because of the absence of necessary measures (hazard indices) for other actions and the inappropriateness of aggregating these measures across the different chemicals used in different industries. Under normal operations, no impacts to the public are expected from chemical exposure for the action or the no action alternatives.

5.3.2.5 Air Quality

The Portsmouth site is currently located in an attainment region, although measured concentrations for certain criteria pollutants (O_3 and $PM_{2.5}$) were above the state and national air quality standards (see Section 3.1.3.3). During construction at the site for additional on-site storage or the conversion facility, total PM_{10} and/or $PM_{2.5}$ concentrations would be higher than applicable ambient standards, due in part to their high background concentrations. Because of their near-ground-level releases, high concentrations would be limited to the immediate vicinity of the site. However, these impacts would be temporary and could be minimized by using good engineering and construction practices and standard dust suppression methods. During the period of conversion at the Portsmouth site, total annual-average $PM_{2.5}$ concentrations would exceed state and national standards, primarily because of higher background concentrations.

5.3.2.6 Noise

No cumulative noise impacts are expected for the alternatives considered in this EIS. Noise energy dissipates within short distances from the sources, and significant noise impacts are not expected in the vicinity of the conversion facility.

5.3.2.7 Water and Soil

Cumulative impacts on surface water at the Portsmouth site for construction and normal operations would not exceed the 30 µg/L of uranium used for comparison in discharges to Little Beaver Creek, Big Beaver Creek, or the Scioto River, even under low-flow conditions for the first two. Cumulative impacts on surface water would be localized and temporary even for small creeks, with adequate dilution occurring once such a creek entered larger waterways. Under the no action alternative, care would be taken during cylinder painting to prevent a further toxicity effect.

Data from the 2000 annual groundwater monitoring at the Portsmouth site indicated that seven pollutants exceeded primary drinking water standards in groundwater: alpha activity, americium, beta activity, beryllium, chloroethane, TCE, and uranium (DOE 2001d,e). Such impacts would continue under cumulative impacts, although site management practices that continue to stabilize plume movement and improve current groundwater quality should not allow further noteworthy contamination under the cumulative case. The groundwater analysis indicates that current cylinder maintenance practices would control cylinder corrosion under the no action alternative; thus, the maximum uranium concentration in groundwater (from cylinder breaches) would be 5 µg/L, considerably below the 30-µg/L guideline level used for comparison. Direct contamination of groundwater could occur during the construction and operation of a conversion facility (e.g., from the dissolution and infiltration of stockpiled chemicals into aquifers). However, good engineering and construction practices should ensure that impacts associated with construction would be minimal and not change existing groundwater conditions. Slight contamination similarly could occur during normal operation of a conversion facility. However, the contamination is not anticipated to reach a noteworthy magnitude. Cumulative impacts might contribute slightly to groundwater contamination, although the combination of efforts to address existing contaminants and practices to minimize increasing contamination should limit the magnitude of increases.

No noteworthy cumulative impacts to soils are anticipated.

5.3.2.8 Ecology

Cumulative ecological impacts are anticipated to be negligible under the no action alternative and negligible to minor under the action alternatives, in conjunction with the effects of existing conditions and other activities. Habitat disturbance would involve settings commonly found in this part of Ohio, in many cases previously disturbed. Construction of a conversion facility at Location A could directly affect a small wetland. Construction of a conversion facility at Location C would also remove trees that could provide habitat for the Indiana bat; this federally endangered species is not known to utilize this area. No impacts on this or other state- or federal-listed species are anticipated.

5.3.2.9 Land Use

All DUF_6 activities under the alternatives would be confined to the Portsmouth site, which is already used for similar activities. Other activities on the site similarly are consistent with existing land use at Portsmouth, while activities already in the vicinity of the site change land uses to, at most, only relatively very small areas. No cumulative land use impacts are anticipated.

5.3.2.10 Cultural Resources

The probability of encountering significant archaeological resources at the Portsmouth site would vary, depending on the area disturbed by a proposed activity or activities and the amount of disturbance. Further cultural resource surveys in consultation with the SHPO would be required for areas as yet unsurveyed that have not been previously disturbed. Consultation with Native Americans, conducted under this project, similarly would have to occur. If significant cultural resources were encountered during any of the activities under cumulative impacts, adverse effects would need to be mitigated. If any structures at the Portsmouth GDP were determined to be historically significant and there was a potential for a short-term adverse effect from the deposit of particulate matter on building surfaces, these adverse effects would be mitigated. All additional survey and mitigation would be conducted in consultation with the Ohio SHPO.

5.3.2.11 Environmental Justice

No environmental justice cumulative impacts are anticipated for the Portsmouth site. Although disproportionately high percentages of minority and low-income populations occur in the vicinity of the site, no cumulative impacts in the vicinity of Portsmouth are high and adverse.

5.3.2.12 Socioeconomics

Socioeconomic impacts under all alternatives are anticipated to be generally positive, often temporary, and relatively small. Growth in population could occur to meet labor demands during construction and operation, but it would not be so great as to place excessive demands on existing housing or public services. Cumulative socioeconomic impacts similarly are expected to be relatively small and positive, although some would be more long-lived than others.

5.3.3 ETTP Site

Because some of the DUF_6 processed at the Portsmouth conversion facility under the action alternatives would come from the ETTP site, cumulative impacts also would involve activities at this locality. Under the no action alternative, in contrast, existing DUF_6 at ETTP would continue to be stored at the site, similarly causing cumulative impacts. Although the focus of this EIS is on impacts (including cumulative impacts) associated with the Portsmouth site, this section briefly examines cumulative impacts at ETTP.

Cumulative impacts associated with the no action alternative would involve the effects of continued storage of DUF_6 at ETTP in conjunction with other activities at or near that site, as summarized in the PEIS for long-term storage of this material (DOE 1999a). Reasonably foreseeable future actions at or in the vicinity of ETTP include waste management activities (DOE 1997a, 2000b, 2001a); stockpile, stewardship, and management activities (DOE 1996b); the disposition of highly enriched uranium (DOE 1996c); the disposition of potentially reusable uranium (DOE 2002b); interim storage of enriched uranium (DOE 1994b); construction and operation of the Spallation Neutron Source Facility (DOE 1999d); tritium production in a commercial light-water reactor (DOE 1999g); transfer of non-nuclear functions (DOE 1993); changes in the sanitary sludge land application program (DOE 1996d); reindustrialization of ETTP (DOE 1997b, 2002a); and environmental restoration activities at ETTP (DOE 2001f). The absence of noteworthy negative impacts under the no action alternative, described in Section 5.1.3, is consistent with the absence of large cumulative impacts in the no action case (see also DOE 1999a).

Cumulative impacts at ETTP under the action alternatives would involve activities associated with preparing cylinders stored at this site for transportation, followed by their shipment to the Portsmouth site. The other past, present, and reasonably foreseeable activities listed in the preceding paragraph for ETTP would be the same. Cylinder preparation impacts, described in Section 5.2.4, are anticipated to be minimal. When aggregated with other activities at or near the ETTP site, cumulative impacts would not be large or serious for any impact area. Transportation impacts associated with ETTP cylinders, described in Section 5.2.5, similarly are not anticipated to be large. Cumulative impacts of transportation, discussed in Section 5.3.2 and presented in Table 5.3-1, likewise would not be large or serious.

5.4 MITIGATION

In general, the impacts of the alternatives presented in this chapter are conservative estimates of impacts expected for each alternative. Factors such as flexibility in siting at and within the three alternative locations at Portsmouth and facility design and construction options could be used to reduce impacts from these conservative levels. This section identifies what impacts could be mitigated to reduce adverse impacts. On the basis of the analyses conducted for this EIS, the following recommendations can be made:

- Potential future impacts on site air and groundwater could be avoided by inspecting cylinders, carrying out cylinder maintenance activities (such as painting), and promptly cleaning up releases from any breached DUF_6 cylinders. In addition, runoff from cylinder yards should be collected and sampled so that contaminants can be detected and their release to surface water or groundwater can be avoided. If future cylinder painting results in permit violations, treating cylinder yard runoff prior to release may be required.

- Temporary impacts on air quality from fugitive dust emissions during construction of any new facility should be controlled by the best available practices to avoid temporary exceedances of the PM_{10} and $PM_{2.5}$ standard. Technologies that would be used to mitigate air quality impacts during construction include using water sprays on dirt roadways and on bare soils in work areas for dust control; covering open-bodied trucks transporting materials likely to become airborne when full and at all times when in motion; water spraying and covering bunkered or staged excavated and replacement soils; maintaining paved roadways in good repair and in a clean condition; using barriers and windbreaks around construction areas such as soil banks, temporary screening, and/or vegetative cover; mulching or covering exposed bare soil areas until vegetation has time to recover or paving has been installed; and prohibiting any open burning.

- During construction, impacts to water quality and soil can be minimized through implementing storm water management, sediment and erosion controls (e.g., temporary and permanent seeding; mulching and matting; sediment barriers, traps, and basins; silt fences; runoff and earth diversion dikes), and good construction practices (e.g., covering chemicals with tarps to prevent interaction with rain; promptly cleaning up any spills).

- Potential impacts to wetlands at the Portsmouth site could be minimized or eliminated by maintaining a buffer near adjacent wetlands during construction. Impacts at Location A may potentially be avoided by an alternative routing of the entrance road, or mitigation may be developed in coordination with the appropriate regulatory agencies.

- If trees (either live or dead) with exfoliating bark are encountered on construction areas, they should be saved if possible to avoid destroying potential habitat for the Indiana bat. If necessary, the trees should be cut before April 15 or after September 15.

- The quantity of radioactive and hazardous materials stored on site, including the products of the conversion process, should be minimized.

- The construction of a DUF_6 conversion facility at Portsmouth would have the potential to impact cultural resources. Neither an archaeological nor an architectural survey has been completed for the Portsmouth site as a whole or for any of the alternative locations, although an archaeological sensitivity study has been conducted. In accordance with Section 106 of the NHPA, the adverse effects of this undertaking must be evaluated once a location is chosen.

- Testing should be conducted either prior to or during the conversion facility startup operations to determine if the air vented from the autoclaves should be monitored or if any alternative measures would need to be taken to ensure that worker exposures to PCBs above allowable OSHA limits do not occur.

- The nuclear properties of DUF_6 are such that the occurrence of a nuclear criticality is not a concern, regardless of the amount of DUF_6 present. However, criticality is a concern for the handling, packaging, and shipping of enriched UF_6. For enriched UF_6, criticality control is accomplished by employing, individually or collectively, specific limits on uranium-235 enrichment, mass, volume, geometry, moderation, and spacing for each type of cylinder. The amount of enriched UF_6 that may be contained in an individual cylinder and the total number of cylinders that may be transported together are determined by the nuclear properties of enriched UF_6. Spacing of cylinders of enriched UF_6 in transit during routine and accident conditions is ensured by use of regulatory approval packages that provide protection against impact and fire.

- Because of the relatively high consequences estimated for some accidents, special attention will be given to the design and operational procedures for components that may be involved in such accidents. For example, the tanks holding hazardous chemicals on site such as anhydrous NH_3 and aqueous HF would be designed to all applicable codes and standards, and special procedures would be in place for gaining access to the tanks and for filling of the tanks. In addition, although the probabilities of occurrence for high consequence accident are extremely low, emergency response plans and procedures would be in place to respond to any emergencies should an accident occur. Additional details are discussed below.

Although the probability of transportation accidents involving hazardous chemicals such as HF and NH_3 is very low, the consequences could be severe. For this EIS, the assessment of transportation accidents involving HF assumed conservative conditions. Currently, a number of industry practices are commonly employed to minimize the potential for large HF releases, as discussed below.

HF is usually shipped in 100-ton (91-t), 23,000-gal (87,000-L) shell, full, noncoiled, noninsulated tank cars. Most HF railcars today meet DOT Classification 112S500W, which represents the current state of the art. To minimize the potential for accidental releases, these railcars have head protection and employ shelf couplers, which help prevent punctures during an accident. The use of these improved tank cars has led to an improved safety record with respect to HF accidents over the last several years. In fact, the HF transportation accident rate has steadily decreased since 1985. Industry recommendations for the new tank car guideline appear in *Recommended Practices for the Hydrogen Fluoride Industry* (Hydrogen Fluoride Industry Practices Institute 1995b).

Accidents involving HF and NH_3 at a conversion facility could have potentially serious consequences. However, a wide variety of good engineering and mitigative practices are available that are related to siting, design, and accident mitigation for HF and NH_3 storage tanks, which might be present at a conversion facility. Many are summarized in *Guideline for the Bulk Storage of Anhydrous Hydrogen Fluoride* (Hydrogen Fluoride Industry Practices Institute 1995a). There is an advanced set of accident prevention and mitigative measures that are recommended by industry for HF storage tanks, including storage tank siting principles (e.g., evaluating seismic, high wind, and drainage conditions), design recommendations, and tank appurtenances, as well as spill detection, containment, and mitigation. Measures to mitigate the consequences of an accident include detection systems, spill containment systems such as dikes, remote storage tank isolation valves, water spray systems, and rapid acid deinventory systems (that rapidly remove acid from a leaking vessel). Details on these mitigative strategies are also provided in the Hydrogen Fluoride Industry Practices Institute (1995a) guidelines.

5.5 UNAVOIDABLE ADVERSE IMPACTS

Unavoidable adverse impacts are those impacts that cannot be mitigated by choices associated with siting and facility design options. They are impacts that would be unavoidable, no matter which options were selected.

The cylinders currently in storage would require continued monitoring and maintenance under all alternatives. These activities would result in the exposure of workers in the vicinity of the cylinders to low levels of radiation. The radiation exposure of workers could be minimized, but some level of exposure would be unavoidable. The radiation doses to workers are estimated to be well within public health standards under all alternatives. Radiation exposures of workers would be monitored at each facility and would be kept ALARA. Cylinder monitoring and maintenance activities would also emit air pollutants, such as vehicle exhaust and dust (PM_{10}), and produce small amounts of sanitary waste and LLW. Concentrations of air emissions during operations are estimated to be within applicable standards and guidelines, and waste generation would not appreciably affect waste management operations.

Under all alternatives, workers would have a potential for accidental on-the-job injuries and fatalities that would be unrelated to radiation or chemical exposures. These would be a consequence of unanticipated events in the work environment, typical of all workplaces. On the basis of statistics in similar industries, it is estimated that less than 1 fatality and on the order of several hundred injuries would occur under the alternatives, including the required transportation among sites associated with the alternatives. The chance of fatalities and injuries occurring would be minimized by conducting all work activities in as safe a manner as possible, in accordance with occupational health and safety rules and regulations. However, the chance of these types of impacts cannot be completely avoided.

Conversion would require the construction of a new facility at the Portsmouth site. Up to 65 acres (26 ha) of land could be disturbed during construction, with approximately 10 acres (4 ha) required for the facility footprint. Construction of the facility could result in losses of terrestrial and aquatic habitats. Dispersal of wildlife and temporary elimination of habitats would result from land clearing and construction activities involving movement of construction personnel and equipment. The construction of the facility could cause both short-term and long-term disturbances of some biological habitats. Although some destruction would be inevitable during and after construction, these losses could be minimized by careful site selection and construction practices.

5.6 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

The major irreversible and irretrievable commitments of natural and man-made resources related to the alternatives analyzed in this EIS are discussed below. A commitment of a resource is considered *irreversible* when the primary or secondary impacts from its use limit the future options for its use. An *irretrievable* commitment refers to the use or consumption of a resource that is neither renewable nor recoverable for later use by future generations.

The decisions to be made in the ROD following the publication of this EIS would commit resources required for implementing the selected alternative. Three major resource categories would be committed irreversibly or irretrievably under the alternatives considered in this EIS: land, materials, and energy.

5.6.1 Land

Land that is currently occupied by UF_6 cylinder storage or selected for the conversion facility could ultimately be returned to open space if the yards, buildings, roads, and other structures were removed, the areas cleaned up, and the land revegetated. Future use of these tracts of land, although beyond the scope of this EIS, could include restoring them for unrestricted use. Therefore, the commitment of this land would not necessarily be irreversible. However, the land used to dispose of any conversion products or construction or D&D wastes would represent an irretrievable commitment, because wastes in belowground disposal areas could not be completely removed, the land could not be restored to its original condition, and the site could not feasibly be used for other purposes following the closure of the disposal facility. All disposal activities associated with alternatives analyzed in this EIS would take place at DOE or commercial disposal facilities that would be permitted or licensed to accept such wastes.

5.6.2 Materials

The irreversible and irretrievable commitment of material resources for the various EIS alternatives would include construction materials that could not be recovered or recycled, materials rendered radioactive that could not be decontaminated, and materials consumed or reduced to unrecoverable forms of waste. Materials related to construction could include wood, concrete, sand, gravel, steel, aluminum, and other metals (Table 5.6-1). At this time, no unusual construction material requirements have been identified. The construction resources, except for those that could be recovered and recycled with current technology, would be irretrievably lost. None of the identified construction resources is in short supply, and all should be readily available in the local region.

TABLE 5.6-1 Materials/Resources Consumed during Conversion Facility Construction at the Portsmouth Site

Materials/Resources	Total Consumption	Unit	Peak Demand	Unit
Utilities				
Water	550,000	gal	1,500	gal/h
Electricity	1,500	MWh	7.2	MWh/d
Solids				
Concrete	9,139	yd^3	NA[a]	NA
Steel	511	tons	NA	NA
Inconel/Monel	33	tons	NA	NA
Liquids				
Fuel	73,000	gal	250	gal/d
Gases				
Industrial gases (propane)	15,000	gal	50	gal/d

[a] NA = not applicable.

Strategic and critical materials (e.g., Monel and Inconel) would not be required in quantities that would seriously reduce the national or world supply. This material would be used throughout the facilities and would be used in the generation of HF in the conversion process. The autoclaves and conversion units (process reactors) are long-lead-time procurements with few qualified bidders. Many suppliers are available for the remainder of the equipment.

Estimated annual consumption rates of raw materials are provided in Table 5.6-2. Consumption of operating supplies (e.g., miscellaneous chemicals such as lime and potassium hydroxide, and gases such as nitrogen), although irretrievable, would not constitute a permanent drain on local sources or involve any material in critically short supply in the United States as a whole.

5.6.3 Energy

The irretrievable commitment of energy resources during the operation of the various facilities considered under the alternatives would include the consumption of fossil fuels used to generate steam and heat and electricity for the facilities (Table 5.6-3). Energy also would be expended in the form of diesel fuel and gasoline for cylinder transport equipment and transportation vehicles. Consumption of these utilities, although irretrievable, would not constitute a permanent drain on local sources or involve any utility in critically short supply in the United States as a whole.

5.7 RELATIONSHIP BETWEEN SHORT-TERM USE OF THE ENVIRONMENT AND LONG-TERM PRODUCTIVITY

For this EIS, *short term* is considered the period of construction activities for the alternatives analyzed — the time when most short-term (or temporary) environmental impacts would occur. Disposal of solid nonhazardous waste resulting from new facility construction, operations, and D&D would require additional land at a sanitary landfill site, which would be unavailable for other uses in the long term. Any radioactive or hazardous waste generated by the various alternatives would involve the commitment of associated land, transportation, and disposal resources and resources associated with the processing facilities for waste management.

For the construction and operation the of conversion facility, the associated construction activities would result in both short-term and long-term losses of terrestrial and aquatic habitats from natural productivity. Dispersal of wildlife and temporary elimination of habitats would result from land clearing and construction activities involving movement and staging of construction personnel and equipment. The building of new facilities could cause long-term disturbances of some biological habitats, potentially causing long-term reductions in the biological activity of an area. Although some habitat loss would be inevitable during and after construction, these losses would be minimized by careful site selection and by thorough environmental reviews of specific proposals. Short-term impacts would be reduced and mitigated as necessary. After closure of the new facilities, they would be decommissioned and could be reused, recycled, or remediated.

TABLE 5.6-2 Materials Consumed Annually during Conversion Facility Operations at the Portsmouth Site[a]

Chemical	Quantity (tons/yr)
Solid	
Lime (CaO)[b]	14
Liquid	
Ammonia (99.95% minimum NH_3)	510
Potassium hydroxide (45% KOH)	6
Gaseous	
Nitrogen (N_2)	7,800

a Material estimates are based on facility conceptual-design-status data (UDS 2003b). A number of studies are planned to evaluate design alternatives, the results of which may affect the above materials needs.

b Assuming lime is used only for potassium hydroxide regeneration. If HF neutralization is required, the annual lime requirement would be approximately 7,000 tons/yr (6,350 t/yr).

5.8 POLLUTION PREVENTION AND WASTE MINIMIZATION

Implementation of the EIS alternatives would be conducted in accordance with all applicable pollution prevention and waste minimization guidelines. Pollution prevention is designed to reduce risk to public health, safety, welfare, and the environment through source reduction techniques and environmentally acceptable recycling processes. The Pollution Prevention Act of 1990 (42 USC 11001–11050) established a national policy that pollution should be prevented or reduced at the source, whenever feasible. The act indicates that when pollution cannot be prevented, polluted products should be recycled in an environmentally safe

TABLE 5.6-3 Utilities Consumed during Conversion Facility Operations at the Portsmouth Site[a]

Utility	Annual Average Consumption	Unit	Peak Demand[b]	Unit
Electricity	31,084	MWh	6.2	MW
Liquid fuel	3,000	gal	NA[c]	NA
Natural gas[d,e]	4.0×10^7	scf[f]	180	scfm[f]
Process water	30×10^6	gal	215	gal/min
Potable water	3×10^6	gal	350	gal/min

[a] Utility estimates are based on facility conceptual-design-status data (UDS 2003b). A number of studies are planned to evaluate design alternatives, the results of which may affect the above utility needs.

[b] Peak demand is the maximum rate expected during any hour.

[c] NA = not applicable.

[d] Standard cubic feet measured at 14.7 psia and 60°F (16°C).

[e] The current facility design (UDS 2003b) uses electrical heating. However, an option of using natural gas is being evaluated.

[f] scf = standard cubic feet; scfm = standard cubic feet per minute.

manner. Disposal or other releases into the environment should be employed only as a last resort. Executive Order 12856, *Federal Compliance with Right-to-Know Laws and Pollution Prevention Requirements* (U.S. President 1993), and DOE Order 5400.1, *General Environmental Protection Program* (DOE 1988), implement the provisions of the Pollution Prevention Act of 1990. Pollution prevention measures could include source reduction, recycling, treatment, and disposal. The emphasis would be on source reduction and recycling to prevent the creation of wastes (i.e., waste minimization).

Waste minimization is the reduction, to the extent feasible, of the generation of radioactive and hazardous waste. Source reduction and waste minimization techniques include good operating practices, technology modifications, changes in input material, and product changes. An example of waste minimization would be to substitute nonhazardous materials, when possible, for materials that contribute to the generation of hazardous or mixed waste.

A consideration of opportunities for reducing waste generation at the source, as well as for recycling and reusing material, will be incorporated to the extent possible into the engineering and design process for the conversion facility. Pollution prevention and waste minimization will be major factors in determining the final design of any facility to be constructed. Specific pollution prevention and waste minimization measures will be considered in designing and operating the final conversion facility.

5.9 DECONTAMINATION AND DECOMMISSIONING OF THE CONVERSION FACILITY

When operations at the conversion facility are complete, D&D would be performed to protect both public health and safety and the environment from accidental releases of any remaining radioactivity and hazardous materials. The conversion facility is being designed to facilitate D&D activities. This analysis assumes that the D&D activity would provide for the disassembly and removal of all radioactive and hazardous components, equipment, and structures associated with the conversion facility. The objective assumed in this EIS would be to completely dismantle the various buildings and achieve "greenfield" (unrestricted use) conditions. The design requirements for the D&D of this facility can be found in two DOE Directives from 1999: DOE Guide 430.1-3, *Deactivation Implementation Guide*, and DOE Guide 430.1-4, *Decommissioning Implementation Guide* (DOE 1999e,f).

Because the D&D of the conversion facility is not expected to occur for at least 18 years, it is likely that an additional environmental review would need to be performed before it occurred. It is also expected that such a review would be based on the actual condition of the facilities and a more definite identification of the resulting waste materials.

5.9.1 Human Health and Safety — Off-Site Public

It is expected that D&D of the DUF_6 conversion facility would result in low radiation doses to members of the public and would be accomplished with no significant adverse environmental impacts.

DOE has established a primary dose limit for any member of the public of 0.1 rem (1 mSv) total effective dose equivalent (TEDE) per year for protection of public health and safety. Compliance with the limit is based not just on an individual DOE source or practice but on the sum of internal and external doses resulting from all modes of exposure to all radiation sources other than background and medical sources (DOE 1993). However, it could be very difficult to determine doses from all radiation sources for the purpose of demonstrating compliance. Therefore, DOE elements are instructed to apply a public dose constraint of 0.025 rem (0.25 mSv) of TEDE per year to each DOE source or practice (DOE 2002h). Also, DOE elements are required to implement a process to ensure, on a case-specific basis, that public radiation exposures will be ALARA below the dose constraint (DOE 1993).

To be consistent with DOE's general approach to protecting the public from radiation exposure as explained above, the release of radioactive material from D&D activities at a DOE-controlled site, such as a DUF_6 conversion or cylinder treatment facility, would be limited to an amount determined on a case-specific basis through the ALARA process to be ALARA but, in any event, less than 0.025 rem/yr (0.25 mSv/yr). This would ensure that doses to the public from DOE real property releases following D&D were consistent with NRC requirements for commercial nuclear facilities, as stated in 10 CFR 20, Subpart E, "Radiological Criteria for License Termination."

In its final generic EIS for decommissioning of NRC-licensed nuclear facilities (NRC 1994), the NRC concluded that at any site where the 0.025-rem/yr (0.25-mSv/yr) dose criterion established in 10 CFR 20, Subpart E, is met, the likelihood that individuals who use the site would be exposed to multiple sources with cumulative doses approaching 0.1 rem/yr (1 mSv/yr) would be very low. Accordingly, the likelihood would also be very low that a member of the public would be exposed in excess of the DOE primary dose limit after D&D of the DUF_6 conversion and cylinder treatment facilities to meet site-specific limits that are ALARA below the dose constraint of 0.025 mrem/yr (0.25 mSv/yr).

The total public dose from D&D of the DUF_6 conversion facility is estimated to range from 4 to 5 person-rem. This estimate was scaled from data on public exposure doses found in NRC (1988) to account for the capacity of the conversion facility and the effort required for its D&D. Because of the low specific activity of uranium, the estimate is very small and primarily would result from the transportation of D&D wastes for ultimate disposition (NRC 1988). Radiation doses to the public resulting from accidents during D&D activities would be low enough to be considered insignificant (NRC 1988).

5.9.2 Human Health and Safety — On-Site Workforce

Radiological impacts to involved workers during D&D of the conversion facility would result primarily from external radiation due to the handling of depleted uranium materials. Because of the low radiation exposures from depleted uranium, one of the initial D&D activities would be removal of any residual uranium from the process equipment, significantly reducing radiation exposure to the involved workforce.

Radiation exposure estimates for the involved workforce during D&D activities involving nuclear facilities licensed by the NRC are provided in NRC (1988) and NRC (1994). These nuclear facilities include UF_6 production plants and uranium fuel fabrication plants that are similar to the conversion facilities considered in this EIS. Average radiation dose rates in the conversion facility during the initial cleaning are expected to be much less than 2 mrem/h, which is the radiation dose rate from bulk quantities of uranium (NRC 1988).

Table 5.9-1 lists the estimated LCFs of the involved workforce during decontamination and cleanup activities at the facility as a function of the residual dose rate (NRC 1994). The radiological impacts in Table 5.9-1 were estimated on the basis of the dose rates to which the workers are subjected and the collective effort required to reduce the residual contamination levels.

One of the most critical parameters in developing the decommissioning plan would be the release criterion applicable for the project. Subpart E of 10 CFR Part 20 addresses release criteria for NRC licensees, while DOE Order 5400.5 (DOE 1990) governs the development of release limits for DOE facilities. On the basis of a residual dose rate of 25 mrem/yr, the estimated LCFs of the involved workforce would be much lower than unity (i.e., no radiation-related fatalities), since the radiation dose to involved workers would be a small fraction of the exposure experienced over the operating lifetime of the facility and well within the occupational exposure limits imposed by regulatory requirements.

Radiation exposure of the involved D&D workers would be monitored by a dosimetry program and maintained below regulatory limits.

The risk of on-the-job fatalities and injuries to conversion facility D&D workers was calculated by using industry-specific statistics from the BLS, as reported by the National Safety Council (2002). Annual fatality and injury rates from the BLS construction industry division were used for the D&D phase. On the basis of D&D cost information provided in Elayat et al. (1997), it is assumed that the D&D workforce would be approximately 10% of the construction workforce. On the basis of these assumptions and information provided in UDS (2003b), the estimated incidences of fatalities and injuries for the D&D of the conversion facilities are 0.01 and 5, respectively.

TABLE 5.9-1 Estimated Latent Cancer Fatalities from Radiation Exposure Resulting from Conversion Facility D&D Activities at the Portsmouth Site[a]

Residual Dose Rate (mrem/yr)	Low[b]	High[c]
100	2.12×10^{-3}	3.61×10^{-3}
60	2.12×10^{-3}	3.63×10^{-3}
30	2.12×10^{-3}	3.65×10^{-3}
15	2.14×10^{-3}	3.66×10^{-3}
10	2.16×10^{-3}	3.67×10^{-3}
3	2.18×10^{-3}	3.68×10^{-3}
1	2.19×10^{-3}	3.69×10^{-3}
0.3	2.19×10^{-3}	3.70×10^{-3}
0.1	2.20×10^{-3}	3.71×10^{-3}
0.03	2.20×10^{-3}	3.72×10^{-3}

a Values in this table are unscaled values taken directly from NRC (1994).

b Based on the D&D of a uranium fuel fabrication plant that converts enriched UF_6 into UO_2 for production of light-water reactor fuel (DOE 1999g).

c Based on the D&D of a UF_6 production plant where yellowcake is converted to UF_6.

5.9.3 Air Quality

Before structural dismantlement, all contaminated surfaces would be cleaned manually. Best construction management practices, such as dust control measures, would be used to protect air quality and to mitigate any airborne releases during the D&D process. As discussed in Section 5.9.1, it is anticipated that the D&D activities would not produce any significant radiological emissions that would affect the off-site public.

D&D can be considered to be the reverse of the construction of buildings and structures. Available information (Elayat et al. 1997) indicates that the level of construction-related activities during D&D would be an order of magnitude lower than during conversion facility construction. Air quality during D&D activities would thus be bounded by the results presented in Sections 5.2.1.3 and 5.2.2.3 for construction activities, if it is assumed that the existing emission control systems were efficiently maintained.

5.9.4 Socioeconomics

The potential consequences from D&D of the conversion facilities would be lower than those discussed in Section 5.2.1.5 for conversion facility construction, because the total D&D workforce would be smaller for facility D&D than for facility construction.

To decommission the conversion facility, many of the same people who operated the facility could do the cleaning; however, the dismantling and moving of equipment would have to be performed by electricians, plumbers, mechanics, and equipment operators, most of whom would be hired or contracted (NRC 1988) specifically for this purpose.

5.9.5 Waste Management

The major challenge of the D&D activity would be to remove and dispose of radioactive and hazardous wastes while keeping occupational and other exposures ALARA. Section 3.7 of DOE Guide 420.1-1 (DOE 2000c) requires facilities where radioactive or other hazardous contaminating materials will be used to be designed so as to simplify periodic decontamination and ultimate decommissioning. For example, if necessary, all cracks, crevices, and joints would have to be caulked or sealed and finished smooth to prevent the accumulation of contaminated material in inaccessible areas. These design features should minimize the generation of radioactive and/or hazardous materials during D&D activities.

There are three major classes of D&D waste, based on the composition and radioactivity of the materials involved: LLW, mixed LLW, and hazardous waste. It is assumed that TRU waste would not be present (any TRU waste generated during facility operations would be removed prior to D&D activities). A fourth class is "clean" material; this is any material resulting from D&D activities, including metal, which can be safely reused or recycled without any further radiological or hazardous controls. If no further need is established for these clean materials, they can be disposed of at sanitary landfills without requiring any further radiological or hazardous controls.

D&D-related waste can also be categorized into two general groups: contaminated materials and other wastes. Contaminated materials are standard materials such as steel and concrete that contain or have embedded trace amounts of radioactivity. In general, contamination is caused by the settling or adherence of uranium and its progeny products on internal surfaces such as piping. The average concentrations of the radionuclides contaminating the conversion facility are expected to be generally low enough to rank these materials as Class-A LLW.

Other wastes, the second general group of D&D-related wastes, are composed of materials that can become radioactively contaminated when plant workers use them. They include gloves, rags, tools, plastic sheeting, and chemical decontaminants. These wastes are also expected to have an average radioactivity low enough to be ranked as Class-A LLW. This analysis assumes that the quantities of other wastes would be much lower than those generated during facility deconstruction.

It is assumed that the soil within the conversion facility perimeters would not be contaminated with radiological or hazardous materials as a result of normal facility operations and, therefore, would not require excavation and subsequent treatment and disposition. If soil was contaminated due to an accidental release, it would be cleaned up as quickly as feasible after the release occurred and would not be part of the D&D wastes.

The methodology outlined in Forward et al. (1994) was used to estimate the volumes and types of wastes that would be generated from the D&D of the conversion facilities. Because contaminant inventories for these facilities are unavailable, reference data on the contaminant inventory data compiled by the NRC were applied. Facilities are categorized in Forward et al. (1994) into different types on the basis of their function, structure, design, and degree of D&D difficulty. This analysis assumes that the conversion facilities could be considered to be "radioactively contaminated buildings" with a "low" degree of D&D difficulty.

On the basis of the above assumptions and information provided in UDS (2003a), the annual and total waste generation rates from the D&D of the conversion facility were estimated and are provided in Table 5.9-2. Of the total materials generated during the D&D of the conversion facility, both LLMW and hazardous wastes would make up 2% to 3% of the total, and LLW would constitute about 6% to 7%. The majority of the D&D materials (approximately 88% of the total) would be "clean."

The "clean" waste would be sent to a landfill that accepts construction debris. Low-level waste would be sent to a licensed disposal facility where it will likely be buried in accordance with the waste acceptance criteria and other requirements in effect at that time. Hazardous and mixed waste would be disposed of in a licensed facility in accordance with applicable regulatory requirements.

TABLE 5.9-2 Annual and Total Waste Volume Estimates from Conversion Facility D&D Activities at the Portsmouth Site

Waste Type	Annual D&D Waste (m^3/yr)[a]	Total D&D Waste (m^3)
LLMW	40	110
Hazardous waste	40	110
LLW	70	200
Clean	1,200	4,000

[a] Annual rates based on 3-year D&D.

6 ENVIRONMENTAL AND OCCUPATIONAL SAFETY AND HEALTH PERMITS AND COMPLIANCE REQUIREMENTS

6.1 DUF_6 CYLINDER MANAGEMENT AND CONSTRUCTION AND OPERATION OF A DUF_6 CONVERSION FACILITY

DUF_6 cylinder management as well as construction and operation of the proposed DUF_6 conversion facility would be subject to many federal, state, and local requirements. In accordance with such legal requirements, a variety of permits, licenses, and other consents must be obtained. Table 6.1 at the end of this chapter lists those that may be needed. The status of each is indicated on the basis of currently available information. However, because the DUF_6 project is still at an early stage, the information in Table 6.1 should not be considered comprehensive or binding. UDS may determine that additional consents not listed in Table 6.1 apply, or that the DUF_6 cylinder management and/or conversion facility qualify for exemptions or exclusions from some listed consents.

6.2 TRANSPORTATION OF UF_6

Transportation of UF_6 (depleted, natural, or slightly enriched) is governed by the Hazardous Materials Transportation Act (HMTA), as amended by the Hazardous Materials Transportation Uniform Safety Act of 1990 and other acts (49 USC 5101 et seq.). This law is implemented by the DOT through its hazardous materials regulations (HMRs) (i.e., 49 CFR Parts 171 through 180). Since UF_6 presents hazards because of both its radioactivity and corrosivity, the DOT HMRs impose specific packaging requirements on UF_6 shipments in addition to the otherwise applicable radioactive material transportation requirements. The specific packaging requirements for shipments of UF_6 appear in 49 CFR 173.420 and are summarized below.

- Other than Model 30A cylinders and certain cylinders manufactured before June 30, 1987, DUF_6 packaging must be designed, fabricated, inspected, tested, and marked in accordance with the version of ANSI Standard N14.1, *Uranium Hexafluoride — Packaging for Transport,* that was in effect at the time the packaging was manufactured.

- Each UF_6 packaging must be designed so that it will withstand a hydraulic test at an internal pressure of at least 1.4 megapascals (MPa) (200 lb/in.^{2}) without leakage.

- Each UF_6 packaging must be designed so that it will withstand a free drop test without loss or dispersal of UF_6. The specimen must drop onto a flat, horizontal surface of such a character that any increase in its resistance to displacement or deformation upon impact by the specimen would not significantly increase the damage to the specimen. The drop must occur so that the specimen will suffer maximum damage in respect to the safety features to be tested. Mandatory drop heights, which must be measured from the lowest point of the specimen to the upper surface of the target, vary depending on the packaging mass from 1 ft (0.3 m) if the packaging mass exceeds 33,000 lb (15,000 kg), to 4 ft (1.2 m) if the packaging mass is less than 11,000 lb (5,000 kg).

- Each UF_6 packaging must be designed so that it will withstand, without rupture of the containment system, a thermal test as follows: Exposure for a period of 30 minutes to a thermal environment that provides a heat flux at least equivalent to that of a hydrocarbon fuel/air fire in sufficiently quiescent ambient conditions to give a minimum average flame emissivity coefficient of 0.9 and an average temperature of at least 800°C (1,475°F), fully engulfing the specimen, with a surface absorptivity coefficient that is the greater of 0.8, or the value the package may be expected to possess if exposed to the fire specified and a convective coefficient that must be the value that the package may be demonstrated to have if exposed to the fire specified.

- The UF_6 must be in solid form.

- The volume of solid DUF_6 must not exceed 62% of the certified capacity of the package at 20°C (68°F). For natural and slightly enriched UF_6, this requirement is 61%.

- The pressure in the package at 20°C (68°F) must be less than 101.3 kPa (14.8 lb/in.^{2} absolute [psi]).

- Before initial filling and during periodic inspection and tests, UF_6 packaging must be cleaned in accordance with ANSI N14.1.

- UF_6 packaging must be periodically inspected, tested, marked, and otherwise conform to ANSI N14.1.

- Each repair to UF_6 packaging must be performed in accordance with ANSI N14.1.

If, at the time transportation occurs, the DUF_6 is being stored in a cylinder for which compliance with the then-applicable transportation requirements in 49 CFR 173.420 cannot be verified, UDS may implement one of the following options before shipping the DUF_6:

- Obtain an exception, pursuant to 49 CFR 173.3(b), to allow the cylinder to be transported either "as is" or following repairs, or

- Transfer the DUF_6 from its noncompliant cylinder into a compliant cylinder.

- Ship the noncompliant cylinder in a compliant overpack.

A detailed discussion of regulatory considerations associated with transporting UF_6 is presented in Biwer et al. (2001).

6.3 WORKER SAFETY AND HEALTH

The Occupational Safety and Health Act of 1970 (P.L. 91-596) gives OSHA the authority to prescribe and enforce standards and regulations affecting the occupational safety and health of private-sector employees. However, at facilities where another federal agency has exercised its statutory authority to prescribe or enforce occupational safety and health standards, Section 4(b)(1) of the act waives OSHA's jurisdiction. Relying on this section of the act, in 1974, OSHA explicitly recognized the authority of the AEC to establish and enforce occupational safety and health standards at AEC-sponsored, contractor-operated facilities covered by the AEA. Since then, the AEC and its successor agencies, including DOE, have regulated worker health and safety at most of their own facilities. This approach will be used to regulate worker safety at DUF_6 cylinder management and conversion facilities.

DOE exercises its authority over working conditions at its facilities through an extensive program of internal oversight and a system of DOE regulations and directives that require DOE contractors to comply with relevant worker protection standards and regulations (e.g., 29 CFR Part 1910, *Occupational Safety and Health Standards*, and 29 CFR Part 1926, *Safety and Health Regulations for Construction*) and impose additional radiation and chemical exposure standards developed by DOE (DOE Order 440.1A). DOE enforces its regulations, which have the power of law, by levying fines or by referring the offending contractor to the Department of Justice for other punishment. Most of DOE's worker radiation protection regulations are located in 10 CFR Part 835, *Occupational Radiation Protection*. Pertinent DOE directives are listed in site-specific contract provisions and are enforced by invoking contractual remedies such as contract cancellation. Accordingly, UDS is required by its contract to comply with applicable health, safety, and environmental laws, orders, regulations, and national consensus standards and to develop and execute a radiation protection plan and an integrated safety management plan (DOE 2000d).

TABLE 6.1 Potentially Applicable Consents for the Construction and Operation of a DUF_6 Conversion Facility

License, Permit, or Other Consent	Responsible Agency	Authority	Relevance and Status
Air Quality Protection			
Title V Operating Permit: Required for sources that are not exempt and are major sources, affected sources subject to the Acid Rain Program, sources subject to new source performance standards (NSPS), or sources subject to National Emission Standards for Hazardous Air Pollutants (NESHAPs).	Ohio Environmental Protection Agency (OEPA); U.S. Environmental Protection Agency (EPA)	Clean Air Act (CAA), Title V, Sections 501–507 (*U.S. Code*, Title 42, Sections 7661–7661f [42 USC 7661–7661f]); *Ohio Administrative Code* (OAC) 3745-77-02	Uranium Disposition Services, LLC (UDS), has determined that the DUF_6 conversion facility is not an affected source subject to the Acid Rain Program and is not a source subject to NSPS. Nevertheless, UDS has not yet confirmed whether the DUF_6 conversion facility would be a major source of hazardous air pollutants (HAPs). Also, the facility is subject to *Code of Federal Regulations*, Title 40, Part 61, Subpart H (40 CFR Part 61, Subpart H), "National Emission Standards for Emissions of Radionuclides Other Than Radon from Department of Energy Facilities" (NESHAPs), although emissions are expected to result in an effective dose equivalent to the maximally exposed individual (MEI) of well below the standard (i.e., 10 mrem/yr). Accordingly, UDS is seeking official verification from the OEPA as to whether this permit is needed. OEPA representatives have verbally stated that no Title V Operating Permit will be required.
Ohio Permit to Install: Required for (1) any source to which one or more of the following CAA programs would apply: prevention of significant deterioration (PSD), nonattainment area, NSPS, and/or NESHAPs; and (2) any source to which one or more of the following state air quality programs would apply: Gasoline Dispensing Facility Permit, Direct Final Permit, and/or Small Maximum Uncontrolled Emission Unit Registration.	OEPA	CAA, Title I, Sections 160–169 (42 USC 7470–7479); OAC 3745-31-02	UDS has determined that the PSD, nonattainment area, and NSPS programs do not apply to the DUF_6 conversion facility. In addition, UDS has determined that none of the state air quality programs that would trigger the need for an Ohio Permit to Install would apply. Nevertheless, the facility is subject to the NESHAPs program (40 CFR Part 61, Subpart H). Accordingly, an Ohio Permit to Install will be required for the DUF_6 conversion facility. UDS will submit a timely permit application to the OEPA.

TABLE 6.1 (Cont.)

License, Permit, or Other Consent	Responsible Agency	Authority	Relevance and Status
Air Quality Protection (Cont.)			
Ohio Permit to Operate: Required for (1) any source to which one or more of the following CAA programs would apply: PSD, nonattainment area, NSPS, NESHAPs; and (2) any source to which one or more of the following state air quality programs would apply: State Permit to Operate and/or registration of operating unit with potential air emissions of an amount and type considered minimal; this permit is not required, however, for any facility that must obtain a Title V Operating Permit.	OEPA	CAA, Title I, Sections 160–169 (42 USC 7470–7479); OAC 3745-35-02	UDS has determined that the PSD, nonattainment area, and NSPS programs do not apply to the DUF_6 conversion facility. Nevertheless, the facility is subject to 40 CFR Part 61, Subpart H, "National Emission Standards for Emissions of Radionuclides Other Than Radon from Department of Energy Facilities" (NESHAPs). Therefore, UDS believes the State Permit to Operate program would apply. UDS will submit a timely application for an Ohio Permit to Operate.
Risk Management Plan (RMP): Required for any stationary source that has a regulated substance (e.g., hydrogen fluoride, anhydrous ammonia, ammonia, nitric acid) in any process (including storage) in a quantity that is over the threshold level.	EPA; OEPA	CAA, Title 1, Section 112(r)(7) (42 USC 7412); 40 CFR Part 68; OAC 3745-104	UDS has determined that certain regulated substances would be stored at the DUF_6 conversion facility in quantities that potentially exceed the threshold levels. Accordingly, an RMP may be required. UDS will verify this with the OEPA and, if necessary, prepare an RMP.
CAA Conformity Determination: Required for each criteria pollutant (i.e., sulfur dioxide, particulate matter, carbon monoxide, ozone, nitrogen dioxide, and lead) where the total of direct and indirect emissions in a nonattainment or maintenance area caused by a federal action would equal or exceed threshold rates.	DOE; OEPA; Tennessee Department of Environment and Conservation (TDEC)	CAA, Title 1, Section 176(c) (42 USC 7506); 40 CFR 93; OAC 3745-102; TDEC Regulations 1200-3-34-.02	Pike County, Ohio, and Roane County, Tennessee, have both been designated as "Cannot be Classified or Better Than Standard" for all criteria pollutants. Because these counties are in attainment with National Ambient Air Quality Standards for all criteria pollutants and contain no maintenance areas, no CAA conformity determination is required for any criteria pollutant that would be emitted as a result of the proposed federal action.

TABLE 6.1 (Cont.)

License, Permit, or Other Consent	Responsible Agency	Authority	Relevance and Status
Water Resources Protection			
National Pollutant Discharge Elimination System (NPDES) Permit – Construction Site Storm Water: Required before making point source discharges into waters of the state of storm water from a construction project that disturbs more than 5 acres (2 ha) of land.	OEPA	Clean Water Act (CWA) (33 USC 1251 et seq.); 40 CFR Part 122; OAC-3745-33-02, 3745-38-02, and 3745-38-06	UDS has determined that construction of the DUF_6 conversion facility and new cylinder storage yard would require an NPDES Permit for construction site storm water discharges. A general NPDES Permit for Storm Water Discharges in Ohio (OEPA Permit No. OHR100000 and proposed renewal OHC000002), which covers storm water discharges during construction, including storm water discharges from an on-site concrete batch plant if one is installed, is expected to satisfy this requirement. Accordingly, UDS will submit a Notice of Intent (NOI) to discharge under the General NPDES Permit and, if requested, a Storm Water Pollution Prevention Plan (SWPP) to the OEPA at the appropriate time.
National Pollutant Discharge Elimination System (NPDES) Permit – Industrial Facility Storm Water: Required before making point source discharges into waters of the state of storm water from an industrial site.	OEPA	CWA (33 USC 1251 et seq.); 40 CFR Part 122; OAC-3745-33-02, 3745-38-02, and 3745-38-06	UDS has determined that storm water would be discharged from the DUF_6 conversion facility site during operations. Therefore, an NPDES Permit for industrial facility storm water discharge may be required, unless arrangements can be made to discharge such storm water through existing outfalls covered by an NPDES Permit already held by United States Enrichment Corporation (USEC) for the Portsmouth site. UDS plans to consult with USEC concerning discharges of storm water during operations through existing outfalls. If this cannot be arranged, a General NPDES Permit for Storm Water Discharges Associated with Industrial Activity (NPDES Permit No. OHR000003) may apply. Thus, if storm water cannot be discharged through existing USEC outfalls, UDS plans to consult with the OEPA about the applicability of the General NPDES Permit, and if it applies, submit a NOI to the OEPA at the appropriate time. Otherwise, UDS will submit an application for an individual NPDES permit at the appropriate time.

TABLE 6.1 (Cont.)

License, Permit, or Other Consent	Responsible Agency	Authority	Relevance and Status
Water Resources Protection (Cont.)			
National Pollutant Discharge Elimination System (NPDES) Permit – Process Water Discharge: Required before making point source discharges into waters of the state of industrial process wastewater.	OEPA	CWA (33 USC 1251 et seq.); 40 CFR Part 122; OAC-3745-33-02, 3745-38-02, and 3745-38-06	UDS is studying options for management of process water/blowdown discharges. The need for an NPDES permit for such discharges will be determined based on the outcome of the study. If it is determined that an NPDES permit is required, UDS will apply for the permit at the appropriate time.
Ohio Surface Water Permit to Install: Required before constructing sewers or pump stations.	OEPA	OAC-3745-31-02	UDS has determined that a Surface Water Permit to Install would be required before construction of sewer lines and pump stations at the DUF_6 conversion facility site. Accordingly, UDS plans to submit an application to the OEPA at the appropriate time.
Ohio Surface Water Permit to Install: Required before constructing any wastewater treatment or collection system or disposal facility.	OEPA	OAC-3745-31-02	If it is determined that the DUF_6 conversion facility would have an on-site wastewater treatment facility, UDS plans to submit an application for a Surface Water Permit to Install at the appropriate time.
CWA Section 404 (Dredge and Fill) Permit: Required to place dredged or fill material into waters of the United States, including areas designated as wetlands, unless such placement is exempt or authorized by a nationwide permit or a regional permit; a notice must be filed if a nationwide or regional permit applies.	U.S. Army Corps of Engineers (USACE)	CWA (33 USC 1251 et seq.); 33 CFR Parts 323 and 330	UDS believes that construction of the DUF_6 conversion facility would not result in dredging or placement of fill material into wetlands within the jurisdiction of the USACE. However, construction of a storm water discharge outfall requiring dredging in waters of the United States may be necessary. If construction activities are subject to the CWA Section 404 Permit program, they may be covered under a USACE Nationwide CWA Section 404 Permit (i.e., No. 14 [Linear Transportation Projects], 18 [Minor Discharges], or 19 [Minor Dredging]). Accordingly, UDS plans to consult with the USACE concerning the project and, if appropriate, submit either a preconstruction notification about activities covered by a nationwide permit or an application for an individual Section 404 Permit.

TABLE 6.1 (Cont.)

License, Permit, or Other Consent	Responsible Agency	Authority	Relevance and Status
Water Resources Protection (Cont.)			
Ohio General Permit for Filling Category 1 and Category 2 Isolated Wetlands: Required where the proposed project involves the filling or discharge of dredged material into Category 1 and Category 2 isolated wetlands, causing impacts that total 0.5 acre (0.20 ha) or less.	OEPA	*Ohio Revised Code* (ORC) Sections 6111.021–6111.029	UDS believes that construction of the DUF_6 conversion facility would not result in dredging or placement of fill material into wetlands within the jurisdiction of the OEPA isolated wetlands program. Accordingly, UDS plans to consult with the OEPA concerning the project and, only if appropriate, submit to the OEPA a Pre-Activity Notice of activities covered under the General Permit for Filling Isolated Wetlands.
Ohio Individual Isolated Wetland Permit: Required where the proposed project involves the filling or discharge of dredged material into Category 1 and Category 2 isolated wetlands, causing impacts that total greater than 0.5 acre (0.20 ha) for Category 1 isolated wetlands and/or greater than 0.5 acre (0.20 ha) but not exceeding 3 acres (1.21 ha) for Category 2 isolated wetlands.	OEPA	ORC Sections 6111.021–6111.029	UDS believes that construction of the DUF_6 conversion facility would not result in dredging or placement of fill material into wetlands within the jurisdiction of the OEPA isolated wetlands program. Accordingly, UDS plans to consult with the OEPA concerning the project and, only if appropriate, submit to the OEPA an application for an Individual Isolated Wetland Permit.
Spill Prevention Control and Countermeasures (SPCC) Plan: Required for any facility that could discharge oil in harmful quantities into navigable waters or onto adjoining shorelines.	EPA	CWA (33 USC 1251 et seq.); 40 CFR Part 112	If it is determined that a SPCC plan would be required, UDS will submit the plan to the EPA and the OEPA at the appropriate time.
CWA Section 401 Water Quality Certification: Required to be submitted to the agency responsible for issuing any federal license or permit to conduct an activity that may result in a discharge of pollutants into waters of a state.	OEPA	CWA, Section 401 (33 USC 1341); ORC Chapters 119 and 6111; OAC Chapters 3745-1, 3745-32, and 3745-47	UDS would be required to obtain a CWA Section 401 Water Quality Certification if construction or operation of the DUF_6 conversion facility or new cylinder storage yard requires a federal license or permit. If UDS determines that a federal license or permit is required (e.g., a CWA Section 404 Permit), a CWA Section 401 Water Quality Certification will be requested from the OEPA at the appropriate time.

TABLE 6.1 (Cont.)

License, Permit, or Other Consent	Responsible Agency	Authority	Relevance and Status
Waste Management and Pollution Prevention			
Submit Determination Results: Required when a person who generates waste in the State of Ohio or a person who generates waste outside the state that is managed inside the state determines that the waste he/she generates is hazardous waste.	OEPA	OAC 3745-52-11	At the appropriate time, UDS will submit to the OEPA the results of its determination that any waste generated at the DUF_6 conversion facility is a hazardous waste.
Registration and Hazardous Waste Generator Identification Number: Required before a person who generates over 220 lb (100 kg) per calendar month of hazardous waste ships the hazardous waste off site.	EPA; OEPA	Resource Conservation and Recovery Act (RCRA), as amended (42 USC 6901 et seq.), Subtitle C; OAC 3745-52-12	At the appropriate time, UDS plans to apply to the OEPA for an EPA Hazardous Waste Generator Identification Number.
Hazardous Waste Treatment, Storage, or Disposal Facility Permit: Required if hazardous or mixed waste will undergo nonexempt treatment by the generator, be stored on site for longer than 90 days by the generator of 2,205 lb (1,000 kg) or more of hazardous waste per month, be stored on site for longer than 180 days by the generator of between 220 and 2,205 lb (100 and 1,000 kg) of hazardous waste per month, disposed of on site, or be received from off site for treatment or disposal.	EPA; OEPA	RCRA, as amended (42 USC 6901 et seq.), Subtitle C; OAC 3745-50-40	Hazardous waste would not be disposed of on site at the DUF_6 conversion facility. Also, UDS does not plan to store any hazardous wastes that are generated on site for more than 90 days. Accordingly, UDS believes that no Hazardous Waste Treatment, Storage, or Disposal Facility Permit would be required.
Industrial Solid Waste Landfill Permit to Install: Required before constructing or expanding a solid waste landfill facility in Ohio.	OEPA	OAC 3745-29-06	Industrial solid waste would not be disposed of on site at the DUF_6 conversion facility. Therefore, no Industrial Solid Waste Landfill Permit to Install would be required.

TABLE 6.1 (Cont.)

License, Permit, or Other Consent	Responsible Agency	Authority	Relevance and Status
Waste Management and Pollution Prevention (Cont.)			
Construction and Demolition Debris Facility License: Required before establishing, modifying, operating, or maintaining a facility to dispose of debris from the alteration, construction, destruction, or repair of a man-made physical structure; however, the debris to be disposed of must not qualify as solid or hazardous waste; also, no license is required if debris from site clearing is used as fill material on the same site.	OEPA or the authorized local board of health	OAC 3745-37-01	Construction debris would not be disposed of on site at the DUF_6 conversion facility. Therefore, no Construction and Demolition Debris Facility License would be required.
Low-Level Radioactive Waste Generator Report: Required within 60 days of commencing the generation of low-level waste in Ohio.	Ohio Department of Health	OAC 3701:1-54-02	UDS will file a Low-Level Radioactive Waste Generator Report with the Ohio Department of Health at the appropriate time.
Underground Storage Tank (UST) Installation Permit: Required before beginning installation of a UST system (i.e., a tank and/or piping of which 10% or more of the volume is underground and that contains petroleum products or substances defined as hazardous by the Comprehensive Environmental Response, Compensation, and Liability Act [CERCLA], except those hazardous substances that are also defined as hazardous waste by the RCRA).	Ohio Department of Commerce, Ohio Bureau of Underground Storage Tank Regulations (BUSTR)	OAC 1301:7-9-06(D)	No UST systems would be installed at the DUF_6 conversion facility. Therefore, no UST Installation Permit would be required.
New UST System Registration: Required within 30 days of bringing a new UST system into service.	EPA; Ohio BUSTR	RCRA, as amended, Subtitle I (42 USC 6991a–6991i); 40 CFR 280.22; OAC 1301:7-9-04	No UST systems would be installed at the DUF_6 conversion facility. Therefore, no New UST System Registration would be required.
Notification of PCB Waste Activity	EPA	Toxic Substances Control Act (TSCA), as amended (15 USC 2601 et seq.); 40 CFR Part 761	UDS would be required to notify EPA of PCB waste activities at the time that DUF_6 cylinders to which paints containing PCBs have been applied are designated for disposal, either alone or as containers for depleted uranium oxide. At the appropriate time, UDS will notify the EPA by filing the required form.

TABLE 6.1 (Cont.)

License, Permit, or Other Consent	Responsible Agency	Authority	Relevance and Status
Emergency Planning and Response			
List of Material Safety Data Sheets: Submission of a list of Material Safety Data Sheets is required for hazardous chemicals (as defined in 29 CFR Part 1910) that are stored on site in excess of their threshold quantities.	Local Emergency Planning Commission (LEPC); Ohio State Emergency Response Commission (SERC)	Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA), Section 311 (42 USC 11021); 40 CFR 370.20; OAC 3750-30-15	UDS will prepare and submit a List of Material Safety Data Sheets at the appropriate time.
Annual Hazardous Chemical Inventory Report: Submission of the report is required when hazardous chemicals have been stored at a facility during the preceding year in amounts that exceed threshold quantities.	LEPC; Ohio SERC; local fire department	EPCRA, Section 312 (42 USC 11022); 40 CFR 370.25; OAC 3750-30-01	UDS will cooperate with other DOE tenants at the Portsmouth GDP site regarding submission of a site-wide Annual Hazardous Chemical Inventory Report each year. For the purpose of preparing the site-wide report, the total quantities of hazardous chemicals stored by all tenants at the Portsmouth GDP site, including those stored at the depleted UF_6 conversion facility, will be considered.
Notification of On-Site Storage of an Extremely Hazardous Substance: Submission of the notification is required within 60 days after on-site storage begins of an extremely hazardous substance in a quantity greater than the threshold planning quantity.	Ohio SERC	EPCRA, Section 304 (42 USC 11004); 40 CFR 355.30; OAC 3750-20-05	UDS will prepare and submit the Notification of On-Site Storage of an Extremely Hazardous Substance at the appropriate time, if such substances are determined to be stored in a quantity greater than the threshold planning quantity at the DUF_6 conversion facility.

TABLE 6.1 (Cont.)

License, Permit, or Other Consent	Responsible Agency	Authority	Relevance and Status
Transportation of Radioactive Wastes and Conversion Products			
Certificate of Registration: Required to authorize the registrant to transport hazardous material or cause a hazardous material to be transported or shipped.	U.S. Department of Transportation (DOT)	Hazardous Materials Transportation Act (HMTA), as amended by the Hazardous Materials Transportation Uniform Safety Act of 1990 and other acts (49 USC 1501 et seq.); 49 CFR 107.608(b)	UDS will obtain a Certificate of Registration at the appropriate time.
Packaging, Labeling, and Routing Requirements for Radioactive Materials: Required for packages containing radioactive materials that will be shipped by truck or rail.	DOT	HMTA (49 USC 1501 et seq.); Atomic Energy Act (AEA), as amended (42 USC 2011 et seq.); 49 CFR Parts 172, 173, 174, 177, and 397	When shipments of radioactive materials are made, UDS will comply with DOT packaging, labeling, and routing requirements.
Biotic Resources			
Threatened and Endangered Species Consultation: Required between the responsible federal agencies and affected states to ensure that the project is not likely to (1) jeopardize the continued existence of any species listed at the federal or state level as endangered or threatened or (2) result in destruction of critical habitat of such species.	U.S. Department of Energy (DOE); U.S. Fish and Wildlife Service; Ohio Department of Natural Resources	Endangered Species Act of 1973, as amended (16 USC 1531 et seq.); ORC 1531.25–26 and 1531.99	Neither a species listed at the federal or state level as endangered or threatened, nor the critical habitat of such a species, has been identified that would be affected by construction or operation of the DUF_6 conversion facility or new cylinder storage yard.

TABLE 6.1 (Cont.)

License, Permit, or Other Consent	Responsible Agency	Authority	Relevance and Status
Nuclear Facility Operations			
Approval to Start Up a Nuclear Facility: Required before start-up of new nuclear facilities, which are activities or operations that involve radioactive and/or fissionable materials in such form or quantity that a nuclear hazard potentially exists to the employees or the general public.	DOE	AEA, as amended (42 USC 2011 et seq.); DOE Order 425.1B	UDS will obtain approval from DOE to start up the DUF_6 conversion facility at the appropriate time.
Approval to Release Materials Containing Residual Radioactive Contamination: Required before releasing (1) nonuranium products from the DUF_6 conversion process (such as hydrogen fluoride [HF] or calcium fluoride [CaF_2]) for unregulated use and (2) decontaminated DUF_6 cylinders for unregulated use as scrap metal.	DOE	AEA, as amended (42 USC 2011 et seq.); DOE Order 5400.5	UDS will obtain approval from DOE before releasing HF, CaF_2, or decontaminated cylinders for unregulated use.
Cultural Resources			
Archaeological and Historical Resources Consultation: Required before a federal agency approves a project in an area where archaeological or historic resources might be located.	DOE; Advisory Council on Historic Preservation; Ohio State Historic Preservation Officer (SHPO)	National Historic Preservation Act of 1966, as amended (16 USC 470 et seq.); Archaeological and Historical Preservation Act of 1974 (16 USC 469-469c-2); Antiquities Act of 1906 (16 USC 431 et seq.); Archaeological Resources Protection Act of 1979, as amended (16 USC 470aa–mm)	DOE has coordinated with the Advisory Council on Historic Preservation and the Ohio SHPO regarding previous archeological and architectural surveys at the Portsmouth Gaseous Diffusion Plant site. Discussion of the results of such surveys is ongoing.

TABLE 6.1 (Cont.)

License, Permit, or Other Consent	Responsible Agency	Authority	Relevance and Status
Cultural Resources (Cont.)			
Government-to-Government Tribal Consultation: Required to ensure that project activities have been designed to protect access to, physical integrity of, and confidentiality of traditional cultural and religious sites.	DOE	American Indian Religious Freedom Act of 1978 (42 USC 1996 and 1996a); Native American Graves Protection and Repatriation Act of 1990 (25 USC 3001 et seq.); National Historic Preservation Act of 1966, as amended (16 USC 47OF); 36 CFR Part 800, Subpart B; 43 CFR Part 10	DOE has initiated government-to-government consultations with Native American tribes in the area of the DUF_6 conversion facility. No religious or sacred sites, burial sites, or resources significant to Native Americans have been identified to date.
Other			
Environmental Impact Statement (EIS): Required to evaluate the potential environmental impacts of a proposed major federal action that may significantly affect the quality of the human environment and to consider alternatives to the proposed action.	DOE	National Environmental Policy Act of 1969, as amended (NEPA) (42 USC 4321 et seq.); 40 CFR Parts 1500–1508; 10 CFR Part 1021	The requirements of NEPA are satisfied by publication of this EIS for the DUF_6 conversion facility and cylinder management area.
Annual Toxic Release Inventory (TRI) Report: Required for facilities that have 10 or more full-time employees and are assigned certain Standard Industrial Classification (SIC) codes.	EPA; OEPA	EPCRA, Section 313 (42 USC 11023); 40 CFR Part 372; OAC 3745-100-07	UDS will prepare and submit a TRI Report to the EPA each year.

TABLE 6.1 (Cont.)

License, Permit, or Other Consent	Responsible Agency	Authority	Relevance and Status
Other (Cont.)			
OEPA Director's Final Findings and Orders (issued February 24, 1998): Establishes requirements for management, surveillance, testing, and maintenance associated with the DUF_6 storage yards and cylinders owned by DOE at the Portsmouth site.	DOE; OEPA	ORC 3734 and 3745	UDS will implement the requirements of the OEPA Director's Final Findings and Orders, including preparation and submission to the OEPA of an annual report outlining DOE's good faith efforts to evaluate potential use or reuse of DUF_6.
Tennessee Department of Environment and Conservation Consent Order (issued February 2, 1999): Establishes requirements for management, surveillance, testing, maintenance, and disposition of the UF_6 cylinders at the East Tennessee Technology Park.	DOE; Tennessee Department of Environment and Conservation (TDEC)		UDS will implement the requirements of the TDEC Consent Order.

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9 GLOSSARY

Accident: An unplanned sequence of events resulting in undesirable consequences, such as the release of radioactive or hazardous material to the environment.

Accident consequence assessment: An assessment of the impacts following the occurrence of an accident, independent of the probability of that accident. The environmental impact statement (EIS) provides estimates of the consequences of a number of possible accidents, ranging from those with low probability (rare) to those with relatively high probability (frequent).

Accident frequency: The likelihood that a specific accident will occur, that is, the probability of occurrence. If an accident is estimated to happen once every 50 years, the accident frequency is generally reported as 0.02 per year (1 occurrence divided by 50 years = 0.02 occurrence per year). For the EIS, accident frequencies were grouped as follows:

- I, likely (L) — The average frequency of occurrence is estimated to be greater than or equal to 1 in 100 years.
- II, unlikely (U) — The average frequency of occurrence is estimated to be 1 in 100 to 1 in 10,000 years.
- III, extremely unlikely (EU) — The average frequency of occurrence is estimated to be 1 in 10,000 to 1 in 1 million years.
- IV, incredible (I) — The average frequency of occurrence is estimated to be less than 1 in 1 million years.

Accident risk: Risk based on both the severity of an accident (consequence) and the probability that the accident will occur. High-consequence accidents that are unlikely to occur (low probability) may pose a low overall risk. For purposes of comparison, accident risk is typically calculated by multiplying the accident consequence (e.g., dose or expected fatalities) by the accident probability.

Accident risk assessment: An assessment that considers the probabilities and consequences of a range of possible accidents, including low-probability accidents that have high consequences and high-probability accidents that have low consequences. The overall risk associated with an accident is generally estimated by multiplying the accident consequence by the probability of occurrence.

Accident source term: The amount of radioactive or hazardous material released to the environment in dispersible form following an accident.

Adsorption: Process in which solid surfaces attract and retain a layer of ions from a solution.

Advection: The process by which material is transported by the bulk motion of flowing gas or liquid.

Air quality: Measure of the health-related and visual characteristics of the air, often derived from quantitative measurements of the concentrations of specific injurious or contaminating substances. Air quality standards are the prescribed level of constituents in the outside air that cannot be exceeded during a specific time in a specified area.

Air Quality Control Region (AQCR): An interstate or intrastate area designated by the U.S. Environmental Protection Agency (EPA) for the attainment and maintenance of National Ambient Air Quality Standards (NAAQS).

Alpha particle (α): A positively charged particle consisting of two protons and two neutrons that is emitted during radioactive decay from the nucleus of certain nuclides. It is the least penetrating of the three common types of radiation (alpha, beta, and gamma).

Ambient air: The surrounding atmosphere as it exists around people, plants, and structures.

American Indian Religious Freedom Act of 1978: The Act that established national policy to protect and preserve for Native Americans their inherent right of freedom to believe, express, and exercise their traditional religions, including the rights of access to religious sites, use and possession of sacred objects, and freedom to worship through traditional ceremonies and rites.

Aquifer: A saturated subsurface geologic formation that can transmit significant quantities of water.

Archaeological and Historic Preservation Act: Act directed at the preservation of historic and archaeological data that would otherwise be lost as a result of federal construction. It authorizes the U.S. Department of the Interior to undertake recovery, protection, and preservation of archaeological and historic data.

As low as reasonably achievable (ALARA): An approach to control or manage radiation exposures (both individual and collective to the workforce and the public) and releases of radioactive material to the environment as low as social, technical, economic, practical, and public policy considerations permit. ALARA is not a dose limit; it is a practice that has as its objective the attainment of dose levels as far below applicable limits as possible.

Atomic Energy Act of 1954 (AEA): The Act that, along with other related legislation, provided the Atomic Energy Commission (a predecessor of the U.S. Department of Energy) with authority to develop generally applicable standards for protecting the environment from radioactive materials.

Attainment area: An area considered to have air quality as good as or better than the National Ambient Air Quality standards as defined in the Clean Air Act (CAA). An area may be an attainment area for one pollutant and a nonattainment area for others (see also *nonattainment area*).

Bald and Golden Eagle Protection Act, as amended: The Act making it unlawful to take, pursue, molest, or disturb bald (American) and golden eagles, their nests, or their eggs anywhere in the United States.

Beta particle (β): An elementary particle emitted from a nucleus during radioactive decay; it is negatively or positively charged, identical in mass to an electron, and in most cases easily stopped, as by a thin sheet of metal or plastic.

Biota: The plant and animal life of a region.

Bounding: In the case of accident analysis, bounding is a condition, consequence, or risk that provides an upper limit that is not exceeded by other conditions, consequences, or risks. This term is also used to identify conservative assumptions that will likely overestimate actual risks or consequences.

Breach: A general term referring to a hole in a cylinder or container. A breach may be caused by corrosion or by mechanical forces, such as those caused by a drop or contact with handling equipment.

Cancer: A group of diseases characterized by uncontrolled cellular growth. Increased incidence of cancer can be caused by exposure to radiation.

Candidate species: Plant or animal species that are not yet officially listed as threatened or endangered but are undergoing status review by the U.S. Fish and Wildlife Service (USFWS). These species are candidates for possible addition to the list of threatened and endangered species.

Carbon monoxide (CO): A colorless, odorless gas that is toxic if breathed in high concentration over a period of time. Carbon monoxide is one of six criteria air pollutants specified under Title I of the CAA.

Cascade: The process system that is used to separate the isotopic streams of uranium-235 and uranium-238 in gaseous diffusion plants.

Cask: A heavily shielded, typically robust container for shipping or storing spent nuclear fuel. Spent nuclear fuel casks are usually cylindrical containers with radiation shielding provided by steel, lead, concrete, or depleted uranium.

Census tract: An area usually containing between 2,500 and 8,000 persons that is used for organizing and monitoring census data. The geographic dimensions of census tracts vary widely, depending on population settlement density. Census tracts do not cross county borders.

Clean Air Act (CAA): The Act that mandates the issuance and enforcement of air pollution control standards for stationary sources and motor vehicles.

Clean Air Act Amendments of 1990: An Act that expanded the enforcement powers of the EPA and added restrictions on air toxins, ozone-depleting chemicals, stationary and mobile emissions sources, and emissions implicated in acid rain and global warming.

Clean Water Act of 1972, 1987: The Act that regulates the discharge of pollutants from a point source into navigable waters of the United States in compliance with a National Pollution Discharge Elimination System permit. Also regulates discharges to or dredging of wetlands.

Code of Federal Regulations (CFR): The codified form in which all federal regulations in force are published.

Collective dose: Summation of individual radiation doses received by all those exposed to the source or event being considered. The collective radiation dose received by a population group is usually measured in units of person-rem.

Collective population risk: A measure of possible loss in a group of people that takes into account the probability that the hazard will cause harm and the consequences of that event. The collective population risk does not express the risk to specific individual members of the population.

Committed effective dose equivalent: The sum of the committed dose equivalents to various tissues of the body, each multiplied by its weighting factor. It does not include contributions from external doses. Committed effective dose equivalent is expressed in units of rem and provides an estimate of the lifetime radiation dose to an individual from radioactive material taken into the body through either inhalation or ingestion.

Convection: Process by which heat is transferred between a surface and a moving fluid when they are at different temperatures.

Criteria pollutants: Six air pollutants for which national ambient air quality standards are established by the EPA under Title I of the CAA. The six pollutants are sulfur dioxide (SO_2), nitrogen oxides (NO_x), carbon monoxide (CO), ozone (O_3), particulate matter (PM_{10}, particles with a mean diameter of 10 micrometers [μm] or less), and lead (Pb).

Critical habitat: Air, land, or water area and constituent elements, the loss of which would appreciably decrease the likelihood of survival and recovery of a species listed as threatened or endangered or a distinct segment of the population of that species.

Cultural resources: Archaeological sites, architectural structures or features, traditional use areas, and Native American sacred sites or special use areas.

Cumulative impacts: The impacts assessed in an environmental impact statement that could potentially result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or nonfederal), private industry, or individual undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

Curie (Ci): A measure of the radioactivity of a material, equal to 3.7×10^{10} disintegrations per second.

Cylinder: As defined for this EIS, a large steel container used to store depleted uranium hexafluoride (DUF_6). Cylinders are typically about 12 ft long by 4 ft in diameter and weigh about 9 to 13 t (10 to 14 tons) when full of DUF_6.

Cylinder preparation: The activities required to prepare DUF_6 cylinders for transportation. Cylinder preparation would be required if cylinders were transported to a conversion facility.

Decay: see also *radioactive decay.*

Decay products: see also *radioactive decay products.*

Decommissioning: The process of removing a facility from operation, followed by decontamination, entombment, dismantlement, or conversion to another use.

Defluorination: The conversion of uranium hexafluoride to triuranium octaoxide (U_3O_8 [uranyl uranate]) accomplished by using steam. UF_6 is chemically decomposed with steam and heat to produce U_3O_8 and HF, with concentrated HF as the direct by-product.

Depleted uranium hexafluoride (DUF_6): A compound of uranium and fluorine from which most of the uranium-235 isotope has been removed. Isotope separation results in two product "streams." The stream containing the additional uranium-235 is said to be "enriched" and is collected for further processing into other forms of enriched uranium. The remaining UF_6 stream is said to be "depleted" and is now stored at the Paducah, Portsmouth, and ETTP sites.

Disposal: The emplacement of material in a manner designed to ensure isolation for the foreseeable future. Disposal is considered to be permanent, with no intent to retrieve the material for future use.

Disposal facility: A facility or part of a facility into which hazardous, radioactive, or solid waste is intentionally placed and at which waste is intended to permanently remain after closure of the facility.

Disproportionately high and adverse environmental impact: An adverse environmental impact determined to be unacceptable or above generally accepted norms. A disproportionately high impact refers to an environmental hazard with a risk or rate of exposure for a low-income or minority population that exceeds the risk or rate of exposure for the general population.

Disproportionately high and adverse human health effect: Any effect on human health from exposure to environmental hazards that exceeds generally accepted levels of risk and affects low-income and minority populations at a rate that appreciably exceeds the rate for the general population. Adverse health effects are measured in risks and rates that could result in latent cancer fatalities, as well as other fatal or nonfatal adverse impacts to human health.

Dose: The amount of energy deposited in body tissue due to radiation exposure. Various technical terms — such as dose equivalent, effective dose equivalent, and collective dose — are used to evaluate the amount of radiation received by an exposed individual or population.

Dose rate: Radiation dose delivered per unit of time and measured in rem per hour.

Drain: A device (e.g., a channel or pipe) used to carry away or to empty liquid from a liquid source.

Effective dose equivalent: The sum of the products of the dose equivalent to various organs or tissues and the weighting factors applicable to each of the body organs or tissues that are irradiated. The effective dose equivalent includes the dose from radiation sources internal and/or external to the body and is expressed in units of rem.

Emergency Planning and Community Right-to-Know Act of 1986: The Act that established programs to provide the public with important information on the hazardous and toxic chemicals in their communities and established emergency planning and notification requirements to protect the public in the event of a release of hazardous substances.

Emergency Response Planning Guideline (ERPG): A hazardous-material personnel exposure level or range which, when exceeded by a short-term or acute exposure, will cause adverse reproductive, developmental, or carcinogenic effects in humans. ERPGs are approved by a committee of the American Industrial Hygiene Association.

Endangered species: Any species that is in danger of extinction throughout all or a significant portion of its geographic range.

Endangered Species Act, as amended: The Act intended to prevent the further decline of endangered and threatened species and to restore these species and their habitats. Consultation with the USFWS is necessary to determine whether endangered and threatened species or their critical habitats are known to be in the vicinity of the proposed action.

Engineering analysis: A comprehensive technical analysis of DUF_6 technology options, including conversion, use, transportation, storage, and disposal.

Enrichment: An isotopic separation process that increases the portion of the uranium-235 isotope in relation to uranium-238 in natural uranium. In addition to the enriched uranium, this process also produces uranium depleted in uranium-235. Enrichment is accomplished in the United States through a process called gaseous diffusion.

Environmental impact statement (EIS): A document prepared in accordance with the requirements of the National Environmental Policy Act (NEPA).

Environmental justice: The fair treatment of people of all races, cultures, incomes, and educational levels with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment implies that no population of people should be forced to shoulder a disproportionate share of the negative environmental impacts of pollution or environmental hazards as a result of their lack of political or economic strength.

Evapotranspiration: Loss of water from the soil by both evaporation and transpiration from plants growing in the soil.

Exposure: The condition of being made subject to the action of radiation, chemicals, or physical hazards. Exposure is sometimes used as a generic term to refer to the dose of radiation or chemicals absorbed by an individual or population.

External exposure: Exposure to radiation, principally gamma radiation, that originates from sources outside of the body.

Farmland Protection Policy Act of 1981: An Act that requires federal agencies to take steps to ensure that federal actions do not contribute to the unnecessary and irreversible conversion of farmland to nonagricultural uses in cases in which other national interests do not override the importance of protecting the farmland resources.

Fault: A fracture in the earth's crust accompanied by displacement of one side of the fracture with respect to the other and in a direction parallel to the fracture.

Federal Facilities Compliance Act of 1992: An Act that amended the Resource Conservation and Recovery Act (RCRA) with the objectives of bringing all federal facilities into compliance with applicable federal and state hazardous waste laws, of waiving federal sovereign immunity under those laws, and of allowing the imposition of fines and penalties. The law also requires the U.S. Department of Energy (DOE) to submit an inventory of all its mixed waste and to develop a treatment plan for mixed waste.

Federal listed species: see also *threatened, endangered,* and *candidate species.*

Fission: The splitting of a heavy atomic nucleus into two nuclei of lighter elements, accompanied by the release of energy and generally one or more neutrons. Fission can occur spontaneously or be induced by neutron bombardment.

Floodplain: The lowlands adjoining inland and coastal waters and relatively flat areas, including at a minimum that area inundated by a 1% or greater chance flood in any given year. The base floodplain is defined as the 100-year (1%) floodplain. The critical action floodplain is defined as the 500-year (0.2%) floodplain.

Food chain: The scheme of feeding relationships between trophic levels that unites the member species of a biological community.

Fugitive dust: The dust released from activities associated with construction, manufacturing, or transportation.

Fugitive emissions: Uncontrolled emissions to the atmosphere from pumps, valves, flanges, seals, and other process points not vented through a stack. Also includes emissions from area sources such as ponds, lagoons, landfills, and piles of stored material.

Gamma radiation (γ): High-energy, short-wavelength electromagnetic radiation (a packet of energy) emitted from a radioactive nucleus during decay. Gamma radiation frequently accompanies alpha and beta emissions and always accompanies fission. Gamma rays are very penetrating and are best stopped or shielded against by dense materials such as lead or uranium. Gamma rays are similar to X-rays, but are usually more energetic.

Gaseous diffusion: The uranium enrichment process first developed in the 1940s as part of the Manhattan Project. In gaseous diffusion, gaseous UF_6 is allowed to flow irreversibly through a membrane or diffusion barrier. With holes just large enough to allow the passage of individual molecules without passage of the bulk gas through the membrane or diffusion barrier, more of the lighter molecules (i.e., those containing uranium-235 atoms) will flow through the barrier than the heavier molecules (i.e., those containing uranium-238 atoms), thus effecting partial separation. Gaseous diffusion results in two streams of UF_6: one enriched in the uranium-235 isotope and one depleted in the uranium-235 isotope.

General public: For purposes of analyses in this EIS, anyone outside the boundary of a site at the time of an accident or during normal facility operations, as well as people along transportation routes used to ship hazardous chemicals or radioactive materials.

Glove box: An airtight box used to work with hazardous material, vented to a closed filtering system, having gloves attached inside the box to protect the worker.

Greater-than-Class-C waste: Low-level radioactive waste generated by the commercial sector that exceeds U.S. Nuclear Regulatory Commission (NRC) concentration limits for Class-C low-level waste, as specified in Title 10, Part 61, *Code of Federal Regulations* (10 CFR Part 61).

Green salt: see *uranium tetrafluoride.*

Groundshine: Gamma radiation emitted from radioactive materials deposited on the ground.

Groundwater: Generally, all water contained in the ground; water held below the water table available to freely enter wells.

Grout: A cementing or sealing mixture of cement and water to which sand, sawdust, or other fillers (additives — e.g., waste) may be added.

Grouted waste: Refers to the solid material obtained by mixing waste material with cement and repackaging it in drums. Grouting is intended to reduce the mobility of the waste material.

Habitat: Area where a plant or animal lives.

Hazard index: A summation of the hazard quotients for all chemicals to which an individual is exposed. A hazard index value of 1.0 or less than 1.0 indicates that no adverse human health effects (noncancer) are expected to occur.

Hazard quotient: A comparison of an estimated chemical intake (dose) with a reference dose level below which adverse health effects are unlikely. The hazard quotient is expressed as the ratio of the estimated intake to the reference dose. The value is used to evaluate the potential for noncancer health effects, such as organ damage, from chemical exposures.

Hazardous air pollutants: The 189 chemicals and chemical classes — such as asbestos, beryllium, mercury, benzene, and radionuclides — whose emissions are specially regulated by the CAA.

Hazardous material: A material that poses a potential risk to health, safety, and property when transported or handled.

Hazardous waste: Under RCRA, a solid waste, or combination of solid waste, which — because of its quantity, concentration, or physical, chemical, or infectious characteristics — may (a) cause or significantly contribute to an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness or (b) pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed. Source material (including UF_6), special nuclear material, and by-product material, as defined by the AEA, are specifically excluded from the definition of solid waste.

Health risk conversion factors: Estimates of the expected number of health effects (i.e., cancer cases, cancer fatalities, or genetic effects) caused by exposure to a given amount of radiation. Health risk conversion factors are multiplied by the estimated radiation dose received by a given population (such as workers or members of the public) in order to estimate the number of health effects expected to occur as a result of the exposure. Health risk conversion factors are derived from data collected from Japanese atomic bomb survivors, historical medical and industrial exposures, and animal experimentation.

Heels: Residual amounts of nonvolatile material left in a cylinder following the removal of DUF_6.

High-efficiency particulate air (HEPA) filter: A filter with an efficiency of at least 99.95% used to separate particles from air exhaust streams prior to releasing that air into the atmosphere.

Hydrocarbons: Chemical compounds containing carbon and hydrogen as the principal elements.

Hydrogen fluoride (HF): A colorless, toxic, fuming, corrosive liquid or gas miscible with cold water and very soluble in hot water. HF is produced when UF_6 comes in contact with water, such as humidity in the air, and is often a by-product produced when UF_6 is converted to another chemical form.

Hygroscopic: A chemical substance with an affinity for water; one that will absorb moisture, usually from the air.

Inconel: A metal alloy containing nickel, chromium, and iron, which exhibits good resistance to corrosion in aqueous environments.

Internal exposure: The ingestion or inhalation of radioactive contaminants in air, water, food, or soil, and the subsequent radiation dose to internal organs and tissues of the body.

Involved worker: A worker directly involved in the handling or processing of radioactive or hazardous materials.

Ion: An atom, molecule, or molecular fragment carrying a positive or negative electrical charge.

Ionizing radiation: Radiation that has enough energy to remove electrons from substances that it passes through, forming ions.

Isotope: One of two or more species of an element that have the same atomic number but different masses. The difference in mass is due to the presence of one or more extra neutrons in the nucleus. The number of protons for different isotopes of the same element is the same. Uranium-235 and uranium-238 are examples of isotopes of the element uranium.

Land disposal restrictions: Restrictions on the disposal of waste that is hazardous under RCRA. The land disposal restrictions include technology-based or performance-based treatment standards that must be met before hazardous waste can be disposed of on land.

Latent cancer fatality (LCF): Term used to indicate the estimated number of cancer fatalities that may result from exposure to a cancer-causing element. Latent cancer fatalities are similar to naturally occurring cancers and may be expressed at any time after the initial exposure.

Lead (Pb): A toxic metal element with atomic number 82. Overexposure to this metal in air, food, water, and soil can cause damage to the circulatory, digestive, and central nervous systems. Lead is one of six criteria air pollutants specified under Title I of the CAA.

Long-term storage: The containment of a material for a period of years, in such a manner as not to constitute disposal of such material. Long-term storage would preserve access to the material until a future use is identified or until a decision is made to dispose of the material.

Low-income population: Persons of low-income status. This status is based on U.S. Bureau of the Census definitions of individuals living below the poverty line, as defined by a statistical threshold that considers family size and income. For 1990, the poverty line threshold for a family unit of four individuals was $12,674 (based on 1989 income). In this EIS, low-income population was defined as consisting of any census tract located within a 50-mi (80-km) radius of a site that has a proportion of low-income population that is greater than the respective state average.

Low-level mixed waste (LLMW): Waste that contains both hazardous waste under RCRA and radioactive material, including source, special nuclear, or by-product material subject to the AEA. Such waste has to be handled, processed, and disposed of in a manner that considers its chemical as well as its radioactive components.

Low-level radioactive waste (LLW): Waste that contains radioactivity but is not classified as high-level waste, transuranic waste, spent nuclear fuel, or "11e(2) by-product material" as defined by DOE Order 5820.2A. Low-level waste is typically disposed of by using shallow land burial.

Low-Level Radioactive Waste Policy Act: The Act, as amended, that established procedures for the implementation of compacts providing for the establishment and operation of regional disposal facilities for LLW that made the federal government responsible for ultimate disposal of commercially generated waste with a classification of greater-than-Class-C (see also *greater-than-Class-C waste*).

Maximally exposed individual (MEI): A hypothetical individual who — because of proximity, activities, or living habits — could potentially receive the maximum possible dose of radiation or of a hazardous chemical from a given event or process.

Migratory Bird Treaty Act, as amended: Act intended to protect birds that have common migration patterns between the United States and Canada, Mexico, Japan, and Russia.

Millirem: A unit of radiation exposure equal to one-thousandth of a rem.

Minority population: Persons classified by the U.S. Bureau of the Census as Negro/ Black/African-American, Hispanic, Asian and Pacific Islander, American Indian, Eskimo, Aleut, or other nonwhite; based on self-classification by individuals according to the race with which they most closely identify. For this EIS, a minority population was defined as any census tract located within a 50-mi (80-km) radius of a site that has a proportion of minority population that is greater than the respective state average.

Mixed waste: see also *low-level mixed waste.*

Model: A conceptual, mathematical, or physical system obeying certain specified conditions, whose behavior is used to understand the physical system to which it is analogous. Models are often used to predict the behavior or outcome of future events.

Modified Mercalli Intensity: A level on the Modified Mercalli scale. A measure of the perceived intensity of earthquake ground-shaking with 12 divisions, from I (not felt by people) to XII (damage nearly total).

Monel: Trade name for a white copper-nickel alloy that is acid- and corrosion-resistant.

National Ambient Air Quality Standards (NAAQS): Air quality standards established by the CAA, as amended. The primary NAAQS are intended to protect the public health with an adequate margin of safety; the secondary NAAQS are intended to protect the public welfare from any known or anticipated adverse effects of a pollutant.

National Emission Standards for Hazardous Air Pollutants (NESHAPs): A set of national emission standards for listed hazardous pollutants emitted from specific classes or categories of new and existing sources. These standards were implemented in the CAA Amendments of 1977.

National Environmental Policy Act (NEPA) of 1969: The Act that established the national policy to protect humans and the environment, requiring environmental reviews of federal actions that have the potential for significant impact on the environment. It also established the Council on Environmental Quality (CEQ).

National Historic Preservation Act of 1966, as amended: The Act directing federal agencies to consider the effects of their programs and projects on properties listed on or eligible for the National Register of Historic Places. It does not require any permits, but pursuant to federal code, if a proposed action might impact any archaeological, historical, or architectural resource, this Act mandates consultation with the proper agencies.

National Pollutant Discharge Elimination System (NPDES): Federal permitting system required for hazardous effluents regulated through the CWA, as amended.

National Register of Historic Places: A list maintained by the Secretary of the Interior as the official list of historic properties (districts, sites, buildings, structures, and objects) deserving preservation because of their local, state, or national significance in American history, architecture, archaeology, engineering, and culture. Properties listed on or eligible for the National Register are protected by the National Historic Preservation Act of 1966, as amended.

NEPA document: A document prepared pursuant to requirements of the National Environmental Policy Act or CEQ regulations, including the following: environmental assessment, environmental impact statement, Notice of Intent, Record of Decision, and Finding of No Significant Impact.

Nitrogen oxides (NO_x): The oxides of nitrogen, primarily nitrogen oxide (NO) and nitrogen dioxide (NO_2), that are produced in the combustion of fossil fuels and can constitute an air pollution problem. When NO_2 combines with volatile organic compounds in sunlight, ozone is produced. Nitrogen oxides are one of six criteria air pollutants specified under Title I of the CAA.

Nonattainment area: An AQCR (or a portion thereof) for which the EPA has determined that ambient air concentrations exceed NAAQS for one or more criteria pollutants (see also *attainment area* and *criteria pollutants*).

Nonhazardous waste: Routinely generated waste, including general facility refuse such as paper, cardboard, glass, wood, plastics, scrap, metal containers, dirt, and rubble. Nonhazardous waste is segregated and recycled whenever possible.

Noninvolved worker: A worker employed at a site who is not directly involved in the handling of radioactive or hazardous materials.

Normal operations: Conditions during which facilities and processes operate as expected or designed. In general, the evaluation of normal operations includes the occurrence of some infrequent events that, although not considered routine, are not classified as accidents. For example, the identification and repair of breached cylinders, expected to occur infrequently, was considered to be normal operations.

Nuclear weapon: The general name given to any weapon in which the explosion results from energy released by reactions involving atomic nuclei — either fission or fusion, or both.

Occupational Safety and Health Administration (OSHA): The agency that oversees and regulates workplace health and safety, created by the Occupational Safety and Health Act of 1970.

Overpack: Container used for transporting cylinders not meeting U.S. Department of Transportation (DOT) requirements. An overpack is a container into which a cylinder would be placed for shipment. The overpack would be designed, tested, and certified to meet all DOT shipping requirements and would be suitable to contain, transport, and store the cylinder contents regardless of cylinder condition.

Ozone (O_3): The triatomic form of oxygen. In the stratosphere, ozone protects the earth from the sun's ultraviolet rays, but in lower levels of the atmosphere, ozone is considered an air pollutant and can cause irritation of the eyes and respiratory tract. Ozone is one of six criteria air pollutants specified under Title I of the CAA.

Palustrine: Nontidal wetlands dominated by trees, shrubs, or persistent emergent vegetation or small shallow wetlands.

Particulate matter, particulates: Particles in an aerosol stream, the larger of which usually can be removed by filtration.

Pasquill stability categories: Classification scheme that describes the degree of atmospheric turbulence. Categories range from extremely unstable (A) to extremely stable (F). Unstable conditions promote the rapid dispersion of atmospheric contaminants and result in lower air concentrations compared with stable conditions.

Pathway: A route or sequence of processes by which radioactive or hazardous material may move through the environment to humans or other organisms. For example, one potential exposure pathway involves the contamination and subsequent use of surface water or groundwater.

Permeability: In hydrology, the capacity of a medium (rock, sediment, or soil) to transmit groundwater. Permeability depends on the size and shape of the pores in the medium and how they are interconnected.

Permissible exposure limits (PELs): Occupational exposure limits established for worker exposures to various chemicals, endorsed by the OSHA. Permissible exposure limits are defined so as to protect worker health and may be for short-term or 8-hour duration exposure.

Plume: The spatial distribution of a release of airborne or waterborne material as it disperses in the environment.

Plutonium (Pu): A heavy, radioactive, metallic element with the atomic number 94. Plutonium is produced artificially in a reactor by bombardment of uranium with neutrons and is used primarily in the production of nuclear weapons.

PM_{10}: Particulate matter with a mean aerodynamic diameter of 10 micrometers (μm) or less. PM_{10} is one of six criteria air pollutants specified under Title I of the CAA.

Pollution Prevention Act of 1990: The Act establishing the national policy that pollution should be prevented or reduced at the source or recycled in an environmentally safe manner and that pollution that cannot be prevented or recycled should be, as a last resort, treated and disposed of in an environmentally safe manner.

Polychlorinated biphenyls (PCBs): A class of chemical substances formerly manufactured as an insulating fluid in electrical equipment. PCBs are highly toxic to aquatic life and, in the environment, exhibit many of the characteristics of dichloro diphenyl trichloroethane (DDT). PCBs persist in the environment for a long time and accumulate in animals.

Polycyclic aromatic hydrocarbons (PAHs): A group of organic compounds, some of which are known to be potent human carcinogens.

Population dose: see also *collective dose*.

Programmatic environmental impact statement (PEIS): A type of EIS that deals with broad strategies and decisions, such as those that are regional or national in scope.

Proposed action: The term used in an EIS to refer to the activity planned by a federal agency that generates the need to prepare an EIS.

Public: see also *general public.*

Radiation: The particles (alpha and beta particles) or photons (gamma rays) emitted from the nuclei of radioactive atoms. Some elements are naturally radioactive; others are induced to become radioactive by bombardment in a reactor. Naturally occurring radiation, such as that from uranium, is indistinguishable from induced radiation.

Radiation absorbed dose (rad): The basic unit of absorbed dose equal to the absorption of 0.01 joule per kilogram (J/kg) of absorbing material.

Radioactivity: The spontaneous decay or disintegration of unstable atomic nuclei, accompanied by the emission of radiation.

Radioactive decay: Natural process by which a radioactive atom is physically transformed into another form by the release of energy in the form of subatomic particles such as alpha or beta particles, or electromagnetic radiation such as gamma rays.

Radioactive decay products: The isotopes produced when another isotope undergoes radioactive decay. The decay products are also typically radioactive.

Radionuclide: An atom that exhibits radioactive properties. Standard practice for naming a radionuclide is to use the name or atomic symbol of the element followed by its atomic weight (e.g., cobalt-60 [Co-60], a radionuclide of cobalt with an atomic weight of 60).

Recharge: Replenishment of water to an aquifer.

Record of Decision (ROD): A document prepared in accordance with the requirements of 40 CFR 1505.2 that provides a concise public record of the DOE's decision on a proposed action for which an EIS was prepared. A ROD identifies the alternatives considered in reaching the decision, the environmentally preferable alternative(s), and the factors balanced by the DOE in making the decision. The ROD also identifies whether all practicable means of avoiding or minimizing environmental harm have been adopted and, if not, why they were not.

Region of influence (ROI): The physical area that bounds the environmental, sociological, economic, or cultural feature of interest for the purpose of analysis.

Rem: The dosage of an ionizing radiation that will cause the same biological effect as one roentgen of X-ray or gamma-ray exposure.

Resource Conservation and Recovery Act (RCRA), as amended: An act that provides a "cradle-to-grave" regulatory program for hazardous waste that established, among other things, a system for managing hazardous waste from its generation until its ultimate disposal.

Retardation: The process by which dissolved material moves more slowly through the soil than the velocity of the bulk fluid (i.e., water).

Risk: A quantitative or qualitative expression of possible loss that considers both the probability that a hazard will cause harm and the consequences of that event.

Safe Drinking Water Act, as amended: An act that protects the quality of public water supplies and all sources of drinking water.

Sanitary waste: Waste generated by normal housekeeping activities, liquid or solid (includes sludge), that is not hazardous or radioactive.

Scope: The range of actions, alternatives, and impacts to be considered in a document prepared pursuant to NEPA of 1969.

Scoping: The process of inviting public comment on what should be considered prior to preparation of an EIS.

Severe accident: An accident with a frequency of less than 1 in 1 million (10^{-6}) per year that would have more severe consequences than a design-basis accident in terms of damage to the facility, off-site consequences, or both.

Shielding: Any material that is placed between a source of radiation and people, equipment, or other objects, in order to absorb the radiation and thereby reduce radiation exposure. Common shielding materials include concrete, steel, water, and lead. In general, for shielding gamma radiation sources, the denser a material is, the more effective it is as a shield.

Sinter: To form a homogenous mass by heating without melting.

Socioeconomic analysis: Analysis of those parts of the human environment in a particular location that are related to existing and potential future economic and social conditions.

Socioeconomic impacts: For this EIS, impacts expressed in terms of regional economic impacts (notably changes in local employment, income, and economic output [sales]), impacts to public services and finance in local jurisdictions, and impacts to local housing markets.

Soil and Water Conservation Act of 1977: An Act to establish a program administered by the Secretary of Agriculture to further the conservation of soil, water, and related resources consistent with the roles and responsibilities of other federal agencies and state and local governments.

Solid Waste Disposal Act: An Act that regulates the treatment, storage, or disposal of solid, both nonhazardous and hazardous, waste, as amended by RCRA and the Hazardous and Solid Waste Amendments of 1984.

Source: Any physical entity that may cause radiation exposure, for example, by emitting ionizing radiation or releasing radioactive material. Examples of radiation sources include X-ray machines and radionuclides such as uranium.

Source term: The amount of radioactive or hazardous material released to the environment following an accident.

Stability class: see *Pasquill stability categories.*

Stakeholder: Any person or organization interested in or potentially affected by activities and decisions of the DOE.

Storage: The temporary holding of material in a controlled and monitored facility.

Sulfur dioxide (SO_2): A compound of sulfur produced by burning sulfur-containing compounds. It is considered a major air pollutant and is one of six criteria air pollutants specified under Title I of the CAA.

Sulfur oxides (SO_x): A general term used to describe the oxides of sulfur — pungent, colorless gases formed primarily by the combustion of fossil fuels. Sulfur oxides, which are considered major air pollutants, may damage the respiratory tract as well as vegetation.

Technetium: A radioactive element with the atomic number 43. Its isotope, Tc-99 is generated in nuclear reactors during uranium and plutonium fission.

Terrestrial: Pertaining to plants or animals living on land rather than in the water.

Threatened species: Any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

Throughput: A general term that refers to the amount of material handled or processed by a facility in a year.

Tiering: The process of first addressing general (programmatic) matters in a broad PEIS, followed by more narrowly focused (project-level) environmental documentation that incorporates by reference the more general document.

Topography: Physical shape of the ground surface.

Total effective dose equivalent: The sum of the effective dose equivalent from external exposure and the 50-year committed effective dose equivalent from internal exposure.

Toxic Substances Control Act of 1976 (TSCA): The act authorizing the EPA to secure information on all new and existing chemical substances and to control any of these substances determined to cause an unreasonable risk to public health or the environment. This law requires that the health and environmental effects of all new chemicals be reviewed by the EPA before they are manufactured for commercial purposes.

Transuranic (TRU) waste: Waste contaminated by alpha-emitting transuranic radionuclides (i.e., radionuclides with atomic numbers greater than 92) with half-lives of more than 20 years and concentrations higher than 100 nanocuries per gram (nCi/g) at the time of assay.

Triuranium octaoxide (U_3O_8): An oxide form of uranium that is the most common chemical form found in nature. U_3O8 is very stable and has a low solubility in water.

Uranium: A heavy, silvery white, naturally radioactive, metallic element (atomic number 92). Its two principally occurring isotopes are uranium-235 and uranium-238. Uranium-235 is indispensable to the nuclear industry because it is the only isotope existing in nature to any appreciable extent that is fissionable by thermal neutrons. Uranium-238 is also important because it absorbs neutrons to produce a radioactive isotope that subsequently decays to plutonium-239, an isotope that also is fissionable by thermal neutrons.

Uranium dioxide (UO_2): A black crystalline powder that is widely used in the manufacture of fuel pellets for nuclear reactors. Pressed and sintered, it is stable when exposed to water or air below 300°C (572°F).

Uranium hexafluoride (UF_6): A chemical composed of one atom of uranium combined with six atoms of fluorine. UF_6 is a volatile white crystalline solid at ambient conditions. This form of uranium is used as feed for gaseous diffusion enrichment plants.

Uranium metal: A heavy, silvery white, malleable, ductile, softer-than-steel metallic element. One of the densest materials known, it is 1.6 times more dense than lead and slightly less toxic. Uranium metal is not as stable as U_3O_8 or UF_4 because it is subject to surface oxidation. It tarnishes in air, with the oxide film preventing further oxidation of massive metal at room temperature.

Uranium tetrafluoride (UF_4): A green crystalline solid that melts at about 960°C (1,652°F) and has an insignificant vapor pressure. It is very slightly soluble in water; generally an intermediate in the conversion of UF_6 to either uranium oxide (U_3O_8 or UO_2) or uranium metal. Also known as green salt.

Uranyl fluoride (UO_2F_2): A yellow hygroscopic (i.e., moisture-retaining) solid that is very soluble in water. In accidental releases of UF_6, UO_2F_2 is a solid particulate compound that may deposit on the ground over a large area.

Vacuum: A pressure less than atmospheric. Depleted uranium hexafluoride (DUF_6) is stored in a vacuum in cylinders.

Volatile organic compounds (VOCs): A broad range of organic compounds (such as benzene, chloroform, and methyl alcohol), often halogenated, that vaporize at ambient or relatively low temperatures.

Waste management: The planning, coordination, and direction of those functions related to generation, handling, treatment, storage, transportation, and disposal of waste, as well as associated pollution prevention and surveillance and maintenance activities.

Waste minimization: An action that economically avoids or reduces the generation of waste via source reduction, reducing the toxicity of hazardous waste, improving energy usage, or recycling.

Wastewater: Water that typically contains less than a 1% concentration of organic hazardous waste materials.

Water Quality Act of 1987: An act amending the Federal Water Pollution Control Act to make NPDES requirements applicable to storm water discharges.

Web site: A collection of information — possibly including text, figures, pictures, audio, and video — that can be accessed by computer through the Internet computer network. These sites are intended to communicate and distribute information to anyone having access to the Internet.

Wetlands: Lands or areas exhibiting hydric soils, saturated or inundated soil during some portion of the plant growing season, and plant species tolerant of such conditions (include swamps, marshes, and bogs).

Wild and Scenic Rivers Act: An Act providing for protection of the free-flowing, scenic, and natural values of rivers designated as components or potential components of the National Wild and Scenic Rivers System.

10 INDEX

APPENDIX A:

TEXT OF PUBLIC LAW 107-206 PERTINENT TO THE MANAGEMENT OF DUF_6

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Section 502 of Public Law 107-206, "2002 Supplemental Appropriations Act for Further Recovery from and Response to Terrorist Attacks on the United States" (signed by the President 08/02/2002)

SEC. 502. Section 1 of Public Law 105-204 (112 Stat. 681) is amended —

(1) in subsection (b), by striking "until the date" and all that follows and inserting "until the date that is 30 days after the date on which the Secretary of Energy awards a contract under subsection (c), and no such amounts shall be available for any purpose except to implement the contract."; and

(2) by striking subsection (c) and inserting the following:
"(c) CONTRACTING REQUIREMENTS —

(1) IN GENERAL — Notwithstanding any other provision of law (except section 1341 of title 31, United States Code), the Secretary of Energy shall —

(A) not later than 10 days after the date of enactment of this paragraph, request offerors whose proposals in response to Request for Proposals No. DE-RP05-010R22717 ('Acquisition of Facilities and Services for Depleted Uranium Hexafluoride (DUF6) Conversion Project') were included in the competitive range as of January 15, 2002, to confirm or reinstate the offers in accordance with this paragraph, with a deadline for offerors to deliver reinstatement or confirmation to the Secretary of Energy not later than 20 days after the date of enactment of this paragraph; and

(B) not later than 30 days after the date of enactment of this paragraph, select for award of a contract the best value of proposals confirmed or reinstated under subparagraph (A), and award a contract for the scope of work stated in the Request for Proposals, including the design, construction, and operation of —

(i) a facility described in subsection (a) on the site of the gaseous diffusion plant at Paducah, Kentucky; and

(ii) a facility described in subsection (a) on the site of the gaseous diffusion plant at Portsmouth, Ohio.

(2) CONTRACT TERMS — Notwithstanding any other provision of law (except section 1341 of title 31, United States Code) the Secretary of Energy shall negotiate with the awardee to modify the contract awarded under paragraph (1) to —

(A) require, as a mandatory item, that groundbreaking for construction occur not later than July 31, 2004, and that construction proceed expeditiously thereafter;

(B) include as an item of performance the transportation, conversion, and disposition of depleted uranium contained in cylinders located at the Oak Ridge K-25 uranium enrichment facility located in the East Tennessee Technology Park at Oak Ridge, Tennessee, consistent with environmental agreements between the State of Tennessee and the Secretary of Energy; and

(C) specify that the contractor shall not proceed to perform any part of the contract unless sufficient funds have been appropriated, in advance, specifically to pay for that part of the contract.

(3) CERTIFICATION OF GROUNDBREAKING — Not later than 5 days after the date of groundbreaking for each facility, the Secretary of Energy shall submit to Congress a certification that groundbreaking has occurred.

(d) FUNDING —

(1) IN GENERAL — For purposes of carrying out this section, the Secretary of Energy may use any available appropriations (including transferred unobligated balances).

(2) AUTHORIZATION OF APPROPRIATIONS — There are authorized to be appropriated, in addition to any funds made available under paragraph (1), such sums as are necessary to carry out this section."

APPENDIX B:

ISSUES ASSOCIATED WITH DUF_6 CYLINDER CONTAMINATION

APPENDIX B:

ISSUES ASSOCIATED WITH DUF_6 CYLINDER CONTAMINATION

This appendix discusses issues associated with possible contamination of the depleted uranium hexafluoride (DUF_6) within the cylinders and on the cylinders themselves. Section B.1 addresses possible contamination of the DUF_6 with transuranic (TRU) isotopes and technetium-99 (Tc-99). Section B.2 addresses the existence of polychlorinated biphenyls (PCBs) used in the paint on some portion of the cylinder inventory. References are provided in Section B.3.

B.1 POSSIBLE TRANSURANIC CONTAMINATION

B.1.1 Summary

This section addresses the concerns and impacts associated with potential contamination of DUF_6 cylinders with TRU isotopes (these isotopes have an atomic number greater than that of uranium-92 [U-92]) and Tc-99. The extent of contamination is discussed, and potential radiological, chemical, and waste management impacts are evaluated. The results indicate that a small but unknown number of DUF_6 cylinders in the U.S. Department of Energy's (DOE's) inventory are likely to contain relatively high concentrations of TRU and Tc-99 in a small volume inside the cylinders. The TRU and Tc-99 concentrations in a great majority of the cylinders and in the bulk of the small number of contaminated cylinders are expected to be relatively low. The impacts associated with such low concentrations are also expected to be negligibly low (less than 10%) compared with the impacts that would be associated with DUF_6 in the cylinders. In addition, both the concentrations and impacts associated with TRU and Tc-99 in the conversion facility at either the Paducah, Kentucky, or Portsmouth, Ohio, site and in the conversion products are estimated to be negligibly small. However, under certain circumstances, the doses resulting from the high concentrations of TRU and Tc-99 in a small number of emptied cylinders could be relatively high. In addition, depending on how the emptied cylinders are processed and dispositioned, there may be some transuranic waste (TRUW) issues at either conversion site. However, under the proposed action and by using the cylinder disposition strategy proposed by the conversion contractor, Uranium Disposition Services, LLC (UDS), no TRUW is expected to be generated at either the Paducah or Portsmouth site.

B.1.2 Background

At about the time the final programmatic environmental impact statement (PEIS) for DUF_6 was published in April 1999 (DOE 1999), and while DOE was preparing a request for proposals (RFP) to acquire the services of a private firm to design, construct, and operate two plants at Paducah and Portsmouth to convert DOE's inventory of DUF_6 to a more stable chemical form (DOE 2000a), concern was raised that some portion of DOE's DUF_6 inventory might be contaminated with TRU and Tc. This concern arose because in the period before 1985, some reprocessed uranium from defense production sites was fed into the diffusion cascades in the form of UF_6. The reprocessed uranium was obtained from the fuel that had been irradiated in the production reactors (reactors used by the government to produce nuclear materials for weapons). This irradiation produced a large number of radionuclides that initially had not been present in the fresh fuel. These radionuclides were either TRU or fission products (radionuclides created from the fissioning of uranium atoms). When the used fuel was reprocessed to separate the wanted nuclear materials and the uranium to be used again, a small fraction of the TRU elements and a fission product, Tc-99, ended up in the uranium stream. It was thought that when the reprocessed uranium was converted to UF_6 and fed to the diffusion cascades for reenrichment, part of the contaminants in the uranium might have transferred into the tails cylinders (cylinders containing the DUF_6). The principal isotopes of concern were two TRU isotopes, plutonium-239 (Pu-239) and neptunium-237 (Np-237), and Tc-99.

DOE wanted to determine the extent of contamination in the cylinders so that potential responders to the RFP could properly factor it into their proposals. To resolve this uncertainty, DOE commissioned Oak Ridge National Laboratory (ORNL) to develop a strategy for characterizing TRU and Tc contamination in the tails cylinders (Hightower et al. 2000). The draft strategy developed by ORNL was peer reviewed by a team of scientists and engineers from Lawrence Livermore National Laboratory and Argonne National Laboratory (Brumburgh et al. 2000). The peer review team found that available data and process knowledge was sufficient to establish bounding concentrations of contaminants in the tails cylinders and that additional sampling of the cylinders would not be cost-effective. The ORNL team also concluded that additional characterization of the cylinders would not be likely to result in lower bids by prospective vendors, and that direct sampling of many older cylinders might not be practical. However, during the period December 1999 through August 2000, additional measurements were taken on 14 selected full DUF_6 cylinders and heels cylinders (i.e., empty cylinders containing about 10 to 23 kg (22 to 50 lb) of residual DUF_6, uranium decay products, and, in some cases, TRU and Tc) stored at the Paducah and Portsmouth Gaseous Diffusion Plants. The results of these measurements were included in the final ORNL strategy document (Hightower et al. 2000).

B.1.3 Extent of Transuranic and Technetium Contamination in the DUF_6 Cylinders

Both the ORNL team and the peer review team reviewed the previous characterization studies conducted on the tails cylinders. The ORNL team also interviewed some staff members who worked at the Portsmouth and Paducah Gaseous Diffusion Plant sites when the recycled uranium was being fed to the cascades. On the basis of those reviews and the characterization performed in the period December 1999 to August 2000, it was concluded that the level of contamination in the tails cylinders is very limited. The peer review team stated that the only plausible pathway for the TRU and Tc to get into the DUF_6 cylinders was by way of the heels from prior use of the cylinders to store reactor return feed. It was discovered during the investigations that some cylinders that were used to store reprocessed UF_6 were emptied into the cascades for reenriching the UF_6. The same cylinders were later filled with DUF_6 without first being cleaned. The TRU contamination in the feed cylinders consisted mainly of nonvolatile fluorides. Therefore, they were concentrated in the heels of the feed cylinders. Any TRU isotopes that were carried into the cascades were thought to have plated out and been captured in the cascades; thus, they never made it into the tails cylinders. Similarly, nonvolatile compounds of Tc stayed in the heels, while the volatile components, because of their low molecular weight compared with UF_6, moved up the cascades and either were released in the purge stream or stayed with the enriched product.

The number of reprocessed uranium feed cylinders that were later used to store DUF_6 was not known, but it was estimated to be in the hundreds (Hightower et al. 2000). This number represents only a portion of the total of approximately 60,000 DUF_6 cylinders that are used to store DOE's inventory of DUF_6 at the three storage sites — Portsmouth, Paducah, and East Tennessee Technology Park.

It is believed that when the cylinders with contaminated heels were filled with DUF_6, the liquid DUF_6 entering the cylinder stirred the heels and caused some fraction of the contamination to be mixed with the DUF_6. It is also possible that a small fraction of the TRU that had been captured in the cascades may have revolatized during the cascade improvement projects and was carried into some DUF_6 cylinders. Therefore, TRU and Tc could be found both in the heels and in the bulk of a small, but unknown, number of DUF_6 cylinders in the DOE inventory. To provide guidance to prospective responders to the RFP, the ORNL study listed bounding concentrations of TRU and Tc in the cylinders in the bulk DUF_6 and in the heels. It also gave an estimated maximum quantity that could exist in the entire cylinder inventory. This information was included in the final RFP issued in October 2000 (DOE 2000a) and is reproduced here in Tables B-1 and B-2. The quantities listed were used in this environmental impact statement (EIS) to estimate the impacts associated with TRU and Tc contamination.

TABLE B-1 Bounding Concentrations of Dispersed Transuranic and Tc-99 Contamination in the DUF_6 Full and Heels Cylinders

Contaminant[a]	Concentration in Full Cylinders (ppb)[b]	Concentration in Heels Cylinders (ppb)[b]
Pu-238	0.00012	5
Pu-239	0.043	1,600
Np-237	5.2	54,000
Tc-99	15.9	5,700,000
Am-241	0.0013	0.57

[a] Am = americium, Np = neptunium, Pu = plutonium, and Tc = technetium.

[b] Equivalent to grams of contaminant per billion grams of uranium.

B.1.4 Extent of Transuranic and Technetium Contamination in the Conversion Facility

It is expected that when cylinders with TRU and Tc contamination would be fed into the conversion facility, the TRU and the Tc contamination, which would principally exist in the form of nonvolatile fluorides, would remain in the heels of the emptied cylinders (Brumburgh et al.

2000; Hightower et al. 2000). Although a small fraction of TRU might be carried out of the cylinders with the gaseous UF_6 as particulates, it is expected that it would instead be captured in the filters through which the UF_6 would pass before it entered the conversion equipment. Therefore, the only places at the entire conversion facility where TRU contamination could be of concern would be in some full cylinders before they were emptied, in some heels cylinders after they were emptied, and in the filters at the front end of the facility.

TABLE B-2 Maximum Total Quantities of Transuranics and Technetium in the DUF_6 Inventory

Radionuclide	Maximum Quantity (g)
Pu	24
Np	17,800
Tc	804,000

It is also expected that most of the Tc that existed in the cylinders would remain in the heels or be captured in the filters. However, because of the existence of some volatile technetium fluoride compounds, and for the purposes of analyses in this EIS, it was assumed that all of the Tc would volatilize with UF_6 and be carried into the conversion process equipment. Any Tc compounds transferred into the reaction chambers would be oxidized in the reaction chambers along with the DUF_6. For this EIS, it was also assumed that the Tc in the form of oxides would partition into the triuranium octaoxide (U_3O_8) and hydrogen fluoride (HF) products in the same ratio as the uranium.

Under the proposed action, it is assumed that after the emptied cylinders were removed from the autoclaves, a stabilizing agent would be introduced in the cylinders to neutralize residual fluoride in the heels. The cylinders would then be moved out to the aging yard and stored for at least 4 months to allow short-lived daughter products of uranium to decay. Then the cylinders would be transported to the cylinder disposition facility on site, where they would be compacted and dissected. Finally, the sectioned cylinder parts with heels in them would be transported to the Envirocare of Utah, Inc., facility for disposal. The emptied cylinders would be surveyed by using nondestructive assay (NDA) techniques to determine the presence of a significant quantity of TRU isotopes. If TRU isotopes were detected, samples would be taken and analyzed. Cylinders that exceeded the disposal site limits at the Envirocare of Utah facility would be treated to immobilize the heel (e.g., with grout) within the cylinder, compacted, and sectioned; then the cylinder/heel waste stream would be sent to the Nevada Test Site (NTS) and disposed of as low-level radioactive waste (LLW).

Because of a recent design change, UDS is now planning to fill the emptied cylinders with the depleted U_3O_8 product, transport the filled cylinders to the Envirocare of Utah disposal facility, and dispose of them there. Previously, the depleted U_3O_8 product was to have been poured into 11,340-kg (25,000-lb) capacity bulk bags, transported to the same disposal facility, and disposed of there. The cylinders were to be treated and disposed of as a separate waste stream, as discussed above. This EIS considers both options.

A small quantity of nonvolatile TRU contamination, which might be entrained in the gaseous DUF_6 during the cylinder emptying operations and carried out of the cylinders, would be captured in the filters that would be used between the cylinders and the conversion equipment.

These filters would be monitored and changed out periodically to prevent buildup of TRU, and they would be disposed of as LLW.

Under the proposed action, there would not be any TRUW (radioactive waste that contains transuranic radionuclides with half-lives greater than 20 years and in concentrations greater than 100 nCi/g) generated at the conversion plant at either the Paducah or Portsmouth site. However, to provide a conservative estimate of the impacts associated with the management of TRU- and Tc-contaminated heels materials, this EIS also considers the option of washing the emptied cylinders, removing the heels from the emptied cylinders, and disposing of the solids from the washing solution as waste. Under this option, it is shown that some of the waste thus generated might possibly be classified as TRUW.

B.1.5 Impact Areas

TRU contamination of DUF_6 is of concern with regard to its potential impact on the health and safety of the workers and the public primarily because the radiological toxicity of TRU radionuclides is higher than that of uranium isotopes. If the TRU was concentrated in waste materials generated during the conversion process, potential generation of TRUW would also be of concern.

As discussed above, TRU and Tc could occur in some full and heels cylinders. They could also be collected in the filters used in the front end of the conversion plant process. TRU and Tc would be health and safety concerns primarily if they were released to the environment in forms that could be taken internally by workers and the general public through inhalation, ingestion, or dermal absorption. The primary pathway of exposure is inhalation of particulates in air. The chemical toxicity of both the TRU and Tc is not much different than that of uranium, but because the concentrations of TRU and Tc are much less than that of uranium, their chemical impacts compared with those of uranium would be negligibly small.

During normal operations, the DUF_6 and any contaminants in it would be contained in the cylinders or the process equipment to prevent any measurable internal contamination of the workers or the public. However, if an accident caused the DUF_6 to be released to the atmosphere, the potential would arise for internal exposures. As discussed above, the TRU contaminants would be present in some of the cylinders and in the filters, but they would not enter the conversion process areas. Tc-99 could also be present in the same locations and could transfer into the process areas and conversion products. The highest concentration of the contaminants would be in the heels of some of the emptied cylinders. Therefore, potential impacts of any TRU and Tc contamination would be the greatest in cases involving accidents during storage, transportation, or handling of the cylinders, and during the management of wastes associated with the cleaning and disposition of empty cylinders.

Relative contributions of TRU and Tc to radiological doses under accident conditions are discussed below and in the main text of this EIS. Also discussed is the potential quantity of TRUW that could be generated at a conversion plant if the empty cylinders were to be washed and the heels separated.

In 1999 and 2000, a team of experts from DOE conducted a study on the historical generation and flow of recycled uranium (through reprocessing and reusing) in the DOE complex. The team report provided evaluation guidelines for the health and safety impacts associated with the contaminants found in the recycled uranium (DOE 2000b). In particular, Appendix A of the report provided the technical basis for identifying the relative radiological health hazards of the constituents. For each constituent and for a range of uranium enrichments, the appendix listed the concentrations of TRU radionulides in the reprocessed uranium that would result in a 10% increase in the dose received by an individual over and above the dose the individual would receive from the uranium alone. The concentrations that corresponded to the depleted uranium (0.2% U-235) are reproduced in Table B-3 for three different clearance classes, D, W, and Y. The clearance class indicates the speed by which the radionuclides taken internally by an individual would leave the body through biological mechanisms. Depending on the chemical from of the radionuclide, it could be on the order of days (D class), weeks (W class), or years (Y class). Among the chemical forms of uranium that are of concern in this EIS, UF_6 and uranyl fluoride (UO_2F_2) are considered to be D class, whereas the oxides and uranium tetrafluoride (UF_4) are considered to be W class.

A comparison of the concentrations given in Tables B-1 and B-3 shows that the concentrations of all the constituents in full cylinders (Column 2 in Table B-1) are less than the concentrations given in Table B-3. This indicates that each constituent would contribute less than 10% to dose. By applying the sum of fractions rule, it can be shown that the contribution to dose

TABLE B-3 Concentrations of Transuranic Constituents and Tc-99 in Depleted Uranium That Would Result in 10% Contribution to Dose

	ppb U[a]			pCi/g[b]		
	Clearance Class			Clearance Class		
Contaminant	D	W	Y	D	W	Y
Pu-238	0.0115	0.0227	0.804	201	395	14,000
Pu-239	2.17	4.34	193	133	266	11,900
Np-237	189	379	5,630	133	266	3,950
Am-241	0.0387	0.0775	1.15	133	266	3,950
Tc-99	NL[c]	NL	NL	NL	NL	NL

[a] ppb U = parts per billion of uranium.

[b] pCi/g = picocuries of constituent per gram of total uranium.

[c] NL = no limit.

Source: DOE (2000b).

by all the constituents combined would also be less than 10% even under the most restrictive clearance class (D class). According to this rule, if the sum of the concentration of each constituent from Table B-1 divided by the concentration of the same constituent from Table B-3 is less than 1, then the sum of contributions to dose from all the constituents would be expected to be less than 10%. Under the D class, this sum would be 0.00012/0.0115 (Pu-238) + 0.043/2.17 (Pu-239) + 5.2/189 (Np-237) + 0.0013/0.0387 (Am-241) + 0 (Tc-99) = 0.091. For the W and Y classes, the same sum of ratios would be 0.046 and 0.0024, respectively.

Thus, on the basis of the above analysis, it can be concluded that as long as the TRU and Tc-99 existed in uranium streams at concentrations equal to or less than those shown in Column 2 of Table B-1, their contribution to dose would be less than 10% of the dose due to uranium alone. In fact, because the sum of ratios is considerably below 1.0, the contribution would be much less than 10%. Given the uncertainties associated with the estimation of doses, this type of contribution to dose would be considered negligible. The analyses performed for this EIS (see Section B.1.6.1 below) also demonstrate the fact that when the TRU and Tc-99 concentrations are at or below the levels shown in Table B-1, Column 2, for full cylinders, their contribution to dose is negligibly small. However, as discussed below, doses that can be attributed to TRU and Tc-99 found in the heels of some of the cylinders under accident conditions can be relatively high compared to uranium doses.

B.1.6 Conservative Estimates of Impacts

B.1.6.1 Cylinder Accidents

The TRU and Tc contaminants in the cylinders could become available for human uptake as a result of accidents involving the release of some portion of the contents of a cylinder. Such accidents could occur during storage, handling, or transportation of cylinders. A spectrum of cylinder accidents was analyzed for the DUF_6 PEIS (Policastro et al. 1997). The resulting impacts were estimated on the basis of projected release quantities of DUF_6. For purposes of this analysis, it is assumed that in accidents involving full cylinders, TRU and Tc would exist at their maximum concentrations, as listed in Table B-1. It is also assumed that these contaminants would be released and transported through environmental media at the same relative concentration as that present in the cylinder (i.e., it is assumed that the mass concentration of TRU divided by the mass concentration of total uranium isotopes would remain constant). When DUF_6 is released to the environment, it interacts with moisture in the air and converts to depleted UO_2F_2, which is solid at atmospheric conditions. Therefore, the assumption that depleted UO_2F_2 particles and particulate forms of TRU and Tc travel in tandem is considered to be reasonable.

The possibility of an accident involving heels cylinders with the highest TRU concentrations as shown in Table B-1 is also considered. Table B-4 shows the pertinent radiological data for the radionuclides under consideration. Table B-5 shows the relative doses (relative to uranium, assuming that the uranium is 0.25% U-235, with the remaining being U-238) for the TRU isotopes and Tc-99. The data show that when TRU isotopes are present at

TABLE B-4 Radiological Parameters for Uranium, Transuranic, and Technetium Isotopes

	Dose Conversion Factor			Nuclide Constants	
Radionuclide	Inhalation (mrem/pCi)	Ingestion (mrem/pCi)	External Surface ([mrem/yr]/[pCi/cm^2])	Half-Life (yr)	Atomic Mass
U-238	0.118	2.69×10^{-4}	3.25×10^{-2}	4.47×10^{9}	238
U-235	0.123	2.67×10^{-4}	0.194	7.04×10^{8}	235
Pu-238	0.392	3.2×10^{-3}	9.79×10^{-4}	87.74	238
Pu-239	0.429	3.54×10^{-3}	4.29×10^{-4}	2.41×10^{4}	239
Np-237	0.54	4.44×10^{-3}	0.261	2.14×10^{6}	237
Tc-99	8.33×10^{-6}	1.46×10^{-6}	9.11×10^{-5}	2.13×10^{5}	99
Am-241	0.444	3.64×10^{-3}	3.21×10^{-2}	432.2	241

TABLE B-5 Relative Contributions of Transuranic and Technetium Isotopes to Dose

	Bounding Concentration in ppb (U)[a]		TRU Contribution[b]	
Radionuclide	Tails	Heels	Inhalation Dose (conservative heels concentration)	Inhalation Dose (realistic tails concentration)
Pu-238	1.2×10^{-4}	5	0.835	2.00×10^{-5}
Pu-239	4.3×10^{-2}	1.6×10^{3}	1.06	2.85×10^{-5}
Np-237	5.2	5.4×10^{4}	0.511	4.92×10^{-5}
Tc-99	15.9	5.7×10^{6}	2.00×10^{-2}	5.59×10^{-8}
Am-241	1.3×10^{-3}	0.57	2.16×10^{-2}	4.93×10^{-5}
Total			2.45	1.47×10^{-4}

[a] Equivalent to grams of contaminant per billion grams of uranium.

[b] Relative to uranium; e.g., the dose from Pu-238 would be 0.835 times the dose from uranium for a conservative heels concentration.

the maximum bulk concentrations, the TRU and Tc add only about 0.015% to the dose calculated on the basis of DUF_6 alone. However, when they are present in maximum heels concentrations, the dose can be increased by about a factor of 4 (2.45 + 1 for uranium) over what it would be for DUF_6 alone.

In the accident analyses performed for the DUF_6 PEIS, accidents involving both full cylinders and heels were considered. However, it was found that the releases and, consequently, the impacts from the accidents involving full cylinders were considerably higher than those involving only the heels cylinders. In fact, in the source document for the PEIS, the Engineering Analysis Report (Dubrin et al. 1997, Section 7, p. 7-5), an accident involving two heels cylinders was described. The estimated amount of DUF_6 leaving each cylinder was 7 kg (15 lb), for a total release of about 14 kg (31 lb) of DUF_6. A similar accident was also postulated for full cylinders. In that case, it was estimated that about 1,500 kg (3,306 lb) of DUF_6 would be released from the cylinders. As expected, the estimated impacts from the accident involving the full cylinders were considerably greater than the estimated impacts from the heels cylinder accident; therefore, only the impacts for the full cylinder accident were discussed in the PEIS.

Dose contributions from potential TRU and Tc contaminants were not considered in the PEIS. If such contributions were added, the dose from a heels cylinder accident would increase by a factor of about 4, which would be equivalent to about 60 kg (132 lb) of DUF_6 being released (the dose is directly proportional to the quantity of DUF_6 released from the cylinders), whereas the dose from the full cylinder accident would remain the same, with about 1,500 kg (3,307 lb) of DUF_6 being released. Because the doses from the full cylinder accident were much greater and because the frequencies of the two accidents were considered to be about the same (they were both considered to belong to the extremely unlikely category, with a frequency range of 10^{-4} to 10^{-6} per year), the full cylinder accident was discussed in the PEIS, but the heels cylinder accident was not. As the analyses above show, even after including the contributions from TRU and Tc, the full cylinder accident would still produce a much greater dose than the heels cylinder accident and, therefore, would still be bounding for the group of accidents belonging to the extremely unlikely frequency category.

The relative contributions of Tc-99 to dose from exposure to bulk DUF_6 in the cylinders and to heels material with maximum contaminant concentrations (Table B-1) are 0.000006% and 0.2%, respectively (Table B-5). Similar to TRU contaminants, most of Tc-99 would be expected to remain in the heels or be captured in the filters when the cylinders were emptied. However, if it did transfer into the conversion equipment, there it would be expected to (a) convert to technetium oxide during the conversion of DUF_6 to U_3O_8 and (b) partition into the uranium and HF products at about the same ratio as the uranium. As a result, the relative concentration of Tc-99 in both products (relative to uranium) would be about the same as in the bulk DUF_6; namely, 15.9 ppb. Its relative contribution to dose (relative to uranium) would be about 0.000006%. Given such a low contribution and the low doses that would result from exposure to U_3O_8 (see Section 5.2.3) and HF product (see Section 5.2.6), the radiological impacts of Tc-99 in the conversion products can be considered to be negligible.

B.1.6.2 Waste Management

As mentioned previously, no TRUW would be generated at either conversion facility in Paducah or Portsmouth under the proposed action. The empty cylinders would be refilled with the depleted U_3O_8 product and disposed of. The impacts associated with management of LLW, including transportation to a disposal facility, are discussed in Sections 5.2.3 and 5.2.5 of this EIS. The option of disposing of the emptied cylinders as a separate LLW stream is also discussed. This section provides a conservative estimate of waste management impacts associated with the heels material in emptied cylinders, under the assumption that they are cleansed by washing the cylinders with water and treating the wash solution to generate solid U_3O_8 and a small quantity of solid CaF_2. Such an option was discussed in the Engineering Analysis Report (Dubrin et al. 1997, Section 6.3) and in the PEIS. Under the approach considered, no liquid radioactive waste would be generated.

Table B-6 shows that if the heels in the emptied cylinders contained TRU and Tc at the maximum concentrations shown in Table B-1, and if the heels material was separated and declared waste, it would be classified as TRUW because the concentration of TRU radionuclides would exceed 100 nCi/g. If the heels were left in the form of DUF_6, the calculated TRU activity concentration would be about 150 nCi/g. If the heels were converted to U_3O_8 and dried and the TRU were also converted to oxides, the TRU activity concentration would be about 190 nCi/g (Table B-7).

Table B-2 indicates that there is a maximum of 24 g (0.85 oz.) of Pu and 17.8 kg (3.97 lb) of Np in the DUF_6 inventory. If this amount of TRU was distributed uniformly in the heels of as many cylinders as possible and if the concentration of TRU in the converted U_3O_8 heels material was 100 nCi/g, there would be approximately 240 drums of converted U_3O_8 (each drum containing 627 kg [1,382 lb] of U_3O_8) that could be classified as TRUW (see Table B-8). The total number of drums of converted U_3O_8 heels material would be about 820 (61,422 cylinders × 8 kg [18 lb] heels U_3O_8 per cylinder/627 kg [1,382 lb] per drum × 1.023, where the factor 1.023 accounts for the presence of granulating binder, water, etc., in the final product). That would mean that about 30% of the heels-generated U_3O_8 would be classified as TRUW; the remainder (about 580 drums) would be classified as LLW. In actuality, the amount of waste that would fall under the definition of TRUW would be considerably less than 30%. The assumptions made in deriving the above TRUW quantities are highly conservative. These assumptions include the following:

1. The quantity of heels material in an emptied cylinder was assumed to be 10 kg (22 lb). This amount is actually likely to be greater than 10 kg (22 lb). In fact, it could be greater than 20 kg (44 lb) per cylinder, in which case none of the heels material would be classified as TRUW.

2. It is very unlikely that TRU would be distributed uniformly at a concentration just high enough to make the waste TRUW. Some might be present at concentrations greater than 100 nCi/g, with the result that the volume and the number of drums of TRUW would be less.

Filters used to process the DUF_6 leaving the cylinders would be monitored and replaced before the concentration of TRU reached the stage where the filters would have to be managed as TRUW. Therefore, no TRUW is assumed to be generated from the filters. However, an estimate was made of the amount of LLW that could be generated. The following assumptions were used in the estimation:

1. The filters are metallic, cylindrical in shape (6-in. [5-cm] diameter and 15-in. [38-cm] height), and weigh about 38 kg (84 lb);

TABLE B-6 Estimated Maximum Transuranic Radioactivity Concentration in Heels

Contaminant	Concentration (ppb) (U)[a]	Quantity of DUF_6 in Heel (kg)	Quantity of U in Heel (kg)	Quantity of Contaminant in Heel (g)	Specific Activity (Ci/g)	Radioactivity in Heel	
						in Ci	in nCi
Pu-238	5	10	6.8	3.38×10^{-5}	1.71×10^{1}	5.79×10^{-4}	5.79×10^{5}
Pu-239	1,600	10	6.8	1.08×10^{-2}	6.22×10^{-2}	6.72×10^{-4}	6.72×10^{5}
Np-237	54,000	10	6.8	3.65×10^{-1}	7.05×10^{-4}	2.57×10^{-4}	2.57×10^{5}
Am-241	0.57	10	6.8	3.85×10^{-6}	3.43	1.32×10^{-5}	1.32×10^{4}
Total				3.76×10^{-1}		1.52×10^{-3}	1.52×10^{6}

[a] Equivalent to grams of contaminant per billion grams of uranium.

TABLE B-7 Estimated Maximum Transuranic Activity Concentration in Converted Heels Material

Final Form	Quantity in Heel (g)	Total TRU Activity Concentration (nCi/g)
$^{238}PuO_2$	3.8×10^{-5}	72.6
$^{239}PuO_2$	1.2×10^{-2}	84.3
$^{237}NpO_2$	4.1×10^{-1}	32.3
$^{241}AmO_2$	4.4×10^{-6}	1.66
U_3O_8	8.0×10^{3}	0
Total	8.0×10^{3}	191

TABLE B-8 Estimated Maximum Number of Drums Containing Potential Transuranic Waste

Contaminant	Maximum Quantity (g)	Isotope-Averaged Specific Activity (Ci/g)	Maximum Activity (Ci)	Total Quantity in One Drum (g)	TRUW Concentration Limit (nCi/g)	Radioactivity in One Drum (nCi)	No. of Drums
Pu	24	1.15×10^{-1}	2.77	627,273	100	62,727,273	44
Np	17,800	7.05×10^{-4}	12.5	627,273	100	62,727,273	200
Total			15.3	627,273	100	62,727,273	244

2. About 10% of the TRU in the cylinders is entrained during emptying of the cylinders by sublimation and captured in the filters;

3. Filters are replaced when the activity concentration reaches 50 nCi/g; and

4. Filters are macroencapsulated and placed in 55-gal drums for disposal.

On the basis of the above assumptions, it is estimated that on average, 1 drum of LLW would be generated per year of operation, and overall there would be about 26 drums generated over the lifetime of the conversion campaign at both plants combined (Folga 2002).

B.1.6.3 Transportation

Transportation impacts estimated for the PEIS and this EIS include the impacts of transporting all wastes and all products of the conversion process as LLW, low-level mixed waste (LLMW), or nonradioactive/nonhazardous waste (see Section 5.2.5). Under the proposed action, no TRUW would be generated at either the Paducah or Portsmouth site. However, as discussed in Section B.1.6.2, there could be up to 244 drums of TRUW generated over the lifetime of the conversion campaign at both conversion facilities combined, if the heels cylinders were to be washed and the heels materials disposed of as waste. Under these conditions, the TRUW would need to be shipped from the conversion facilities to a disposal site authorized to receive such waste. The total number of truck shipments required would be 6 (assuming 14 drums per TRUPACT-II container and 3 containers per truck) from both conversion plants combined. This number is much less than the approximately 6,000 to 36,000 truck shipments of LLW from the two facilities.

On a single-shipment basis, the impacts associated with incident-free transportation of a TRUW shipment and with a LLW shipment of U_3O_8 drums would be comparable, because the external exposure rate in the vicinity of the truck would be about the same. However, the accident risks would be larger for the TRU shipments if the same amount of material spilled to the environment. The factor of increase in doses would be similar to what was estimated for heels cylinder accidents, namely a factor of 4. However, the TRUW would be shipped in drums placed in TRUPACT-II containers. TRUPACT-II containers are much stronger than the drums themselves. As a result, the probability of material being released to the environment from TRUW shipments as a result of an accident is much smaller than the probability associated with LLW shipments. (LLW drums are generally shipped "as is," without additional protection.) The overall relative risk of shipping the U_3O_8 generated during cylinder washing in the cylinder treatment facility (if one is constructed) to a disposal facility would be about the same, irrespective of whether it was classified as TRUW or LLW.

B.2 ISSUES ASSOCIATED WITH POLYCHLORINATED BIPHENYLS IN CYLINDER PAINT

B.2.1 Background

B.2.1.1 PCBs in Cylinder Paint

The three-site cylinder inventory contains cylinders of diverse ages, with cylinders having been generated from the early 1950s to the present time. The paints applied to the cylinders had various compositions and included some PCBs. Up until 1977, when the manufacture and use of PCBs in the United States was generally discontinued, certain paints contained up to 10% by weight PCBs. The PCBs were added to the paints to act as a fungicide and to increase durability and flexibility.

Records of the PCB concentrations in the paints used were not kept, so it is currently unknown how many cylinders are coated with paint containing PCBs. However, paint chips from a representative sample of cylinders at the ETTP site have been analyzed for PCBs. The results indicate that up to 50% of the cylinders at ETTP may have coatings on them containing PCBs. Because the Portsmouth and Paducah inventories contain a large number of cylinders produced before 1978, it is reasonable to assume that a significant number of cylinders at those sites also contain PCBs.

The PCBs in dried paint generally have a low environmental mobility, but as the paint ages and chips off the cylinders, there is a potential for transport and subsequent exposure to the PCBs. There is also a potential for the volatilization of the PCBs if the cylinders are heated enough during processing.

B.2.1.2 PCB Use, Contamination, and Distribution at ETTP, Portsmouth, and Paducah

PCB use was very prevalent and widespread in the United States prior to 1978. As a result, PCBs are often detected in locations with no known source of contamination. Because of their tendency to bioaccumulate, PCBs are also widespread in fish and other biota.

For each of the three storage sites, the PCBs in cylinder paints constitute an extremely small proportion of the PCBs that were previously and are currently at the sites. For example, although the Paducah site has been working for several years to dispose of PCB-containing equipment, the site still had about 870 liquid PCB-containing items (mostly capacitors) in service at the end of 2001 (DOE 2002a). The Portsmouth and ETTP sites also still have a large number of liquid PCB-containing items in service.

The three current DUF_6 cylinder storage sites are suspected to have had spills of PCB liquids during past operations, prior to the identification of the health and environmental hazards of PCBs. Each of the three sites has an existing program for managing PCB-contaminated waste under the Toxic Substances Control Act (TSCA). In addition, the environmental monitoring program at each site includes monitoring of PCB concentrations in soil, sediment, groundwater, surface water, and biota on and in the vicinity of the sites (results are presented in Sections 3.1 and 3.2). Soil, water, sediment, and biota samples obtained from on and near each of the sites since the early 1990s have periodically contained detectable levels of PCBs. Background samples have also had detectable levels of PCBs.

B.2.1.3 Regulation of PCBs

Processing, use, storage, transportation, and disposal of cylinders with applied dried paint that contains PCBs are subject to the federal TSCA regulations applicable to PCBs and PCB items. These federal regulations are located in Title 40, Part 761 of the *Code of Federal Regulations* (40 CFR Part 761), "Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions," and are implemented by the U.S. Environmental Protection Agency (EPA). 40 CFR Part 761 requires that after PCB items have been designated for disposal, they be packaged and marked in compliance with applicable U.S. Department of Transportation (DOT) hazardous materials regulations (HMRs), which are located in 49 CFR Parts 171 through 180. If DOT HMRs do not apply to a PCB waste, then 40 CFR Part 761 identifies applicable packaging and marking requirements.

B.2.2 Potential Impacts from PCBs in Cylinder Paint

The remainder of this appendix discusses the potential impacts associated with PCBs in cylinder paint during storage, transport, processing, and disposal of the cylinders. The presence of PCBs in the coatings of some cylinders is not expected to result in health and safety risks to workers or the public, as detailed in the sections that follow.

B.2.2.1 Storage

During cylinder storage, the risk to cylinder handlers from dermal contact with the PCBs on cylinders is negligible. The PCBs are bound in a matrix from which dermal absorption is insignificant (Fowler 1999). Because the PCBs are bound in the paint, the potential for them to volatilize under ambient conditions and be inhaled by the workers or the general public would be negligible. In addition, in the case of a cylinder accident involving a fire, the impacts associated with PCBs released from the paint on the cylinders would be negligibly small when compared with the impacts associated with the DUF_6 released from the cylinders.

Cylinder paint chips deposited on the cylinder yard soils can be carried to surface water via runoff. All three sites monitor their surface water discharges for PCBs and also conduct some downstream surface water and sediment monitoring. In general, PCBs have been below detection limits. However, PCBs have occasionally been detected (see Affected Environment in Sections 3.1 and 3.2 of the EIS).

At the Paducah site, effluent at Kentucky Pollutant Discharge Elimination System (KPDES) outfall 017 (which receives runoff from the cylinder yards) contained a maximum of 0.415 μg/L PCBs in 2001 samples; this was not a KPDES permit violation (DOE 2002a). PCBs were not detected in 2002 samples (DOE 2003b). At the Portsmouth site in 2001, seven samples from five different sampling locations that receive runoff from the cylinder yards were obtained throughout the year (DOE 2002b); no PCBs were detected in these samples. PCBs are also monitored in outfalls, sediment, and surface water at and near the ETTP site. Several outfalls at the site (S14, S20, and 113) have contained PCBs at levels of up to 6 μg/L (DOE 2000c, 2001, 2003a). The PCBs in samples from ETTP outfalls are likely attributable to past releases of liquid PCB oils at the plant. The primary source of PCBs in environmental samples is past releases of liquid PCBs. Movement of nonliquid PCBs from the cylinder yards via paint chips in runoff is likely a very minor contributor to environmental releases of PCBs from the sites.

B.2.2.2 Transportation

Transport of cylinders from the ETTP site to either Portsmouth or Paducah would occur under the action alternatives addressed in this EIS. Under the proposed action, to the extent practicable, emptied cylinders at the conversion facilities would be refilled with uranium oxide product, welded shut, and shipped to the designated disposal facility. As a precautionary measure, cylinders with loose paint chips may be bagged for transport to avoid loss of potentially PCB-containing material.

B.2.2.3 Cylinder Processing

Potential impacts during cylinder processing might occur if PCBs volatilized during autoclaving to remove the DUF_6 from the cylinders or if PCBs were released and/or transformed during the cutting and welding process.

During autoclaving, desorption of pure-phase PCBs from the paint matrix would be unlikely, given that the PCBs are bound into the paint structure. PCBs by their very nature are not highly volatile, and losses from PCBs bound in the paint matrix would also be unlikely. However, initial experiments conducted at the University of British Columbia have indicated that some lower chlorinated PCBs may volatize from PCB-containing paints at 70°C (Gill et al. 1997). Because the DUF_6 autoclaves would operate at approximately 95°C, testing should be conducted either prior to or during the conversion facility startup operations to determine if the air vented from the autoclaves should be monitored or if any alternative measures would need to be taken to ensure that worker exposures to PCBs above allowable Occupational Safety and Health Administration (OSHA) limits do not occur.

Before the emptied cylinders were refilled with depleted uranium oxide product, a solvent would be applied to a small area on each cylinder to remove the paint before cut/weld operations occurred (McCoy 2004). Any paint removed from the surface would be managed as Resource Conservation and Recovery Act (RCRA) hazardous waste, TSCA hazardous waste, or LLMW, as appropriate. Removing the paint before welding would reduce or eliminate the potential for the volatilization of PCBs or for the generation of other toxic chemicals during welding operations. The quantity of waste generated by this operation would be negligibly small when compared with the quantities generated by other operations at either the Paducah or Portsmouth sites.

B.2.2.4 Disposal

The proposed action alternatives of this EIS assume that the cylinders (either filled with depleted uranium oxide or empty) would be disposed of at Envirocare of Utah, located in Utah, or at NTS, located in Nevada. The waste acceptance criteria for both facilities indicate that they have units permitted to receive LLW containing PCBs.

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APPENDIX C:

SCOPING SUMMARY REPORT FOR DEPLETED URANIUM HEXAFLUORIDE CONVERSION FACILITIES

ENVIRONMENTAL IMPACT STATEMENT SCOPING PROCESS

APPENDIX C

This appendix contains the summary report prepared after the initial public scoping period for the depleted uranium hexafluoride conversion facilities environmental impact statement (EIS) project. The scoping period for the EIS began with the September 18, 2001, publication of a Notice of Intent (NOI) in the *Federal Register* (66 FR 23213) and was extended to January 11, 2002. The report summarizes the different types of public involvement opportunities provided and the content of the comments received.

While the EIS preparation was underway, the U.S. Congress passed and the President signed Public Law No. 107-206, which directed the U.S. Department of Energy (DOE) to award a contract for conversion facilities to be built at the Paducah and Portsmouth sites. Accordingly, DOE awarded a contract to Uranium Disposition Services, LLC (UDS), on August 29, 2002. In light of Public Law 107-206, DOE reevaluated its approach for conducting the National Environmental Policy Act (NEPA) process and decided to prepare two separate site-specific EISs in parallel: one EIS for the plant proposed for the Paducah site and a second EIS for the Portsmouth site. This change was announced in a *Federal Register* Notice of Change in NEPA Compliance Approach published on April 28, 2003 (the Notice is included as Attachment B) One set of comments in response to the Change in NEPA Compliance Approach was received from the Oak Ridge Reservation Local Oversight Committee. These comments were similar to those received during public scoping and were considered in the preparation of this EIS.

SCOPING SUMMARY REPORT FOR DEPLETED URANIUM HEXAFLUORIDE CONVERSION FACILITIES

ENVIRONMENTAL IMPACT STATEMENT SCOPING PROCESS

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June 17, 2002

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SCOPING SUMMARY REPORT

Depleted Uranium Hexafluoride Conversion Facilities Project

1 INTRODUCTION

On September 18, 2001, the U.S. Department of Energy (DOE) published a notice of intent (NOI) in the *Federal Register* (66 FR 23213) announcing its intention to prepare an environmental impact statement (EIS) for a proposal to construct, operate, maintain, and decontaminate and decommission two depleted uranium hexafluoride (DUF_6) conversion facilities, one at Portsmouth, Ohio, and one at Paducah, Kentucky. DOE would use the proposed facilities to convert its inventory of DUF_6 to a more stable chemical form suitable for storage, beneficial use, or disposal. Approximately 730,000 metric tons of DUF_6 in about 60,000 cylinders are stored at Portsmouth and Paducah, and at an Oak Ridge, Tennessee, site.[1] The EIS would address potential environmental impacts of the construction, operation, maintenance, and decontamination and decommissioning (D&D) of the conversion facilities. A copy of the NOI is included in Attachment A.

The purpose of the NOI was to encourage early public involvement in the EIS process and to solicit public comments on the proposed scope of the EIS, including the issues and alternatives it would analyze. To facilitate public comments, the NOI included a detailed discussion of the project's background, listings of the preliminary alternatives and environmental impacts DOE proposed to evaluate in the EIS, and a project schedule. The NOI announced that the scoping period for the EIS would be open until November 26, 2001. The scoping period was later extended to January 11, 2002, for reasons discussed in Section 1.3.

This report presents a summary of the scoping process for the DUF_6 conversion facilities project. The first section of the report includes a short summary of the preliminary alternatives and environmental issues described in the NOI and a discussion of how the scoping process was conducted. The second section summarizes the comments submitted to DOE for its consideration in preparing the EIS; the comments are categorized and summarized to capture their substance.

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1 At the time the NOI was issued and the scoping meetings were held, DOE's inventory of DUF_6 consisted of approximately 700,000 metric tons of the material in about 57,700 cylinders. The inventory increased with the signing of an agreement between DOE and the United States Enrichment Corporation (USEC) on June 17, 2002, which could result in the transfer of up to 23,300 metric tons of DUF_6 from USEC to DOE.

1.1 PRELIMINARY ALTERNATIVES IDENTIFIED IN THE NOI

The preliminary alternatives were identified in the NOI; they are described here to provide the background information necessary to understand the substance of comments summarized in Section 2.

Preferred Alternative

Under the preferred alternative, two conversion facilities would be built: one at the Paducah Gaseous Diffusion Plant (GDP) site in Kentucky and another at the Portsmouth GDP site in Ohio. The cylinders currently stored at the East Tennessee Technology Park (ETTP) site near Oak Ridge, Tennessee, would be transported to Portsmouth for conversion. The conversion products (i.e., depleted uranium as well as fluorine components produced during the conversion process) would be stored, put to beneficial uses, or disposed of at an appropriate disposal facility. This alternative is consistent with the Conversion Plan, which DOE submitted to Congress in July 1999 in response to Public Law 105–204. Several subalternatives would be considered for the preferred alternative:

- Conversion technology processes identified in response to the final Request for Proposals (RFP) for conversion services, plus any other technologies that DOE believes must be considered;
- Local siting alternatives for building and operating conversion facilities within the Paducah and Portsmouth plant boundaries; and
- Timing options, such as staggering the start of the construction and operation of the two conversion facilities.

One Conversion Plant Alternative

An alternative of building and operating only one conversion facility at either the Portsmouth or the Paducah site was proposed in the NOI. This plant could differ in size or production capacity from the two proposed for Portsmouth and Paducah. Technology and local siting subalternatives would be considered as with the preferred alternative.

Use of Existing UF_6 Conversion Capacity Alternative

DOE proposed the possibility of using existing UF_6 conversion capacity at commercial nuclear fuel fabrication facilities in lieu of constructing one or two new conversion plants. DOE is evaluating the feasibility of using existing conversion capacity, although no expression of interest has been received from such facilities.

No Action Alternative

As required by the National Environmental Policy Act (NEPA), the EIS would include a "no action" alternative. Under the no action alternative, cylinder management activities (e.g., handling, inspection, monitoring, and maintenance) would continue the "status quo" at the three current storage sites indefinitely, consistent with the DUF_6 Cylinder Project Management Plan and the consent orders, which include actions needed to meet safety and environmental requirements.

Where applicable under the alternatives listed above, transportation options, such as truck, rail, and barge, would be considered for shipping DUF_6 cylinders to a conversion facility and conversion products to a storage or disposal facility. For each technology alternative, alternatives for conversion products, including storage, use, and disposal at one or more disposal sites, would also be considered.

1.2 PRELIMINARY ENVIRONMENTAL AND OTHER ISSUES IDENTIFIED IN THE NOI

In the NOI, DOE announced its intent to address the following preliminary environmental issues when assessing the potential environmental impacts of the alternatives in the EIS:

- Potential impacts on health from DUF_6 conversion activities, including those to workers and the public from exposure to radiation and chemicals during routine and accident conditions for the construction, operation, maintenance, and D&D of DUF_6 conversion facilities;

- Potential impacts to workers and the public from exposure to radiation and chemicals during routine and accident conditions for the transport of DUF_6 cylinders from ETTP to one of the conversion sites;

- Potential impacts to workers and the public from exposure to radiation and chemicals during routine and accident conditions for the transport of conversion products that are not beneficially used to a low-level waste disposal facility;

- Potential impacts to surface water, groundwater, and soil during construction activities and from emissions and water use during facility operations;

- Potential impacts on air quality from emissions and noise during facility construction and operations;

- Potential cumulative impacts of the past, present, and reasonably foreseeable future actions, including impacts from activities of the United States Enrichment Corporation (USEC);

- Potential impacts from facility construction on historically significant properties, if present, and on access to traditional use areas;

- Potential impacts from land requirements, potential incompatibilities, and disturbances;

- Potential impacts on local, regional, or national resources from materials and utilities required for construction and operation;

- Potential impacts on ecological resources, including threatened and endangered species, floodplains, and wetlands;

- Potential impacts on local and DOE-wide waste management capabilities;

- Potential impacts on local employment, income, population, housing, and public services from facility construction and operations, and environmental justice issues; and

- Pollution prevention, waste minimization, and energy and water use reduction technologies to decrease the use of energy, water, and hazardous substances and to mitigate environmental impacts.

1.3 SCOPING PROCESS

During the scoping process, the public was provided with six options for submitting comments to DOE on the DUF_6 conversion project proposal:

- Public scoping meetings held in Piketon, Ohio; Paducah, Kentucky; and Oak Ridge, Tennessee;

- Traditional mail delivery;

- Toll-free facsimile transmission;

- Toll-free voice message;

- Electronic mail; and

- Directly through the Depleted UF_6 Management Information Network web site on the Internet (http://web.ead.anl.gov/uranium).

The reason for providing such a variety of ways to communicate issues and submit comments was to encourage maximum participation. All comments, regardless of how they were submitted, received equal consideration.

The scoping period commenced with the publication of the NOI on September 18, 2001, and was originally scheduled to close November 26, 2001. Following publication of the NOI, the scoping period was extended 46 days through January 11, 2002, for the reasons discussed below.

As announced in the NOI, the three public scoping meetings were originally scheduled for the first week of November 2001. However, the meetings were postponed to allow review of DOE's approach for complying with NEPA for the DUF_6 conversion project. The review was not completed in time to hold the scoping meetings as originally scheduled. Consequently, the meetings were postponed, and the scoping period was extended from November 26, 2001, to January 11, 2002. The public was notified of the postponement through a press release, ads in local newspapers, an announcement posted on the Depleted UF_6 Management Information Network web site (http://web.ead.anl.gov/uranium), and by e-mail for those on the DUF_6 program distribution mailing list.

The three public scoping meetings were rescheduled and held in Piketon on November 28, in Oak Ridge on December 4, and in Paducah on December 6, 2001. Announcements of the rescheduled meetings were made on the web site, through a press release, by mailing a postcard directly to individuals on the program mailing list, by e-mail to individuals on the mailing list, and through public service radio advertisements. In addition, advertisements appeared in the local newspapers listed in Table 1.

Each public scoping meeting was presided over by an independent facilitator responsible for conducting the meetings. Background materials, including four fact sheets, the NOI, a video describing characteristics of DUF_6, and a laptop-based demonstration of the web site, were made available at the meetings (all materials distributed at the scoping meetings are available on the Web site at http://web.ead.anl.gov/uranium/eis/eisscoping/).

TABLE 1 Newspapers in Which Rescheduled Scoping Meetings Were Advertised

Meeting	Newspaper	Ad Run Dates
Piketon **Wednesday, November 28**	*Pike County News*	Sunday, Nov. 25 Wednesday, Nov. 28
	Portsmouth Daily Times	Sunday, Nov. 25 Tuesday, Nov. 27
	Chillicothe Gazette	Sunday, Nov. 25 Tuesday, Nov. 27
Oak Ridge **Tuesday, December 4**	*The Oak Ridger*	Friday, Nov. 30 Monday, Dec. 3
	Roane County News	Friday, Nov. 30 Monday, Dec. 3
	Knoxville News-Sentinel	Sunday, Dec. 2 Monday, Dec. 3
Paducah **Thursday, December 6**	*Paducah Sun*	Sunday, Dec. 2 Wednesday, Dec. 5

Each public scoping meeting consisted of an introduction by the facilitator and a 20-minute overview by the DOE DUF_6 Management Program manager, which described DOE's approach to meeting its obligations under NEPA. The presentation was followed by (1) a question and answer session in which the DOE manager responded to questions from the attendees and (2) a comment period where attendees were invited to formally make comments on the record. A court reporter recorded an official transcript of each meeting in its entirety. Transcripts, as well as the presentation slides, can be viewed on the web site at the address given above.

A total of approximately 100 individuals attended the three scoping meetings, and 20 individuals provided oral comments. Persons attending included representatives of federal officials, state regulators, local officials, site oversight committee members, representatives of interested companies, local media, and private individuals. In addition, about 20 individuals and organizations commented through the other means available (i.e., fax, telephone, mail, e-mail, and the web site). Some of the comments received through these means were duplicates of some of the comments made at the scoping meetings. During the scoping period (September 18–January 11), the Depleted UF_6 Management Information Network web site received significant use. A total of 64,366 pages viewed (an average of 554 per day) during 9,983 user sessions (an average of 85 per day) by 4,784 unique visitors.

2 SUMMARY OF SCOPING COMMENTS

Approximately 140 comments were received from about 30 individuals and organizations during the scoping period. The comments were evaluated and grouped into several general categories for this summary. The following sections summarize the substance of the comments received. The wording is intended to capture the substance of the comments, rather than reproduce the exact wording of individual comments. The order in which the issues are presented is not intended to reflect their relative importance. Because of the wide range of interests and opinions about the proposed DUF_6 conversion project, many of the comments in each category illustrate the varied, and perhaps contradictory, issues, concerns, and desired future conditions expressed by individuals, organizations, and public agencies.

2.1 POLICY COMMENTS AND ISSUES

2.1.1 Support for Project

Several commentors expressed general support for DOE's DUF_6 conversion project. Several noted that the project was the culmination of a long process involving DOE and state regulatory agencies, and many stated that the project should be done as quickly as possible. Several commentors noted that the removal of cylinders from ETTP is vital for site reindustrialization efforts.

2.1.2 Importance of Safety

Many commentors stressed that the project should be conducted in a safe and environmentally sound manner. One commentor expressed the opinion that too many past DOE decisions regarding the cylinders have been driven by cost and budget considerations, such as the use of thin-walled cylinders and stacking the cylinders two high, and that these decisions have caused enormous problems.

2.1.3 Impacts of Past Site Operations

Several commentors expressed concern and fear as residents living near the existing diffusion plant sites, citing health problems from past site operations. One individual stated that he feels hostage to the Paducah plant and that residents near the plant do not feel safe and secure. The commentor believed that an alternative should be provided so they do not have to live close to the plant. Another commentor stated that it should be recognized that health problems and contamination are present around the Paducah site.

2.1.4 Need for an EIS

One commentor stressed that the conversion project requires a detailed, site-specific study typical of an EIS, and not an environmental assessment.

2.1.5 NEPA Process

One commentor stated the belief that the NEPA process was being prejudiced by the contracting chronology, specifically stating that the contract award should be made only after the EIS is completed. Another commentor felt that DOE had already made decisions, and that input from the public should have been requested earlier in the process.

2.1.6 Use

One organization expressed its opposition to the use of depleted uranium in weaponry. Several commentors recommended banning the use of depleted uranium in commercial facilities, consumer products, and building and industrial production. In addition, they stated that all mining and processing of uranium should be stopped. The Kentucky Radiation Health and Toxic Agents Branch stated that release of any material from a conversion facility to the public domain must be evaluated by them and the public sector. One commentor noted that depleted uranium is a very important national energy resource and can be used in breeder reactors to provide 200 to 300 years of electrical energy, stressing that the United States needs to think of its energy policy not in the short term, but in terms of hundreds of years. The State of Tennessee Department of Environment and Conservation noted that consideration should be given to the possibility that conversion products should not be free-released because of radiological contamination.

2.1.7 USEC

One individual requested that DOE address the contracts entered into with USEC, whereby DOE continues to take possession of USEC-owned cylinders. The commentor claimed that DOE is using taxpayer dollars to subsidize USEC and that the money paid to DOE by USEC is pathetically low.

2.1.8 Portsmouth Cleanup

One commentor stated that DOE should clean up the Portsmouth site, put the plant in cold storage, restore the quality of air and water, end pollution at the source, and perform D&D of the site before building another facility.

2.1.9 Interaction with State Agencies

The Kentucky Radiation Health and Toxic Agents Branch stated that DOE has not interacted with the responsible radiation agency in Kentucky to provide sufficient information for assessment of the impacts of construction of a conversion facility on public health. In addition, they requested that DOE provide the Radiation Health and Toxic Agents Branch access to the facility to ensure protection of worker and public health. They also stated that handling and disposing of radioactive material and scrap metal must be properly addressed by DOE and evaluated by the Radiation Health and Toxic Agents Branch.

2.1.10 Self-Regulation

The Kentucky Radiation Health and Toxic Agents Branch stated that it is opposed to self-regulation of the facility by the DOE.

2.1.11 DUF_6 as Hazardous Waste

Representatives of the Kentucky Division of Waste Management stated that they believe DUF_6 is a hazardous waste because of its corrosivity and reactivity.

2.2 ALTERNATIVES

2.2.1 Support for DOE's Preferred Alternative

Several individuals and organizations expressed support for DOE's preferred alternative of building two conversion plants, one at Portsmouth and one at Paducah. Supportive organizations included the Ohio Environmental Protection Agency (OEPA), the Kentucky Division of Waste Management, McCracken County administrators, Paducah area business associations, labor representatives, and local Oak Ridge stakeholder groups. The OEPA expressed support for the shipment of cylinders from ETTP to the Portsmouth site, but only after construction of the conversion facility.

2.2.2 Opposition to Proposed Alternatives

One commentor opposed the consideration of a one conversion plant alternative in the EIS. The commentor stated that such an option is not consistent with the intent of Public Law 105-204 and is not a reasonable alternative because no funds have been provided for this option. Another commentor stated that it is a mistake to consider the use of existing U.S. conversion facilities because of transportation issues and potential local opposition.

2.2.3 Recommended Conversion Technologies

Commentors recommended two conversion technology options: (1) building a conversion plant in parallel with a new centrifuge enrichment plant, which would allow the depleted uranium to be used for reenrichment prior to conversion, and (2) not building a conversion plant but directly disposing of the DUF_6 in a vitreous melt within a disposal area (this recommendation was accompanied by a technical proposal). One commentor recommended a specific laser technology to monitor for and alarm against dangerous levels of hydrogen fluoride (HF).

2.2.4 Preferred Chemical Form of Uranium for Disposal

Several commentors expressed the opinion that U_3O_8 is the preferable and prudent chemical form of uranium for disposal based on stability and solubility. They noted that U_3O_8 is the most stable form of uranium and is found in nature. Also, foreign countries store this form of depleted uranium. Several commentors stated that disposal of DUF_4 will pose disposal problems and consideration of UF_4 is a mistake, identifying generation of HF, expansion of disposal containers, and U.S. Nuclear Regulatory Commission concerns as some potential problems. One commentor expressed opposition to converting to depleted uranium metal and provided qualified support for converting to UO_2.

2.2.5 Use of Hydrogen Fluoride

Several commentors stated that there is no credible market for aqueous HF and that anhydrous HF is clearly a better choice in terms of marketable fluoride products. It was stated that aqueous HF is a low value product that would be sold into a saturated market. These commentors strongly recommended the production of anhydrous HF and its subsequent use within the nuclear fuel cycle to avoid problems with the stigma from potential uranium contamination. One commentor noted that anhydrous HF production technology was previously demonstrated at a DOE pilot facility in 1998. One commentor stated that the specifications for allowable uranium in the HF produced must be made clear because HF will always contain some uranium. The commentor noted that the final use of the HF will affect the allowable uranium content and will need to be considered (the commentor stressed the possible accumulation of uranium if HF evaporation processes are used).

2.2.6 Disposition Options

One commentor stated that DUF_6 should be disposed of immediately as high-level waste due to the variety of unknown contaminants and decay products, and further, it should be disposed of in deep, dry areas. The commentor also noted that DOE should address disposal of all forms of converted depleted uranium. Another commentor stated a preference for a disposal process that binds the radionuclides, rendering them benign and immobile before final disposition. One commentor stated that the depleted uranium should be assigned to safe storage facilities with constant monitoring.

2.3 CYLINDER INVENTORY COMMENTS AND ISSUES

2.3.1 ETTP Cylinder Inventory

A number of commentors stated that DOE needs to specifically state the number of UF_6 cylinders stored at the ETTP site, including test and in-line process cylinders that are not the typical 10- and 14-ton cylinders, and rectify inconsistencies between the number of full cylinders reported by DOE Headquarters personnel compared with that of Oak Ridge operations personnel. They claimed that DOE has continued to provide an inaccurate count of the cylinders at the ETTP site. In addition, several commentors stated that all cylinders should be removed from ETTP and that it would make sense to move them all to Portsmouth because handling would be similar. They recommended that the EIS consider removing all the ETTP cylinders.

2.3.2 Cylinder Condition, Surveillance, and Maintenance

Several commentors expressed their concern over the deteriorated condition of cylinders and continued inadequacies of current inspection programs and procedures. They claimed that DOE does not assure the public the cylinders currently stored will not breach due to external corrosion and that there is a high likelihood of future breaches. One commentor stated that a response team is needed at each site to manage potential breaches. One commentor stated that thousands of cylinders no longer have identification tags, which are necessary to determine the amount of DUF_6 in the cylinder, and that DOE must address that issue.

2.3.3 Transuranic Contamination

A number of commentors noted the presence of transuranic (TRU) contaminants in the DUF_6 cylinder inventory. It was stated that the EIS should specifically address the plutonium or TRU present in the stockpile and that DOE should make it a priority to assess the types and amounts of TRU contaminants in the inventory. One commentor stated that the affected environment section of the EIS should describe the contents of cylinders, including possible TRU and decay product elements, specifically americium-241, cadmium-109, cerium-141, curium-42, curium-244, neptunium-239, promethium-149, technetium, thorium-234, uranium-234, uranium-236, xenon-131m, and xenon-133m.

2.3.4 Disposition of Emptied Cylinders

Several commentors requested that DOE consider the possibility that the free release of emptied cylinders may not be an option because of residual contamination. One commentor expressed opposition to the idea of filling the emptied cylinders with conversion products or wastes for on-site storage or disposal.

2.4 TRANSPORTATION ISSUES

2.4.1 Importance of Transportation Safety

A number of commentors stressed the importance of transportation safety, noting that it will be challenging and expensive. One commentor suggested that traveling Hazmat teams should accompany each shipment. The Kentucky Radiation Health and Toxic Agents Branch expressed serious concerns regarding the transport of DUF_6 cylinders from Oak Ridge to Portsmouth, stating that without the proper risk assessments, evaluation of accident scenarios, and other DOE actions, they cannot support the movement of cylinders and are opposed to DOE obtaining any exemption from the U.S. Department of Transportation for the shipment of cylinders. One individual opposed shipping ETTP cylinders to Portsmouth and Paducah and sending conversion products to western sites, stating that the sites should deal with their own wastes.

2.4.2 Shipment Options

One organization stated that if DUF_6 is to be transported via truck, routes should be designated and appropriate risk analysis performed, taking into consideration road conditions. One commentor noted that rail transportation and the minimization of trans-loading can reduce project risks and improve safety. Two commentors stressed that the 11-mile ETTP rail right-of-way is in bad shape, and DOE should consider providing funding for and upgrading of the rail line. One organization stated that the EIS must include a comprehensive analysis of shipments by barge, including assessment of the condition of the barge terminal at ETTP, necessary upgrades, and the impact of possible dredging.

2.4.3 Schedule

With respect to the removal of ETTP cylinders, several commentors stated that the proposed time schedule should be adhered to or bettered. Commentors stated that the current time line is too long, and consideration should be given in the EIS to the removal of ETTP cylinders sooner than 2009.

2.5 SCOPE OF ENVIRONMENTAL IMPACT ANALYSIS

2.5.1 Human Health and Safety

One commenter stated that the EIS must consider the health and safety of construction and demolition workers if the Portsmouth GDP is demolished to build the conversion plant. The Kentucky Radiation Health and Toxic Agents Branch requested that DOE develop monitoring systems that ensure compliance with as low as reasonably achievable requirements. Another commentor requested that the assessment consider all site releases, not just separate sources. Several commentors requested that all actions and exposure pathways that are likely to affect the health and safety of the workers and the general public be considered. The activities mentioned included storage and movement of cylinders, washing of emptied cylinders, and conversion operations.

2.5.2 Air, Water, and Ecological Impacts

Several commentors stated that the EIS should consider off-site contamination of air, water, and soil, and effects from past practices, in particular, HF gas being transported off site. Similarly, water quality analyses should include effects on streams, the watershed, river basin, aquifers, and resident wildlife (in particular, deformed fish and mammals in the vicinity of the site). One commentor was concerned that different pollutants are bioaccumulating in the environment around the Paducah plant and that the long-term impacts are not well understood.

2.5.3 Cumulative Impacts

Commentors requested that the cumulative impact assessment consider the risk of handling old containers and the buildup of contaminants in infrastructures with repeated exposures and breaches; delayed effects of radiation exposures; long-term health monitoring; inventory of plants and wildlife to monitor migration of DNA defects up the food chain; additive effects of multiple contaminants in the environment; indirect and secondary effects; and other activities ongoing at the sites (including non-federal activities). One commentor noted that data already being used by the health care and insurance industries (i.e., mortality and morbidity rates in the communities and areas surrounding these sites) can more accurately predict exposures and resulting illnesses and should be collected and made available for public and independent analysis. According to the commentor, these data can prove a link between people's illnesses and the DOE site. One commentor specifically requested that the effects of uranium-235 be included under the cumulative impacts.

2.5.4 Environmental Justice

One commentor stated that the EIS should consider the cost of retraining workers and noted that pollution-based jobs are offered in areas where workers are "depressed for work." The commentor expressed environmental justice concerns.

2.5.5 Socioeconomics

One commentor requested that extensive socioeconomic analysis be included in the EIS, specifically the economic impact of the facility on the region, including conducting a health inventory of current and past workers and civilians within a 36-mile radius of the Portsmouth and Paducah sites to determine the costs to the community when workers become too ill to work or are laid off; the number of jobs from construction and operation of the conversion facility compared with the number of jobs that can be provided with the reclamation and restoration of the environment and final cleanup during shutdown, D&D, and cold storage; an analysis of the cost to handle, transport, and dispose of depleted uranium that is contaminated; the cost to build, maintain, and operate the conversion facility; and the long-term economic impacts on the community, for example, the loss of other industries because of decreases in land values, contaminated air and water, etc. One commentor requested that the social and psychological effects on the community and the effects on property values in the vicinity of the Paducah site be considered.

2.5.6 Accident Analysis

One commentor stated that the EIS must adequately address the risk from earthquakes at the Paducah site and from large plane crashes into the cylinder yards at all sites, noting that such risks had been inadequately addressed in previous evaluations, including the programmatic environmental impact statement (PEIS). The commentor expressed concern over HF released in an accident and the difficulty site personnel would have in responding to such an accident, noting the proximity of the Barkley Airport to the Paducah site and the crash of a B-1 bomber near the Paducah site during the PEIS public hearings. The commentor requested that serious analysis be conducted to develop approaches to mitigate such events, such as considering building additional yards and stacking cylinders one high to allow better access in the event of an accident. The State of Tennessee Department of Environment and Conservation also requested that the chance of a catastrophic event, such as a plane crash into a cylinder yard, be explored and the possibility of a deliberate act be considered.

2.5.7 Disposal Analysis

One commentor stated that the methods of disposal of this material should be considered for their long- and short-term risks. Another stated that the EIS must address what to do with any metal conversion product if the DUF_6 were converted to metal.

2.5.8 Use Analysis

One commentor stated that if any future production takes place at the Paducah site using the DUF_6 conversion products, it should be included in the EIS; specifically, the EIS should consider any products produced, the actual production techniques, and associated waste production. One commentor requested that DOE evaluate the impacts associated with the use of conversion products. Another commentor stated that making products from converted materials should be considered outside the scope of the EIS and also be considered in other documents when actual conversion products are known.

2.5.9 Life-Cycle Impacts

A number of commentors recommended that the EIS consider the full life cycle of the material, including conversion, packaging, transportation, disposal, and D&D of the facilities. Several commentors stated that the EIS must consider what to do with the empty cylinders. One commentor stated that the maintenance and D&D evaluation should consider the possibility that it may not be possible to ship the conversion products off site immediately.

2.5.10 Waste Management

One commentor requested that the EIS address the disposition of wastes generated from the conversion process. Another commentor stated that the Paducah GDP waste treatment plant may not be adequate to meet the needs of the conversion facility and other facilities at the site.

2.5.11 Cultural Resources

One commentor requested that DOE evaluate the corrosive effects of fluorine compounds released to the environment from the conversion plant at Paducah GDP on buildings and art work in Paducah and other towns in western Kentucky and southern Illinois.

ATTACHMENT A:

NOTICE OF INTENT TO PREPARE AN ENVIRONMENTAL IMPACT STATEMENT FOR DEPLETED URANIUM HEXAFLUORIDE CONVERSION FACILITIES

AGENCY: Department of Energy.

ACTION: Notice of Intent.

SUMMARY: The U.S. Department of Energy (DOE) announces its intention to prepare an Environmental Impact Statement (EIS) for a proposal to construct, operate, maintain, and decontaminate and decommission two depleted uranium hexafluoride (DUF_6) conversion facilities, at Portsmouth, Ohio, and Paducah, Kentucky. DOE would use the proposed facilities to convert its inventory of DUF_6 to a more stable chemical form suitable for storage, beneficial use, or disposal. Approximately 700,000 metric tons of DUF_6 in about 57,700 cylinders are stored at Portsmouth and Paducah, and at an Oak Ridge, Tennessee site. The EIS will address potential environmental impacts of the construction, operation, maintenance, and decontamination and decommissioning of the conversion facilities. DOE will hold public scoping meetings near the three involved sites.

DATES: DOE invites public comments on the proposed scope of the DUF_6 conversion facilities EIS. To ensure consideration, comments must be postmarked by November 26, 2001. Late comments will be considered to the extent practicable. Three public scoping meetings will be held near Portsmouth, Ohio; Paducah, Kentucky; and Oak Ridge, Tennessee. The scoping meetings will provide the public with an opportunity to present comments on the scope of the EIS, and to ask questions and discuss concerns with DOE officials regarding the EIS. The location, date, and time for these public scoping meetings are as follows:

Portsmouth, Ohio: Thursday, November 1, 2001, from 6-9 p.m. at the Vern Riffe Pike County Vocational School, 175 Beaver Creek Road - off State Route 32, Piketon, Ohio 45661.

Paducah, Kentucky: Tuesday, November 6, 2001, from 6-9 p.m. at the Information Age Park Resource Center, 2000 McCracken Blvd., Paducah, Kentucky 42001.

Oak Ridge, Tennessee: Thursday, November 8, 2001, from 6-9 p.m. at the Pollard Auditorium, Oak Ridge Institute for Science and Education, 210 Badger Avenue, Oak Ridge, Tennessee 37831.

ADDRESSES: Please direct comments or suggestions on the scope of the EIS and questions concerning the proposed project to: Kevin Shaw, U.S. Department of Energy, Office of Environmental Management, Office of Site Closure - Oak Ridge Office (EM–32), 19901 Germantown Road, Germantown, Maryland 20874, fax (301) 903–3479, e-mail DUF6.Comments@em.doe.gov (please use 'NOI Comments' for the subject).

FOR FURTHER INFORMATION CONTACT: For information regarding the proposed project, contact Kevin Shaw, as above. For general information on the DOE NEPA process, please contact Carol M. Borgstrom, Director, Office of NEPA Policy and Compliance (EH-42), U.S. Department of Energy, 1000 Independence Avenue, SW, Washington, DC 20585-0119, telephone (202) 586-4600 or leave a message at (800) 472-2756.

SUPPLEMENTARY INFORMATION:

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 percent (by weight), through an isotopic separation process. A U–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 been stripped of a portion of the uranium-235 that it once contained 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.

DOE has 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. 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.

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 Resource Conservation and Recovery Act regulation 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.

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). 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 multi-year 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 February 1999, DOE and the Tennessee Department of Environment and Conservation 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 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 the National Environmental Policy Act (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 Request for Proposals (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 (ORNL/TM- 2000/161, June 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 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 a final RFP to procure a contractor to design, construct, and operate DUF_6 conversion facilities at the Paducah and Portsmouth plant sites. Any conversion plants that result from this procurement would convert the DUF_6 to a more stable chemical form that is suitable for either beneficial use or disposal. The selected contractor would design the conversion plants using the technology it proposes and construct the plants. The selected contractor also would operate the plants for a five-year period, which would include maintaining depleted uranium and product inventories, transporting all uranium hexafluoride storage cylinders in Tennessee to a conversion plant at Portsmouth, as appropriate, and transporting converted product for which there is no use to a disposal site. The selected contractor would also prepare excess material for disposal at an appropriate site.

DOE received five proposals in response to the DUF_6 conversion RFP, and DOE anticipates that a contract will be awarded during the first quarter of fiscal year 2002. Since the site-specific NEPA process will not be completed prior to contract award, the contract shall be contingent on completion of the NEPA process and will be structured such that the NEPA process will be completed in advance of a go/no-go decision. (See NEPA Process below.) DOE initiated the NEPA review by issuing an Advance Notice of Intent to prepare an EIS for the DUF_6 conversion facilities on May 7, 2001 (66 FR 23010).

Purpose and Need for Agency Action

DOE needs to convert its inventory of DUF_6 to a more stable chemical form for storage, use, or disposal. This need follows directly from the decision presented in the August 1999 "Record of Decision for Long-Term Management and Use of Depleted Uranium Hexafluoride," namely to begin conversion of the DUF_6 inventory as soon as possible.

This EIS will assess the potential environmental impacts of constructing, operating, maintaining, and decontaminating and decommissioning DUF_6 conversion facilities at the Portsmouth and Paducah sites, as well as other reasonable alternatives. The EIS will aid decision making on DUF_6 conversion by evaluating the environmental impacts of the range of reasonable alternatives, as well as providing a means for public input into the decision making process. DOE is committed to ensuring that the public has ample opportunity to participate in this review.

Relation to the DUF_6 PEIS

This EIS represents the second level of a tiered environmental review process being used to evaluate and implement the DUF_6 management program. Tiering refers to the process of first addressing general (programmatic) matters in a PEIS followed by more narrowly focused (project level) environmental review that incorporates by reference the more general discussions. The DUF_6 PEIS, issued in April 1999, was the first level of this tiered approach.

The DUF_6 PEIS addressed the potential environmental impacts of broad strategy alternatives, including analyses of the impacts of: (1) continued storage of DUF_6 at DOE's current storage sites; (2) technologies for converting the DUF_6 to depleted U_3O_8, UO_2, or uranium metal; (3) long-term storage of depleted U_3O_8 and UO_2 for subsequent use or disposal; (4) long-term storage of DUF_6 in cylinders at a consolidated site; (5) use of depleted UO_2 and uranium metal conversion products; (6) transportation of materials; and (7) disposal of depleted U_3O_8 and UO_2 at generic disposal sites. The results of the PEIS analysis, as well as supporting documentation, will be incorporated into this EIS to the extent appropriate.

The ROD for the DUF_6 PEIS declared DOE's decision to promptly convert the DUF_6 inventory to a more stable chemical form. This tiered EIS will address specific issues associated with the implementation of the DUF_6 PEIS ROD.

Preliminary Alternatives

Consistent with NEPA implementation requirements, this EIS will assess the range of reasonable alternatives regarding constructing, operating, maintaining, and decontaminating and decommissioning DUF_6 conversion facilities. The following preliminary list of alternatives is subject to modification in response to comments received during the public scoping process.

Preferred Alternative. Under the preferred alternative, two conversion facilities would be built: one at the Paducah Gaseous Diffusion Plant site and another at the Portsmouth Gaseous Diffusion Plant site. The cylinders currently stored at the ETTP site near Oak Ridge, Tennessee, would be transported to Portsmouth for conversion. The conversion products (i.e., depleted uranium as well as fluorine components produced during the conversion process) would be stored, put to beneficial uses, or disposed of at an appropriate disposal facility. This alternative is consistent with the Conversion Plan, which DOE submitted to Congress in July 1999, in response to Public Law 105–204. Subalternatives to be considered for the preferred alternative include:

- Conversion technology processes identified in response to the final RFP for DUF_6 conversion services, plus any other technologies that DOE believes must be considered.
- Local siting alternatives for building and operating conversion facilities within the Paducah and Portsmouth plant boundaries.
- Timing options, such as staggering the start of the construction and operation of the two conversion facilities.

One Conversion Plant Alternative. An alternative of building and operating only one conversion facility at either the Portsmouth or the Paducah site will be considered. This plant could differ in size or production capacity from the two proposed for Portsmouth and Paducah. Technology and local siting subalternatives will be considered as with the preferred alternative.

Use of Existing UF_6 Conversion Capacity Alternative. DOE will consider using already-existing UF_6 conversion capacity at commercial nuclear fuel fabrication facilities in lieu of constructing one or two new conversion plants. DOE is evaluating the feasibility of using existing conversion capacity, although no expression of interest has been received from such facilities.

No Action Alternative. Under the "no action" alternative, cylinder management activities (handling, inspection, monitoring, and maintenance) would continue the "status quo" at the three current storage sites indefinitely, consistent with the DUF_6 Cylinder Project Management Plan and the consent orders, which include actions needed to meet safety and environmental requirements.

Where applicable under the alternatives listed above, transportation options, such as truck, rail, and barge, will be considered for shipping DUF_6 cylinders to a conversion facility and conversion products to a storage or disposal facility. Also, for each technology alternative, alternatives for conversion products, including storage, use, and disposal at one or more disposal sites, will be considered. Further, DOE would appreciate comments regarding whether there are additional siting alternatives for one or more new conversion facilities that should be considered.

Identification of Environmental and Other Issues

DOE intends to address the following environmental issues when assessing the potential environmental impacts of the alternatives in this EIS. Additional issues may be identified as a result of the scoping process. DOE invites comment from the Federal agencies, Native American tribes, state and local governments, and the general public on these and any other issues that should be considered in the EIS:

- Potential impacts on health from DUF_6 conversion activities, including potential impacts to workers and the public from exposure to radiation and chemicals during routine and accident conditions for the construction, operation, maintenance, and decontamination and decommissioning of DUF_6 conversion facilities.
- Potential impacts to workers and the public from exposure to radiation and chemicals during routine and accident conditions for the transportation of DUF_6

cylinders from ETTP to one of the conversion sites.

- Potential impacts to workers and the public from exposure to radiation and chemicals during routine and accident conditions for the transportation of conversion products that are not beneficially used to a low-level waste disposal facility.
- Potential impacts to surface water, ground water, and soil during construction activities and from emissions and water use during facility operations.
- Potential impacts on air quality from emissions and from noise during facility construction and operations.
- Potential cumulative impacts of the past, present, and reasonably foreseeable future actions (including impacts resulting from activities of the United States Enrichment Corporation).
- Potential impacts from facility construction on historically significant properties, if present, and on access to traditional use areas.
- Potential impacts from land requirements, potential incompatibilities, and disturbances.
- Potential impacts on local, regional, or national resources from materials and utilities required for construction and operation.
- Potential impacts on ecological resources, including threatened and endangered species, floodplains, and wetlands.
- Potential impacts on local and DOE-wide waste management capabilities.
- Potential impacts on local employment, income, population, housing, and public services from facility construction and operations, and environmental justice issues.
- Pollution prevention, waste minimization, and energy and water use reduction technologies to reduce the use of energy, water, and hazardous substances and to mitigate environmental impacts.

DOE received comments on the Advance Notice of Intent from the Tennessee Department of Environment and Conservation (TDEC) and the Ohio Environmental Protection Agency (OHEPA). TDEC commented that the EIS should provide an adequate platform for coordination of environmental issues between DOE, Ohio, Kentucky, and Tennessee, without additional agreements if certain specified topics were explored in detail in the EIS. TDEC's comments emphasized issues related to the transportation of the ETTP cylinders to Portsmouth. OHEPA's comment concurred in TDEC's comment that the EIS should coordinate environmental issues between DOE, Ohio, Kentucky, and Tennessee, especially emergency management issues associated with the transportation of the ETTP cylinders to Portsmouth.

NEPA Process

The EIS for the proposed project will be prepared pursuant to the NEPA of 1969 (42 U.S.C. 4321 et seq.), Council on Environmental Quality NEPA Regulations (40 CFR Parts 1500—1508), and DOE's NEPA Implementing Procedures (10 CFR Part 1021). Following the publication of this Notice of Intent, DOE will hold scoping meetings, prepare and distribute the draft EIS for public review, hold public hearings to solicit public comment on the draft EIS, and publish a final EIS. Not less than 30 days after the publication of the U.S. Environmental Protection Agency's Notice of Availability of the final EIS, DOE may issue a ROD documenting its decision concerning the proposed action.

In addition to the above steps, DOE is considering environmental factors in selecting a contractor for the conversion services through the procurement process, including preparation of an environmental critique and an environmental synopsis pursuant to 10 CFR 1021.216. The environmental critique evaluates the environmental data and information submitted by each offeror and is subject to the confidentiality requirements of the procurement process. DOE also is preparing a publicly available environmental synopsis, based on the environmental critique, to document the consideration given to environmental factors in the contractor selection process. The environmental synopsis will be filed with the U.S. Environmental Protection Agency and will be incorporated into the EIS. In accordance with 10 CFR 1021.216(i), since the NEPA process will not be completed prior to contract award, the contract will be structured to allow the NEPA review process to be completed in advance of a go/no-go decision.

Related NEPA Reviews

Final Programmatic Environmental Impact Statement for Alternative Strategies for the Long-Term Management and Use of Depleted Uranium Hexafluoride (DOE/EIS–0269, April 1999);

Final Waste Management Programmatic Environmental Impact Statement for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste (DOE/EIS–0200– F, May 1997);

Disposition of Surplus Highly Enriched Uranium, Final Environmental Impact Statement (DOE/ EIS–0240, June 1996);

Environmental Assessment for the Refurbishment of Uranium Hexafluoride Cylinder Storage Yards C–745–K, L, M, N, and P and Construction of a New Uranium Hexafluoride Cylinder Storage Yard (C– 745–T) at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky (DOE/EA–1118, July 1996);

Environmental Assessment for DOE Sale of Surplus Natural and Low Enriched Uranium (DOE/EA–1172, October 1996); Environmental Assessment for the Lease of Land and Facilities within the East Tennessee Technology Park, Oak Ridge, Tennessee (DOE/EA–1175, 1997);

Notice of Intent for Programmatic Environmental Impact Statement for Disposition of Scrap Metals (DOE/EIS-0327) (66 FR 36562, July 12, 2001).

Scoping Meetings

The purpose of this Notice is to encourage early public involvement in the EIS process and to solicit public comments on the proposed scope of the EIS, including the issues and alternatives it would analyze. DOE will hold public scoping meetings near Portsmouth, Ohio; Paducah, Kentucky; and Oak Ridge, Tennessee, to solicit both oral and written comments from interested parties. Oral and written comments will be considered equally in the preparation of the EIS. See "DATES" above for the times and locations of these meetings.

DOE will designate a presiding officer for the scoping meetings. The scoping meetings will not be conducted as evidentiary hearings, and there will be no questioning of the commentors. However, DOE personnel may ask for clarifications to ensure that they fully understand the comments and suggestions. The presiding officer will establish the order of speakers. At the opening of each meeting, the presiding officer will announce any additional procedures necessary for the conduct of the meetings. If necessary to ensure that all persons wishing to make a presentation are given the opportunity, a time limit may be applied for each speaker. Comment cards will also be available for those who would prefer to submit written comments.

DOE will make transcripts of the scoping meetings and other environmental and project-related materials available for public review in the following reading rooms:
DOE Headquarters, Freedom of Information Reading Room, 1000 Independence Avenue, SW, Room 1 E-190, Washington, DC 20585. Telephone: (202) 586-3142.

Oak Ridge/ DOE, Public Reading Room, 230 Warehouse Road, Suite 300, Oak Ridge, Tennessee 37831. Telephone: (865) 241-4780.

Paducah/DOE, Environmental Information Center, Berkley Centre, 115 Memorial Drive, Paducah, Kentucky 42001, Telephone: (270) 554-6979.

Portsmouth/DOE, Environmental Information Center, 3930 U.S. Route 23, Perimeter Road, Piketon, OH 45661. Telephone: (740) 289-3317.

Information is also available through the project web site at http://web.ead.anl.gov/uranium and on the DOE NEPA web site at http://www.tis.eh.doe.gov/ nepa.

The EIS will also contain a section summarizing the nature of the comments received during the scoping process and describing any modification to the scope of the EIS in response to the scoping process comments.

EIS Schedule

The draft EIS is scheduled to be published by June 2002. A 45-day comment period on the draft EIS is planned, which will include public hearings to receive oral comments. Availability of the draft EIS, the dates of the public comment period, and information about the public hearings will be announced in the Federal Register and in the local news media.

The final EIS for the DUF_6 Conversion Facilities is scheduled for January 2003. A ROD would be issued no sooner than 30 days after the U. S. Environmental Protection Agency notice of availability of the final EIS is published in the Federal Register.

Signed in Washington, DC, this 10th day of September, 2001.

Steven V. Cary
Acting Assistant Secretary
Office of Environment, Safety and Health

NOTICE OF CHANGE IN NATIONAL ENVIRONMENTAL POLICY ACT (NEPA) COMPLIANCE APPROACH FOR THE DEPLETED URANIUM HEXAFLUORIDE (DUF_6) CONVERSION FACILITIES PROJECT

22368 Federal Register / Vol. 68, No. 81 / Monday, April 28, 2003 / Notices

"Browse Pending Collections" link and by clicking on link number 2270. When you access the information collection, click on "Download Attachments" to view. Written requests for information should be addressed to Vivian Reese, Department of Education, 400 Maryland Avenue, SW., Room 4050, Regional Office Building 3, Washington, DC 20202–4651 or to the e-mail address *vivan.reese@ed.gov*. Requests may also be electronically mailed to the internet address *OCIO_RIMG@ed.gov* or faxed to 202–708–9346. Please specify the complete title of the information collection when making your request.

Comments regarding burden and/or the collection activity requirements should be directed to Joseph Schubart at (202) 708–9266 or to his e-mail address *Joe.Schubart@ed.gov*. Individuals who use a telecommunications device for the deaf (TDD) may call the Federal Information Relay Service (FIRS) at 1–800–877–8339.

[FR Doc. 03–10325 Filed 4–25–03; 8:45 am]

BILLING CODE 4000–01–P

DEPARTMENT OF ENERGY

Notice of Change in National Environmental Policy Act (NEPA) Compliance Approach for the Depleted Uranium Hexafluoride (DUF6) Conversion Facilities Project

AGENCY: Department of Energy.

ACTION: Notice of revised approach.

SUMMARY: On September 18, 2001, the U.S. Department of Energy (DOE) published a Notice of Intent (NOI) in the **Federal Register**, announcing its intention to prepare an Environmental Impact Statement (EIS) for a proposed action to construct, operate, maintain, and decontaminate and decommission two depleted uranium hexafluoride (DUF6) conversion facilities at Portsmouth, Ohio, and Paducah, Kentucky. DOE held three scoping meetings to provide the public with an opportunity to present comments on the scope of the EIS, and to ask questions and discuss concerns with DOE officials regarding the EIS. The scoping meetings were held in Piketon, Ohio on November 28, 2001; in Oak Ridge, Tennessee on December 4, 2001, and in Paducah, Kentucky, on December 6, 2001. The purpose of this Notice is to inform the public of the change in the approach for the NEPA review for the DUF6 conversion projects for Paducah and Portsmouth, and to invite public comments on the revised approach.

DATES: Comments received by May 30, 2003, will be considered in the preparation of the draft EISs. Comments received after that date will be considered to the extent practicable.

ADDRESSES: Comments and suggestions can be forwarded to Gary Hartman, U.S. Department of Energy—Oak Ridge Operations Office, Oak Ridge, Tennessee 37831, telephone (865) 576–0273, fax: (865) 576–0746, e-mail: *hartmangs@oro.doe.gov*. Also contact Mr. Hartman with any questions regarding the DOE DUF6 conversion project.

FOR FURTHER INFORMATION CONTACT: For general information on the DOE NEPA process, contact Carol M. Borgstrom, Director, Office of NEPA Policy and Compliance (EH–42), U.S. Department of Energy, 1000 Independence Avenue, SW., Washington, DC 20585–0119, telephone (202) 586–4600 or leave a message at (800) 472–2756.

SUPPLEMENTARY INFORMATION: On September 18, 2001, the U.S. Department of Energy (DOE) published a Notice of Intent (NOI) in the **Federal Register** (66 FR 48123), announcing its intention to prepare an Environmental Impact Statement (EIS) for a proposed action to construct, operate, maintain, and decontaminate and decommission two depleted uranium hexafluoride (DUF6) conversion facilities at Portsmouth, Ohio, and Paducah, Kentucky. DOE held three scoping meetings to provide the public with an opportunity to present comments on the scope of the EIS, and to ask questions and discuss concerns with DOE officials regarding the EIS. The scoping meetings were held in Piketon, Ohio on November 28, 2001; in Oak Ridge, Tennessee on December 4, 2001, and in Paducah, Kentucky, on December 6, 2001. The alternatives identified in the NOI included a two-plant alternative (two conversion plants would be built, one at the Paducah Gaseous Diffusion Plant site and another at the Portsmouth Gaseous Diffusion Plant site), a one-plant alternative (only one plant would be built either at the Paducah or the Portsmouth site), a use of existing UF6 conversion capacity alternative (DOE would consider using already-existing UF6 conversion capacity at commercial nuclear fuel fabrication facilities in lieu of constructing one or two new plants), and the no action alternative. For alternatives that involved constructing one or two new plants, DOE planned to consider alternative conversion technologies, local siting alternatives within the Paducah and Portsmouth plant boundaries, and the shipment of DUF6 cylinders stored at the East Tennessee Technology Park (ETTP) near Oak Ridge, Tennessee, to either the Portsmouth or Paducah sites. The technologies to be considered in the EIS were those submitted in response to a Request for Proposals (RFP) for conversion services that DOE had issued in October 2000, plus any other technologies that DOE believed must be considered.

Then, on August 2, 2002, the U.S. Congress passed the *2002 Supplemental Appropriations Act for Further Recovery From and Response to Terrorist Attacks on the United States* (Public Law 107–206). In pertinent part, this law required that, within 30 days of enactment, DOE award a contract for the scope of work described in the October 2000 RFP, including design, construction, and operation of a DUF6 conversion plant at each of the Department's Paducah, Kentucky and Portsmouth, Ohio sites. Accordingly, the DOE awarded a contract to Uranium Disposition Services, LLC, on August 29, 2002.

In light of Public Law 107–206, and DOE's award of the contract to Uranium Disposition Services, DOE reevaluated the appropriate scope of its NEPA review and decided to prepare two separate EIS's, one for the plant proposed for the Paducah site and a second for the Portsmouth site. The proposed alternatives to be considered in each EIS would focus primarily on where the conversion facilities will be sited at the respective sites, and a no action alternative. DOE will also consider impacts arising from shipment of ETTP cylinders for conversion to each site.

Schedule

Both draft EISs are scheduled to be published in July 2003. A 45-day comment period on the draft EISs is planned, which will include public hearings to receive comments. Availability of the draft EISs, the dates of the public comment period, and information about the public hearings will be announced in the **Federal Register** and in the local news media.

The final EISs are scheduled for publication in January 2004. The Records of Decision would be issued no sooner than 30 days after the U.S. Environmental Protection Agency notices of availability of the final EISs are published in the **Federal Register**. As directed by Pub. L. 107–206, construction of the DUF6 conversion facilities is scheduled to begin not later than July 31, 2004.

The purpose of this Notice is to inform the public of the change in the approach for the NEPA review for the DUF6 conversion projects for Paducah and Portsmouth, and to invite public comments on the revised approach.

David R. Allen,
NEPA Compliance Officer, Oak Ridge Operations Office.
[FR Doc. 03–10373 Filed 4–25–03; 8:45 am]
BILLING CODE 6450–01–P

DEPARTMENT OF ENERGY

Environmental Management Site-Specific Advisory Board, Paducah

AGENCY: Department of Energy (DOE).

ACTION: Notice of open meeting.

SUMMARY: This notice announces a meeting of the Environmental Management Site-Specific Advisory Board (EM SSAB), Paducah. The Federal Advisory Committee Act (Pub. L. 92–463, 86 Stat. 770) requires that public notice of these meetings be announced in the **Federal Register**.

DATES: Thursday, May 15, 2003, 5:30 p.m.–9 p.m.

ADDRESSES: 111 Memorial Drive, Barkley Centre, Paducah, Kentucky.

FOR FURTHER INFORMATION CONTACT: W. Don Seaborg, Deputy Designated Federal Officer, Department of Energy Paducah Site Office, Post Office Box 1410, MS–103, Paducah, Kentucky 42001, (270) 441–6806.

SUPPLEMENTARY INFORMATION:

Purpose of the Board: The purpose of the Board is to make recommendations to DOE and its regulators in the areas of environmental restoration and waste management activities.

Tentative Agenda

5:30 p.m. Informal Discussion
6:00 p.m. Call to Order; Introductions; Approve April Minutes; Review Agenda
6:10 p.m. DDFO's Comments
- Budget Update
- ES & H Issues
- EM Project Updates
- CAB Recommendation Status
- Other

6:30 p.m. Federal Coordinator Comments
6:40 p.m. Ex-officio Comments
6:50 p.m. Public Comments and Questions
7:00 p.m. Review of Action Items
7:15 p.m. Break
7:25 p.m. Presentation
- Fiscal Year (FY) 2004 Budget—Judy Penry (Oak Ridge Chief Financial Officer [CFO])
- Waste Disposition Environmental Assessment (EA) Addendum

8:10 p.m. Public Comments and Questions
8:20 p.m. Task Force and Subcommittee Reports
- Water Task Force
- Waste Operations Task Force
- Long Range Strategy/Stewardship
- Community Concerns
- Public Involvement/Membership

8:55 p.m. Administrative Issues
- Preparation for September Chairs' Meeting
- June Dinner Meeting
- Review of Workplan
- Review Next Agenda
- Final Comments

9:10 p.m. Adjourn

Copies of the final agenda will be available at the meeting.

Public Participation: The meeting is open to the public. Written statements may be filed with the Committee either before or after the meeting. Individuals who wish to make oral statements pertaining to agenda items should contact David Dollins at the address listed above or by telephone at (270) 441–6819. Requests must be received five days prior to the meeting and reasonable provision will be made to include the presentation in the agenda. The Deputy Designated Federal Officer is empowered to conduct the meeting in a fashion that will facilitate the orderly conduct of business. Each individual wishing to make public comment will be provided a maximum of five minutes to present their comments as the first item of the meeting agenda.

Minutes: The minutes of this meeting will be available for public review and copying at the Freedom of Information Public Reading Room, 1E–190, Forrestal Building, 1000 Independence Avenue, SW., Washington, DC 20585 between 9 a.m. and 4 p.m., Monday–Friday, except Federal holidays. Minutes will also be available at the Department of Energy's Environmental Information Center and Reading Room at 115 Memorial Drive, Barkley Centre, Paducah, Kentucky between 8 a.m. and 5 p.m. Monday through Friday or by writing to David Dollins, Department of Energy Paducah Site Office, Post Office Box 1410, MS–103, Paducah, Kentucky 42001 or by calling him at (270) 441–6819.

Issued at Washington, DC, on April 23, 2003.

Belinda G. Hood,
Acting Deputy Advisory Committee Management Officer.
[FR Doc. 03–10374 Filed 4–25–03; 8:45 am]
BILLING CODE 6450–01–P

DEPARTMENT OF ENERGY

Federal Energy Regulatory Commission

[Docket Nos. ER03–610–000]

Allegheny Energy Supply Units 3, 4, & 5, LLC; Notice of Issuance of Order

April 21, 2003.

Allegheny Energy Supply Units 3, 4, & 5, LLC (Allegheny 3, 4 & 5) filed an application for market-based rate authority, with an accompanying tariff. The proposed market-based rate tariff provides for the sale of capacity and energy at market-based rates, as well as sale of ancillary services into PJM Interconnection LLC, New York Independent System Operator, Inc., and ISO New England, Inc. at market-based rates. Allegheny 3, 4, & 5 also requested waiver of various Commission regulations. In particular, Allegheny 3, 4, & 5 requested that the Commission grant blanket approval under 18 CFR part 34 of all future issuances of securities and assumptions of liability by Allegheny 3, 4, & 5.

On April 18, 2003, pursuant to delegated authority, the Director, Division of Tariffs and Market Development—South, granted the request for blanket approval under part 34, subject to the following:

Any person desiring to be heard or to protest the blanket approval of issuances of securities or assumptions of liability by Allegheny 3, 4, & 5 should file a motion to intervene or protest with the Federal Energy Regulatory Commission, 888 First Street, NE., Washington, DC 20426, in accordance with rules 211 and 214 of the Commission's rules of practice and procedure (18 CFR 385.211 and 385.214).

Notice is hereby given that the deadline for filing motions to intervene or protests, as set forth above, is May 19, 2003.

Absent a request to be heard in opposition by the deadline above, Allegheny 3, 4, & 5 is authorized to issue securities and assume obligations or liabilities as a guarantor, indorser, surety, or otherwise in respect of any security of another person; provided that such issuance or assumption is for some lawful object within the corporate purposes of Allegheny 3, 4, & 5 compatible with the public interest, and is reasonably necessary or appropriate for such purposes.

The Commission reserves the right to require a further showing that neither public nor private interests will be adversely affected by continued approval of Allegheny 3, 4, & 5's

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)

October 2002

Environmental Assessment Division
Argonne National Laboratory
Argonne, Illinois

Prepared for

Office of Site Closure – Oak Ridge Office (EM-32)
Office of Environmental Management
U.S. Department of Energy
Washington, D.C.

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ENVIRONMENTAL SYNOPSIS FOR THE DEPLETED UF_6 CONVERSION PROJECT (Solicitation No. DE-RP05-01OR22717)

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 include: (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.

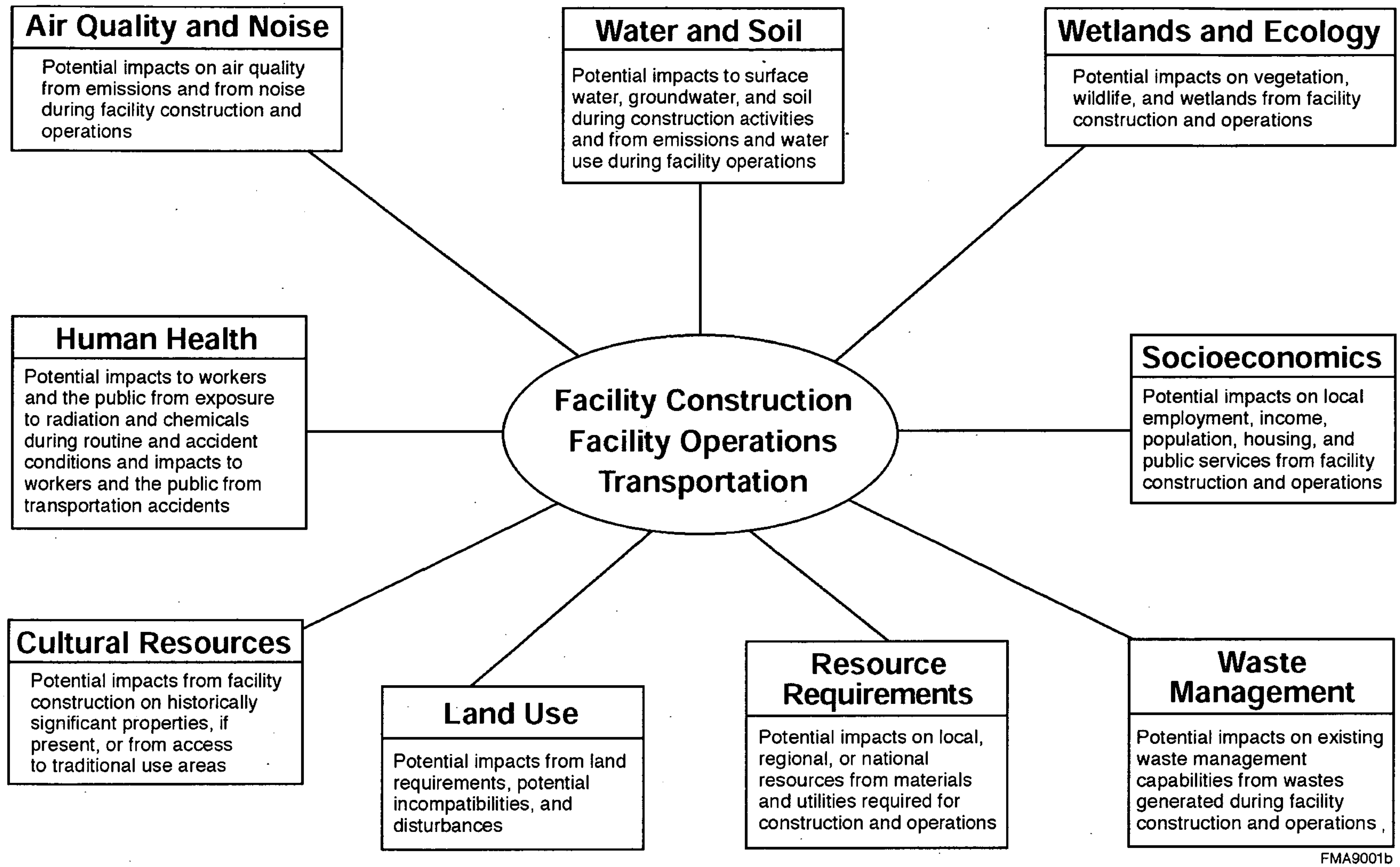

FIGURE 4.1 Areas of Impact Evaluated in the Environmental Critique

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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APPENDIX E:

IMPACTS ASSOCIATED WITH HF AND CaF_2 CONVERSION PRODUCT SALE AND USE

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IMPACTS ASSOCIATED WITH HF AND CaF_2 CONVERSION PRODUCT SALE AND USE

E.1 INTRODUCTION

During the conversion of the depleted uranium hexafluoride (DUF_6) inventory to depleted uranium oxide, products having some potential for sale to commercial users would be produced. These products would include aqueous hydrogen fluoride (HF) and calcium fluoride (CaF_2, commonly referred to as fluorspar). These products are routinely used as commercial materials, and an investigation into their potential reuse was done; results are included as part of this environmental impact statement (EIS). Areas examined as part of this investigation were the characteristics of these materials as produced within the conversion process, the current markets for these products, and the potential socioeconomic impacts within the United States if these products should be provided to the commercial sector. Because some low-level radioactivity would be associated with these materials, a description of the U.S. Department of Energy (DOE) process for authorizing the release of contaminated materials for unrestricted use (referred to as "free release") and an estimate of the potential human health effects of such free release were also considered in this investigation. The results and conclusions of this investigation are presented in the following sections of this appendix.

E.2 CHARACTERISTICS OF HF AND CaF_2 PRODUCED DURING CONVERSION

Conversion of DUF_6 to the solid uranium oxide form appropriate for use or disposal would be accomplished by reacting the UF_6 with steam and hydrogen, as indicated in the following reactions:

$$UF_6 + 2H_2O \rightarrow UO_2F_2 + 4HF \qquad (E.1)$$

and

$$3UO_2F_2 + H_2 + 2H_2O \rightarrow U_3O_8 + 6HF \,. \qquad (E.2)$$

The HF vapor and excess steam would be condensed, resulting in HF of approximately 55% strength. The predominant markets for HF call for 49% and 70% HF solutions; thus, the product from the conversion condensers could be further processed to yield these strengths.

A small fraction of the HF produced in the above reactions would escape capture in the condensers and remain as a vapor in the off-gas system. This uncondensed HF would be passed through a wet scrubber containing a nominal 20% potassium hydroxide (KOH) solution, where the HF would be converted into potassium fluoride (KF) via the following reaction:

$$HF + KOH \rightarrow KF + H_2O \,. \qquad (E.3)$$

The KOH would then be regenerated by adding lime to the above reaction products:

$$2KF + CaO + H_2O \rightarrow 2KOH + CaF_2 . \qquad (E.4)$$

The approximate quantities of HF and CaF_2 that would be produced annually via the above reactions at each site are shown in Table E-1. These quantities are based on converting the East Tennessee Technology Park (ETTP) cylinders at Portsmouth. As noted above, the 55% HF solution would be further processed into 70% and 49% solutions prior to being sold. The quantities of aqueous HF in these two concentrations are shown in Table E-2.

The quantities noted in Tables E-1 and E-2 are based on the assumption that there would be a viable economic market for the aqueous HF produced during the DUF_6 conversion process. If there were no such market, Uranium Disposition Services, LLC (UDS) proposes to convert all of the HF to CaF_2 and then either sell this product or dispose of it as a solid waste.

Under this scenario, CaF_2 would be produced by the following reactions:

$$CaO + H_2O \rightarrow Ca(OH)_2 \qquad (E.5)$$

and

$$Ca(OH)_2 + 2HF \rightarrow CaF_2 + 2H_2O. \qquad (E.6)$$

Approximate quantities of CaF_2 that would be produced annually if all the HF was converted to CaF_2 would be 8,800 t (9,700 tons) at Portsmouth and 11,800 t (13,000 tons) at Paducah. Under this scenario, the quantities of depleted triuranium octaoxide (U_3O_8) would remain the same as those shown in Table E-1.

TABLE E-1 Products from DUF_6 Conversion Assuming HF Acid Is Sold (metric tons per year)

Product	Portsmouth	Paducah	Total
Depleted U_3O_8	10,800	14,300	25,100
HF acid (55% solution)	8,300	11,000	19,300
CaF_2	18	24	42

TABLE E-2 Aqueous HF Levels for Sale (metric tons per year)

Product	Portsmouth	Paducah	Total
70% solution	2,500	3,300	5,800
49% solution	5,800	7,700	13,500

A small quantity of radioactive materials would transfer into the HF and CaF_2 products from the conversion process. As per the requirements of DOE Order 5400.5 (see Section E.4), UDS plans to apply for authorized release limits for these materials. Pending DOE's approval of authorized limits, estimates of the contaminant levels in the HF and CaF_2 have been made on the basis of the experience of Framatome Advanced Nuclear Power, Inc. (ANP) (a partner in UDS) at its Richland, Washington, facility authorized for manufacturing nuclear fuel. These values for HF are shown in Table E-3, along with the values that were assumed for estimating impacts in this EIS.

Any CaF_2 produced (either the small quantities from the off-gas treatment system or the mass conversion of all HF) would also be slightly radioactive. As it would do for HF, UDS also plans to apply for authorized release limits for CaF_2. Pending approval of authorized limits, the values shown in Table E-4 were used to estimate the impacts (UDS 2003a,b).

Certain chemical specifications must also be met for a product to be successfully marketed. Table E-5 shows likely process specifications for the production of HF. These specifications are based on vendor requirements at the Framatome ANP facility in Richland, Washington (UDS 2003a).

Similar process control specifications have been developed for CaF_2. These specifications were based on trade standards for acid-grade CaF_2 and are shown in Table E-6 (UDS 2003a).

TABLE E-3 Activity Levels for Aqueous HF

Contaminant	Expected Value	Assumed Activity
Depleted uranium	0.08 pCi/mL	3.0 pCi/mL (6.4 ppm)
Tc-99	1.6×10^{-5} pCi/mL	2.0×10^{-3} pCi/mL (15.9 ppb U)

TABLE E-4 Activity Levels for CaF_2

Contaminant	Expected Value	Assumed Activity
Uranium	0.04 pCi/g	1.5 pCi/g
Tc-99	0.8×10^{-5} pCi/g	1.0×10^{-3} pCi/g (15.9 ppb U)

TABLE E-5 Process Control Specifications for HF

Chemical Analysis or Physical Property	Specification
HF	49%
H_2SiF_6 (fluosilicic acid)	<70 ppm
H_2SO_4 (sulfuric acid)	<50 ppm
SO_2 (sulfur dioxide)	<50 ppm
Fe (iron)	<15 ppm
As (arsenic)	<14 ppm
U (uranium)	<0.5 ppm[a]
P (phosphorous)	<10 ppm
Color	Water white (clear)

[a] Based on mass concentration of uranium, regardless of radioactivity.

TABLE E-6 Process Control Specifications for Acid-Grade CaF_2

Chemical Analysis	Typical Range (%, except for As)
CaF_2	97.0 – 97.6
Total carbonate	0.8 – 1.8
SiO_2 (silica)	0.4 – 1.0
$BaSO_4$ (barium sulfate)	0.3 – 0.8
Pb (lead)	0.05 – 0.2
Fe	0.05 – 0.2
S (sulfide)	0.005 – 0.014
Moisture	<0.1 (8 – 9 as filtercake)
As (arsenic)	1 – 5 ppm

E.3 DESCRIPTION OF THE COMMERCIAL HF AND CaF_2 MARKETS AND POTENTIAL USES

Two potential markets for products made in the conversion process are considered here. The first is aqueous HF and the other is solid CaF_2. Small quantities of the CaF_2 would be produced in the preferred design. However, if no market for the HF could be found, large quantities of CaF_2 would be produced for sale to the market or for disposal as a solid waste. These products are discussed below.

E.3.1 Aqueous Hydrogen Fluoride (HF)

HF is the source of fluorine for most fluorine-containing chemicals. It is used either to directly manufacture such chemicals or to produce intermediates for their manufacture. HF is used to manufacture a wide variety of products, including refrigerants, gasoline, electronic components, aluminum, and plastics. It is used as a reactant or fluorinating source in the manufacture of fabric- and fiber-treating agents, herbicides, pharmaceutical intermediates, inert fluorinated liquids, and electronic grade etchants. Stannous fluoride, used in toothpaste, is manufactured by using HF. HF lasers have been tested for use in corneal transplants and for use in space. While the majority of HF used by industry is in the anhydrous or 100% form, aqueous HF solutions with concentrations of 70% and lower are used in stainless steel pickling, metal coatings, chemical milling, glass etching, exotic metals extraction, and quartz purification.

The commercial market in the United States for HF is in excess of 300,000 t (330,000 tons) per year (SRI Consulting 2002). However, only a small fraction (about 26,000 t [29,000 tons] or less than 9%) of that market is for aqueous HF. Uses for aqueous HF include the pickling metal and electronics industries. The U.S. capacity for producing HF consists of facilities owned by two companies. A plant near Geismar, Louisiana, has a production capacity of approximately 128,000 t (141,000 tons) per year, and a plant near La Porte, Texas, has a capacity of approximately 80,000 t (88,000 tons) per year. All of the aqueous HF produced in the United States is currently manufactured by Honeywell at the Geismar facility. Of the approximately 100,000 t (110,000 tons) of HF imported each year to the United States, Mexico provides approximately 75%, and Canada provides most of the remainder.

As the market information above shows, the HF produced during the DUF_6 conversion process would represent only about 10% and 6% of the U.S. production and demand, respectively. However, it would represent more than 70% of the total U.S. market for aqueous HF.

E.3.2 Calcium Fluoride (CaF_2)

On the basis of the assumption that a market would be found for the HF, the small quantity of CaF_2 that would be produced (approximately 42 t [46 tons] per year) would be disposed of as a solid waste. Part of this decision stems from the fact that at approximately $135/t (SRI Consulting 2002), annual revenues of only about $5,700 would be realized from the sale of this quantity of material. However, in the event that a market for the HF could not be found, approximately 20,600 t (22,700 tons) of CaF_2 would be produced annually. As shown in Table E-6, this material would be more than 97% pure. CaF_2 of this grade is commonly referred to as "acid-spar."

The U.S. market for fluorspar is approximately 600,000 t (661,000 tons) per year. Of this, approximately 65% is used for the production of HF. Since the closing of the Rosiclare, Illinois, mine in 1995, there has been no mining of fluorspar in the United States. Instead, demand has been met by imports and by purchases of CaF_2 from the National Defense Stockpile. Since the U.S. Department of Defense was authorized to sell fluorspar from its stockpile, these sales have represented 20% or more of the annual U.S. demand for CaF_2. In 2001, approximately 71,000 t (78,000 tons) of fluorspar were sold from the National Defense Stockpile. However, only about 9,500 t (10,500 tons) of acid-spar remain in the stockpile, with an additional 40,000 t (44,000 tons) of metallurgical grade fluorspar (a lower grade of fluorspar having a CaF_2 content of approximately 60% to 85%) (SRI Consulting 2002). Thus, it is not clear whether a significant portion of the U.S. demand for fluorspar could be met by the National Defense Stockpile.

The United States has been heavily dependent on imported fluorspar for many years. Imports have represented more than 90% of the U.S. demand in recent years, and, with the unavailability of the National Defense Stockpile to make any large-scale contributions, the percentage of CaF_2 imports is likely to get even higher. China has become the biggest supplier of fluorspar to the United States, providing 60% to 70% of the total U.S. imports. South Africa and Mexico are the other major suppliers to the United States, representing approximately 20% and 10%, respectively, of U.S. imports (SRI Consulting 2002).

E.4 OVERVIEW OF THE DOE PROCESS FOR ESTABLISHING AUTHORIZED LIMITS FOR RELEASE OF RADIOACTIVELY CONTAMINATED MATERIALS

As previously explained, two products of the DUF_6 conversion technology, HF and CaF_2, would have potential commercial use. However, because these products are expected to contain small amounts of volumetrically distributed residual radioactive material in the form of uranium and technetium-99 (Tc-99), they could not be sold for unrestricted use, unless DOE establishes authorized limits. In this context, authorized limits would be the maximum concentrations of uranium and Tc-99 allowed to remain volumetrically distributed within the HF and CaF_2 being sold.

Authorized limits are limits on the amount of residual radioactive material distributed volumetrically within property that DOE or its contractors release for unrestricted use. In cases involving volumetrically distributed residual radioactive material, such as the proposed release of HF and CaF_2, authorized limits are typically expressed as maximum allowable concentrations of specified residual radionuclides. Correspondingly, the authorized limits for HF and CaF_2 would specify maximum allowable concentrations of residual uranium and Tc-99.

In general, authorized limits for DOE property that will be released from DOE control are established and implemented on a case-specific basis according to a process defined by DOE Order 5400.5, "Radiation Protection of the Public and the Environment," and supporting guidance documents. This process (referred to as the authorized limits process) is designed to achieve the following goals (DOE 2002):

- Property is evaluated, radiologically characterized, and, where appropriate, decontaminated before release.
- The level of residual radioactive material in the property to be released is as near to background levels as is reasonably practicable, as determined by

applying the principles of the DOE ALARA (as low as reasonably achievable) process.

- All property releases meet authorized limits and are appropriately certified, verified, documented, and reported; public involvement and notification needs are addressed; and processes are in place to appropriately maintain records.

If UDS decides to release HF and/or CaF_2 from the DUF_6 conversion facilities for unrestricted use, the authorized limits process would include the following steps:

- Identification, for both HF and CaF_2, of several sets of potential maximum allowable concentrations for residual uranium and technetium-99 to serve as alternative sets of authorized limits for the purpose of ALARA analysis;

- Verification that each alternative set of authorized limits would comply with the DOE public dose limit;

- Selection through an ALARA analysis of one set each of authorized limits to be proposed for DOE approval from among the alternatives for both HF and CaF_2;

- Coordination with the U.S. Nuclear Regulatory Commission (NRC) or the responsible Agreement State agency;

- Development of survey and/or test methods, including provisions for quality assurance, to be used for demonstrating compliance with the proposed authorized limits;

- Acquisition of DOE approval of the proposed authorized limits for release of HF and CaF_2; and

- Placement in the DOE permanent record and in the public record of documentation supporting the release for unrestricted use of HF and CaF_2.

Additional information about each step in the authorized limits process is provided below.

E.4.1 Identification of Alternative Sets of Authorized Limits

As previously mentioned, Framatome ANP (one of the partners in UDS) currently operates an NRC-licensed, nuclear fuel manufacturing facility near Richland, Washington, that has a uranium conversion system with several design features similar to those of the proposed DUF_6 conversion facilities. HF from the Richland facility is sold under the provisions of that facility's NRC license. UDS would identify alternative sets of authorized limits for the release of HF and CaF_2 from the DUF_6 conversion facilities on the basis of the Framatome ANP facility's operating experience and the release limits specified for HF in its existing NRC license. The analyses presented in Section E.5 very conservatively estimate the impacts that would result from the use after sale of HF and CaF_2. Because these analyses are so conservative, they are expected to bound the impacts from selling HF and CaF_2, in compliance with any alternative set of authorized limits that UDS is likely to propose for DOE approval.

E.4.2 Verification of Compliance with the DOE Public Dose Limit

The DOE public dose limit for any member of the general public is 100 mrem total effective dose equivalent (TEDE) in a year. This limit applies to the sum of internal and external doses resulting from all modes of exposure to all radiation sources (i.e., both DOE and non-DOE sources) except background radiation sources and medical sources [DOE Order 5400.5, II.1.a.(3)(a)].

Because the DOE public dose limit applies to exposure from all sources and pathways, not just DOE sources, it would be very complicated and expensive to verify compliance. Therefore, for the purpose of establishing authorized limits, DOE has simplified verification of compliance with the primary dose limit by adopting a presumption of compliance if the dose from a DOE practice, such as releasing HF or CaF_2 containing residual radioactive material, to those individual members of the public most likely to receive the highest doses (referred to as the maximally exposed members of the public) can be demonstrated to comply with a dose constraint of one-quarter of the public dose limit (i.e., 25 mrem TEDE in a year) (DOE 2002). As a result, each alternative set of authorized limits identified by UDS for the release of HF and CaF_2 from the DUF_6 conversion facilities would have to be shown during the authorized limits process to result in doses to maximally exposed members of the public of no more than 25 mrem TEDE in a year.

E.4.3 ALARA Analysis

DOE Order 5400.5 requires that DOE contractors implement the ALARA process with respect to any DOE activity or practice that may cause members of the public to be exposed to radiation [DOE Order 5400.5, II.2]. For that reason, UDS is required to have an ALARA program for the DUF_6 facilities. The ALARA program must address activities on the sites that can cause members of the public or workers to be exposed to radiation. With respect to releases of property, such as the HF or CaF_2 produced by the DUF_6 conversion facilities, the ALARA program must include a procedure for an ALARA analysis to select authorized limits that would reduce radiation exposures to levels that are as low as practicable, taking into account technological, economic, safety, environmental, social, and public policy factors. There is no single best procedure for conducting an ALARA analysis. However, a key component should be a cost-benefit analysis (DOE 1997). For the purposes of this analysis, costs are assumed to accrue as a result of (1) expenditures to purchase, install, operate, and maintain the equipment and (2) expenditures to address health effects that may be induced by exposures of humans to ionizing radiation, such as cancer and genetic diseases. In evaluating expenditures to address health effects, DOE assumes that collective dose is proportional to the risk (i.e., the probability of observing radiation-induced health effects in a fixed population). Benefits accrue as a result of

(1) reduced expenditures for equipment and (2) reduced collective dose. To determine the collective dose to the exposed population for purposes of the ALARA analysis, the number of exposed persons would be multiplied by the average individual dose. The average individual dose is determined, to the extent practicable, by estimating anticipated doses to actual people (rather than doses to hypothetical maximally exposed persons), as was done for verification of compliance with the DOE public dose limit.

In addition to analysis of direct costs and benefits, consideration of technological, environmental, social, and public policy factors must also be a component of the ALARA analysis. While the particular nonradiological factors to be considered with respect to the release of HF and CaF_2 from the DUF_6 conversion facilities would be identified by UDS on the basis of case-specific issues, the following list provides examples of possible factors within each general category.

- *Technological factors:* promotion of emerging technology, technology transfer, robustness of technology, industrial safety of technology, and track record of technology;
- *Environmental factors:* effects on ecological resources, waste generation rates, ease of management of resulting wastes, probable disposition of resulting wastes, and fate of residual radioactive material released;
- *Social factors:* impacts on local/national product market, employment, public acceptance, environmental justice considerations, and transportation effects; and
- *Public policy factors:* consistency with waste minimization principles, promotion of resource conservation, adaptability to existing procedures and protocols, and environmental permitting issues.

E.4.4 Coordination with NRC and Agreement States

DOE policy prohibits the transfer of radioactive materials that require an NRC license to members of the public who are not licensed to receive them (see, e.g., Sections 3.7 and 5.6 of DOE [2002] and Section IV.5 of DOE Order 5400.5 [DOE 1990]). Accordingly, before DOE approves authorized limits for the release of HF or CaF_2, the NRC or responsible Agreement State must be consulted to ensure that releases under the proposed authorized limits do not violate any licensing requirements.

E.4.5 Development of Measurement Protocols

Radiological surveys and measurements of residual radioactive material in HF and CaF_2 must be conducted before the material is released. To accomplish this, measurement protocols, procedures, and equipment must be specified and approved by DOE as being sufficient to meet data quality objectives for characterization of the material being released and verification of compliance with the authorized limits. To obtain DOE approval for measurement protocols and procedures, UDS will need to show that such actions comply with the quality assurance requirements contained in the *Code of Federal Regulations*, Title 10, Part 830 (10 CFR 830), "Nuclear Safety Management," Subpart A.

E.4.6 Obtaining DOE Approval of Authorized Limits

Authorized limits and survey protocols for the sale of HF and CaF_2 containing volumetrically distributed residual radioactive material must be approved by both the responsible DOE Field Element and the Assistant Secretary for Environment, Safety, and Health. The application for these DOE approvals would contain the information listed below.

- Description of the anticipated physical, chemical, and radiological attributes of the HF and CaF_2 proposed for release;

- Descriptions of the alternative sets of authorized limits evaluated in the ALARA analysis;

- For each alternative set of authorized limits, the expected doses to those individual members of the public most likely to receive the highest doses in the actual and likely use scenario and in the worst plausible use scenario;

- Results of the ALARA analysis, including collective doses and other relative costs and benefits for each alternative set of authorized limits, and discussions of any nonradiological factors that influenced the selection of the proposed authorized limits;

- Clear and concise statement of the proposed authorized limits for HF and CaF_2, including the limit for each isotope of concern;

- Discussion of the measurement protocols that would be implemented to determine compliance with the proposed authorized limits; and

- Information on activities that have been conducted to gain agreement with representatives of affected groups, including documentation that coordination has occurred with NRC personnel or Agreement State representatives.

E.4.7 Final Documentation

DOE Order 5400.5 requires that documentation of specific information related to releases of property containing residual radioactive material be made part of DOE's permanent record. In addition, DOE recognizes the importance of public participation in its program operations (DOE 2000) and instructs its contractors to make documentation supporting approval of authorized limits and subsequent releases of property containing residual radioactive material available to the public (DOE 2002). Accordingly, in addition to the information provided in this EIS, the documentation listed below regarding DOE's approval of authorized limits and subsequent sales of HF and CaF_2 from the DUF_6 conversion facilities would be made available in the public record.

- Application submitted by UDS to DOE requesting that authorized limits be established for the sale of HF and CaF_2 from the DUF_6 conversion facilities;
- DOE's final approval of authorized limits for the sale of HF and CaF_2 from the DUF_6 conversion facilities; and
- Periodic performance reports submitted by UDS to DOE summarizing the contents of (1) certificates of conformance issued by UDS after batches of HF and CaF_2 destined for sale have been sampled and analyzed according to approved procedures and determined to meet the applicable authorized limits, (2) analytical results from the sampling and analysis, and (3) shipping manifests indicating the disposition of the HF and CaF_2.

E.5 BOUNDING ESTIMATION OF POTENTIAL HUMAN HEALTH IMPACTS FROM HF AND CaF_2 SALE AND USE

E.5.1 Radiological Impacts

E.5.1.1 Exposures to HF

Bounding radiological impacts resulting from exposure to trace amounts of uranium (U) and technetium (Tc) in HF were calculated by considering a hypothetical worker working in close proximity to an HF storage tank. The storage tank was assumed to be a 10,000-gal (37,854-L) cylindrical container, with a diameter of 3.2 m (10.5 ft) and a height of 4.7 m (15.4 ft). The worker was assumed to work 2,000 hours per year at a distance of 1 m (3 ft) from the storage tank. Concentration of U in the HF solution was assumed to be 3 pCi/mL (6.4 parts per million [ppm]), the NRC-approved limit for the Framatome ANP facility; the concentration of Tc was assumed to be 15.9 parts per billion of uranium (ppb U), or 2×10^{-3} pCi/mL.

Potential radiation exposure incurred by the hypothetical worker was considered to result from external radiation and inhalation. Because of the corrosive nature of HF, ingestion of HF was considered extremely unlikely and was excluded from consideration. According to Occupational Safety and Health Administration (OSHA) standards, the permissible exposure limit to HF vapor is 3 ppm. For concentrations of 3 to 30 ppm, a minimum of a full-face respirator equipped with an HF canister must be worn. Unlike HF, which can vaporize under room temperature, U and Tc oxides that are contained in HF solution would most likely stay in the solution. However, for the purpose of calculating a bounding exposure, the oxides were assumed to be entrained in the vaporized HF molecules. The permissible limit of 3 ppm was assumed as the air concentration for HF. The DOE-recommended air release fraction (ARF) of 0.002 for radionuclide solute in aqueous solutions (DOE 1993) was assumed for the U and Tc oxides. The bounding inhalation dose was calculated by using an inhalation rate of 1.2 m^3/h and the maximum inhalation dose conversion factors (Class Y for U and Class W for Tc) from the U.S. Environmental Protection Agency (EPA 1988). The bounding external dose was calculated with the MicroShield computer code (Negin and Worku 1992).

On the basis of the above assumptions, it is estimated that total radiation dose for a worker in close proximity to the HF storage tank would be 0.034 mrem/yr. External radiation contributes 0.027 mrem/yr to the total dose and is the dominating pathway. Radiation doses result primarily from exposure to uranium isotopes and their decay products; the dose contribution from Tc is negligible. It should be reiterated that this bounding dose was estimated by combining several extremely conservative assumptions; for example, the close proximity to the storage tank, the exposure duration of all the work hours in a year, the entrainment of U and Tc oxides, and the bounding air release fraction for U and Tc oxides. In reality, the actual dose resulting from using or handling the HF product would be much smaller. For comparison, the radiation dose constraint set to protect the general public from a DOE practice is 25 mrem/yr (see Section E.4).

As discussed in Appendix A, Sections A.4 through A.6, transuranic (TRU) radionuclides are not expected to reach the conversion chambers in the facility and should not be present in any measurable quantities in the conversion products. Any minute concentration of such radionuclides in the products would be much less than the 10% threshold discussed in Section A.5. As a result, their contribution to doses calculated in this appendix would be negligible.

E.5.1.2 Exposures to CaF_2

Bounding radiological impacts resulting from exposure to trace amounts of U and Tc in CaF_2 were calculated by considering an exposure scenario similar to that considered for HF. A hypothetical worker was assumed to work in close proximity to a CaF_2 filling bag. The filling bag was assumed to have a 19-t (21-ton) capacity, with a diameter of 2.8 m (9.2 ft) and a height of 1.2 m (4 ft). The worker was assumed to work 2,000 hours per year at a distance of 1 m (3 ft) from the filling bag. Concentrations of U and Tc in CaF_2 were assumed to be half of those in HF solution, that is, 1.5 pCi/g for U and 15.9 ppb U or 1×10^{-3} pCi/g for Tc.

Potential radiation exposure incurred by the hypothetical worker was considered to result from external radiation, inhalation, and ingestion. The U and Tc oxides were assumed to attach to the CaF_2 particles and to become suspended in air during the filling operation. According to OSHA standards (OSHA 2002), the particulate emission limit for fluoride compounds is 2.5 mg/m^3. This limit was used to calculate the air concentration for CaF_2 and, subsequently, the air concentrations of U and Tc. The bounding inhalation dose was calculated by assuming a respirable fraction of 10% and by using an inhalation rate of 1.2 m^3/h and the maximum inhalation dose conversion factors (Class Y for U and Class W for Tc) from the EPA (EPA 1988). The hypothetical worker was also assumed to ingest CaF_2 particles incidentally. The ingestion rate was assumed to be 100 mg/d. Like inhalation, the maximum ingestion dose conversion factors for U and Tc from the EPA (EPA 1988) were used to calculate the bounding ingestion dose. The bounding external dose was calculated with the MicroShield computer code (Negin and Worku 1992).

On the basis of the above assumptions, the estimated total radiation dose for a worker in close proximity to the CaF_2 filling station would be 0.234 mrem/yr. External radiation contributes only 0.007 mrem/yr to the total dose, which is dominated by the contribution from inhalation, 0.217 mrem/yr. The rest of the dose is contributed by ingestion, 0.01 mrem/yr. Radiation doses result primarily from exposure to uranium isotopes and their decay products; the dose contribution from Tc is negligible. It should be reiterated that this bounding dose was estimated by combining several extremely conservative assumptions, for example, the close proximity of the worker to the filling bag, the exposure duration of all the work hours in a year, and the maximum allowable particulate concentration of fluoride compounds in the air. In reality, the actual dose resulting from use or handling the CaF_2 product would be much smaller. For comparison, the radiation dose constraint set by DOE to protect the general public from a DOE practice is 25 mrem/yr (see Section E.4).

E.6 POTENTIAL SOCIOECONOMIC IMPACTS OF HF AND CaF_2 SALE AND USE

The *DUF_6 Conversion Product Management Plan* (UDS 2003a) identifies potential uses of conversion facility products, either as CaF_2 or as aqueous HF. This section assesses the impacts from the use of these products at the U.S. locations likely to be directly affected and in the U.S. economy as a whole. Since the success of CaF_2 and HF sales to chemical manufacturers depends on future market conditions, the impacts of treating CaF_2 or aqueous HF as waste are also considered.

E.6.1 Impacts from the Sale and Use of HF

The current aqueous HF producers have been identified as a potential market for the 19,200 t (21,200 tons) of aqueous HF that could be produced by the proposed conversion facility (UDS 2003a), with UDS-produced aqueous HF replacing some or all of current U.S. production. The impact of HF sales on the local economy in which the existing producer is located and on the U.S. economy as a whole is likely to be minimal.

All aqueous HF currently produced in the United States is manufactured by Honeywell at a facility in Geismar, Louisiana. Additional plants owned by Honeywell and other companies serving the U.S. market are located in Canada and Mexico. The Geismar plant as a whole employs a fairly large number of workers and manufactures a range of industrial chemicals, including both anhydrous and aqueous HF, which is marketed in various concentrations. The manufacture of aqueous HF employs a small number of production and clerical workers. A fleet of dedicated tankers employing a small number of drivers is used to transport HF to end-users in various locations in the United States (Honeywell International, Inc. 2002).

Although the actual impact of the sale of UDS HF is not known, if Honeywell were to purchase HF from UDS, production of aqueous HF at the Geismar facility might be reduced or cease altogether, which would mean the loss of some or all aqueous HF production and transportation employment at the plant and the loss of some related clerical employment.

The loss of employment and income at the Geismar facility with the end of aqueous HF production and transportation would lead to minor additional losses in the surrounding economy, with a slight reduction in activity associated with reduced wage and salary spending. Offsetting these losses would be a slight increase in transportation employment at Paducah and Portsmouth associated with the shipment of HF from the UDS facilities. There would also be benefits to the U.S. balance of trade, with the use of UDS-produced HF reducing the need to import CaF_2, the raw material for HF production. These benefits would be minimal, however, given the small quantity of HF production likely to take place at the proposed facilities and the relatively low potential value of the HF product. There would also be some benefits to Honeywell in terms of cost savings associated with the end of blending anhydrous with aqueous HF. However, if HF concentrations were different than those preferred by end-users, some additional capital and operating expenditures might be needed to accommodate the change in acid concentration (Taylor 2003).

E.6.2 Impacts from the Sale and Use of CaF_2

No market for the 20,600 t (22,700 tons) of CaF_2 that might be produced in the proposed conversion facilities at Paducah and Portsmouth annually has been identified (UDS 2003a). If a market for CaF_2 is found, the impact of CaF_2 sales on the U.S. economy would likely be minimal.

Although CaF_2 was produced in the United States until 1995, most of the 636,000 t (701,000 tons) of CaF_2 consumed in the United States in 2001 was imported. While the use of CaF_2 produced at the UDS facilities would affect the balance of trade, this impact would be minor, given the small quantity of CaF_2 production at the proposed facilities and the relatively low potential value of the CaF_2 product. There might be benefits to U.S. users of CaF_2 if the price of CaF_2 produced in the proposed facilities provided a significant incentive to use the UDS products rather than imported material. However, a price range for UDS-produced CaF_2 has not yet been established, and since plentiful supplies of CaF_2 are available from overseas, the small amount of CaF_2 that would be produced would not likely have a significant effect on the domestic market.

E.6.3 Impacts from the Nonuse of HF and CaF_2

If no market for either HF or CaF_2 is established, it is likely that the material would be disposed of as waste. This would require shipping these wastes to an approved waste disposal facility. While disposal activities would result in a small number of transportation jobs and might lead to additional jobs at the waste disposal facility, the impact of these activities in the transportation corridors, at the waste disposal site(s), and on the U.S. economy would be minimal.

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APPENDIX F:

ASSESSMENT METHODOLOGIES

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ASSESSMENT METHODOLOGIES

In general, the activities assessed in this environmental impact statement (EIS) could affect workers, members of the general public, and the environment during construction of new facilities, during routine operation of facilities, during transportation, and during facility or transportation accidents. Activities could have adverse effects (e.g., human health impairment) or positive effects (e.g., regional socioeconomic benefits, such as the creation of jobs). Some impacts would result primarily from the unique characteristics of the uranium and other chemical compounds handled or generated under the alternatives. Other impacts would occur regardless of the types of materials involved, such as the impacts on air and water quality that can occur during any construction project and the vehicle-related impacts that can occur during transportation. The following sections describe the assessment methodologies that were used to evaluate potential environmental impacts associated with the no action alternative and the action alternatives.

F.1 HUMAN HEALTH AND SAFETY — NORMAL FACILITY OPERATIONS

F.1.1 Radiological Impacts

F.1.1.1 Receptors

For this EIS, radiation effects during normal (or routine) operations were assessed by first estimating the radiation dose to workers and members of the general public from the anticipated activities required under each alternative. The analysis considered three groups of people: (1) involved workers, (2) noninvolved workers, and (3) members of the general public. They are defined as follows:

- *Involved Workers:* Persons working at a site who are directly involved with the handling of radioactive or hazardous materials.
  - They might be exposed to direct gamma radiation emitted from radioactive materials, such as depleted uranium hexafluoride (DUF_6) or other uranium compounds.
  - The radiation doses they would receive from inhaling uranium would be very small when compared with the direct radiation doses that result from enclosed processes. Containment and ventilation controls would be used to reduce airborne radionuclides in workplaces. Furthermore, the requirement of wearing protective respirators would limit inhalation exposures to very low levels.

- Involved workers would be protected by a dosimetry program designed to control doses below the maximum regulatory limit of 5 rem/yr for workers (*Code of Federal Regulations*, Title 10, Part 835 [10 CFR Part 835]).

- *Noninvolved Workers:* Persons working at a site but not directly involved with the handling of radioactive or hazardous materials.

  - They might be exposed to direct radiation from radioactive materials (although at a great distance) and to trace amounts of uranium released to the environment through site exhaust stacks.

  - They could receive radiation exposure through inhalation of radioactive material in the air, external radiation from radioactive material deposited on the ground, and incidental ingestion of soil.

- *Members of the General Public:* Persons living within 50 mi (80 km) of the site.

  - They might be exposed to trace amounts of uranium released to the environment through exhaust stacks or wastewater discharges.

  - They could receive radiation exposure through inhalation of radioactive material in the air, external radiation from deposited radioactive material, and ingestion of contaminated water, food, or soil.

For the noninvolved workers and general public, doses were estimated for the group as a whole (population or collective dose) as well as for a maximally exposed individual (MEI). The MEI is defined as a hypothetical person who — because of proximity, activities, or living habits — could receive the highest possible dose. The radiation exposures of the MEIs would be bounded by the exposure calculated on the basis of maximum air concentrations for airborne releases and on the basis of maximum surface water or groundwater concentrations for waterborne releases. For involved workers, the average individual dose rather than the MEI dose was estimated because of the uncertainty about the activities of each involved worker. In addition to the average individual dose, the collective dose was also estimated for involved workers. Under actual conditions, all radiation exposures and releases of radioactive material to the environment are required to be as low as reasonably achievable (ALARA), a practice that has as its objective the attainment of dose levels as far below applicable limits as possible.

F.1.1.2 Radiation Doses and Health Effects

All radiological impacts were assessed in terms of committed dose and associated health effects. The calculated dose was the total effective dose equivalent (10 CFR Part 20), which is the sum of the deep dose equivalent from exposure to external radiation and the 50-year committed effective dose equivalent from exposures to internal radiation. Radiation doses were calculated in units of milliroentgen-equivalent man (mrem) for individuals and in units of person-rem for collective populations.

The potential radiation doses resulting from normal operations would be so low that the primary adverse health effects would be the potential induction of latent cancer fatalities (LCFs). Health risk conversion factors (expected LCFs per absorbed dose) from Publication 60 of the International Commission on Radiological Protection (ICRP 1991) were used to convert radiation doses to LCFs, that is, 0.0005 per person-rem for members of the general public and 0.0004 per person-rem for workers. Adverse health effects for individuals were assessed in terms of the probability of developing an excess LCF; adverse health effects for collective populations were assessed as the number of excess LCFs expected in the population.

F.1.1.3 Exposure Pathways

External radiation would be the primary exposure pathway for involved workers because they would directly handle radioactive materials and/or be at a close distance from radiation sources. Radiation exposures through inhalation and incidental ingestion of contaminated particulates would be possible; however, the exposure would probably be very small compared with exposures from external radiation. Operations that could result in potential airborne emissions would be confined and most likely would be automated and controlled remotely. Even if airborne emissions did occur, the use of high-efficiency particulate air (HEPA) filters and various air circulation systems would reduce the amount of airborne pollutants in the workplace to a minimal level. Exposures from inhalation could also be prevented by implementation of ALARA practices, as required. For example, workers could wear respirators while performing activities associated with potential airborne emissions. Potential exposure from incidental ingestion of particulates could be reduced if workers wore gloves and followed good working practices.

Inhalation of contaminated particulates and incidental ingestion of deposited particulates were considered for noninvolved workers who, because of being located farther away from the radiation sources handled in the facilities, would not be exposed to direct external radiation from those sources. However, secondary external radiation would be possible from the deposited radionuclides on ground surfaces and from airborne radionuclides when the emission plume from the stacks of the processing buildings passed the locations of the noninvolved workers. The potential radiation exposure would be bounded by the exposure associated with the largest downwind air concentration. To obtain conservative estimates of the bounded value, the noninvolved workers were assumed to be exposed to radiation caused by airborne emissions without any shielding from buildings or other structures.

Radiation exposures of members of the off-site general public were assessed for both airborne and waterborne pathways. The airborne pathways included inhalation of contaminated particulates, external radiation from deposited radionuclides and from airborne radionuclides, incidental ingestion of deposited radionuclides, and ingestion of contaminated food products (plants, meat, and dairy products). Plants grown in the area where the emission plume passed could become contaminated by deposition of radionuclides on leaves or ground surfaces.

Radionuclides deposited on leaves could subsequently translocate to the edible portions of the plants; those deposited on ground surfaces could subsequently be absorbed by plant roots. Livestock and their products could become contaminated if the livestock ate the contaminated surface soil and plants.

The waterborne pathways included ingestion of surface water and groundwater; ingestion of contaminated plant foods, meat, and dairy products; and potential radon exposure from using contaminated water. Plant foods and fodder could be contaminated from irrigation with contaminated water, and the livestock and their products could become contaminated if the livestock were fed with contaminated water and ate contaminated fodder. Potential indoor radon exposures would be possible if contaminated water was used indoors and radon gas emanated from the water. Because of the large dilution capability of surface water at the site, the estimated radionuclide concentrations in surface water were always very low, and potential radiation exposures from the food chain pathways associated with these low water concentrations would be negligible. Therefore, radiation exposures resulting from contaminated surface water were assessed only for the drinking water pathway. The dilution capability would be smaller for groundwater, resulting in higher groundwater concentrations. Therefore, if the groundwater was predicted to be contaminated, radiation exposures from the food chain pathways, radon pathway, and drinking water pathway were all estimated.

Radiation exposure of the off-site general public MEI would be bounded by the exposure associated with the maximum downwind air concentration and maximum water concentration.

F.1.1.4 Data Sources and Software Applications

Potential impacts associated with the operations of the conversion facility were estimated or calculated using measurement data or computer codes.

The external exposures incurred by the involved workers in the conversion facility were estimated on the basis of the measurement data for worker exposures at the Framatome Advanced Nuclear Power (ANP) facility in Richland, Washington. A dry conversion process is used to convert UF_6 into uranium oxide at the Framatome facility. A similar conversion process would be implemented at Portsmouth. According to Uranium Disposition Services, LLC (UDS 2003a), the key components of the conversion facility at Portsmouth would be similar to those at Framatome; therefore, conditions for potential worker exposures are expected to be similar at these two facilities. The worker exposure data from Framatome provided in the UDS National Environmental Policy Act (NEPA) data package (UDS 2003b) were used to obtain involved worker exposures at Portsmouth, with consideration of different specific activities in the processed uranium materials and different uranium processing rates. Potential external radiation exposure for employees working in the cylinder storage yards resulting from loading and unloading cylinders were estimated with the use of the MicroShield computer code (Negin and Worku 1992). To use MicroShield, potential exposure distances, duration of activities, and number of workers involved in each activity were developed. MicroShield is a commercial software program designed to estimate external radiation doses from a variety of sources; it is widely used for such applications. External exposures for cylinder yard workers from maintenance activities were estimated on the basis of past site-specific monitoring data. The increase in cylinder number resulting from arrival of the ETTP cylinders and decrease in cylinder number resulting from conversion of DUF_6 to U_3O_8 were both taken into account. In actuality, the radiation dose to the individual worker would be monitored and maintained below the DOE administrative control limit of 2,000 mrem/yr (DOE 1992), which is below the regulatory dose limit of 5,000 mrem/yr (10 CFR Part 835).

Radiological impacts from airborne pathways were estimated with the emission data provided in the UDS NEPA data package (UDS 2003b) and the use of the CAP88-PC computer code (Chaki and Parks 2003). CAP88-PC was developed under the sponsorship of the U.S. Environmental Protection Agency (EPA) and was designed for use in demonstrating compliance with regulatory requirements on air emissions. It uses site-specific or representative meteorological data (joint frequency data) to estimate the air concentrations at downwind locations, calculates the biota concentrations by using biotransfer models, and then estimates the corresponding radiation doses.

Depending on the location of the conversion facility, the on-site maximum air concentrations would be different from the off-site maximum air concentrations; however, on the basis of the small emission rate provided by UDS (UDS 2003b), both maximum concentrations would be very small. In this EIS, a bounding approach was used to find the potential exposures of the MEI of the noninvolved workers and the general public.

The absolute maximum downwind air concentrations determined solely by the meteorological data were used to find the bounding exposures of both MEIs. Because of the use of the bounding approach, the potential MEI impacts associated with the different conversion facility locations would be the same. This bounding approach was judged to be acceptable because the location of the conversion facility would not be determined on the basis of the MEI exposures, since such impacts would be insignificant.

According to the CAP88-PC results, the maximum downwind air concentrations would be located at approximately 380 m (1,247 ft) from the emission stack of the conversion facility. The bounding collective exposure of the noninvolved workers was estimated by multiplying the MEI dose with the population of noninvolved workers. The number of noninvolved workers was estimated by using year 2000 information on sitewide worker distribution. Collective off-site population exposure was calculated by using CAP88-PC with 2000 population distribution data. A range of 50 mi (80 km) around the site was considered.

Because no waterborne release of uranium is expected from the conversion facility process water (UDS 2003b), potential impacts resulting from the use of contaminated surface water were not estimated.

F.1.1.5 Source for the Derived Results

Results presented in this EIS for the no action alternative and cylinder preparation activities at ETTP under the action alternatives were derived from the site-specific data compilation reports prepared for the DUF_6 management program in support of NEPA requirements (Hartmann 1999a-c) and the programmatic EIS (PEIS) (U.S. Department of Energy [DOE] 1999). The receptors and exposure pathways for the data compilation report and the PEIS were the same as those described above. In addition, site-specific meteorological and aquatic environmental data at the Portsmouth and ETTP sites were used. The assumptions used for the no action alternative in the data compilation report were considered to bound the potential impacts. Detailed discussions on the assumptions are provided in Section 5.1.1 of this EIS. Worker activities for preparing cylinders for shipment (including retrieving cylinders, inspecting them, and loading them to a transportation vehicle) from ETTP to Portsmouth were assumed to be the same as those considered in the PEIS. Therefore, impacts for the involved workers presented for the cylinder preparation activities in the PEIS were used in this report.

For involved workers, radiation exposures were dominated by the external exposure pathway. Potential doses in the data compilation report (UDS 2003b) and PEIS (DOE 1999) were estimated with information on worker activities and with the use of the MicroShield computer code (Negin and Worku 1992). Radiation exposures of the noninvolved workers, on the other hand, would result mainly from the airborne release of depleted uranium. For cylinder preparation activities, air emissions are expected to be negligible. Therefore, no impact would be expected for the noninvolved workers. Under the no action alternative, the emissions locations and emissions rates assumed in the data compilation report (Hartmann 1999b) were adopted to bound the potential impacts. Consequently, the results that were obtained by using the emissions data and an air dispersion model from that report were used directly for the MEIs. For the collective exposure, an upper bound estimate was obtained by multiplying the MEI dose with the sitewide worker population. The upper bound values rather than the actual values were used because the potential level of radiation exposures would be very small (< 0.1 mem/yr).

Radiation exposures of the general public would result from both airborne and waterborne releases. For cylinder preparation activities, there would be negligible air emissions and waterborne releases. Therefore, no impact would be expected for the general public. For the no action alternative, because the bounding assumptions used in the data compilation report were adopted, results from that report were used directly in this EIS for the MEI. The collective exposures were obtained by scaling the results in the data compilation report with the population size. This scaling approach was used because of the very small exposures and the small change (less than 3%) in the total population within 50-mi (80-km) of the Portsmouth site between 1990 and 2000.

F.1.1.6 Exposure Parameters and Dose Conversion Factors

Inhalation rates for workers were assumed to be 1.2 m^3/h (ICRP 1994), with an exposure duration of 8 hours per day for 250 days per year. The inhalation rate for the general public was assumed to be 20 m^3/d, with an exposure duration of 24 hours per day for 365 days per year. The ingestion rate for drinking water for the public was assumed to be 2 L/d. No building shielding effect was considered for inhalation and external radiation exposures. Therefore, radiation doses estimated in this way would be greater than the actual doses, which would always be associated with some shielding from buildings.

Site-specific agriculture data (yield per unit area) for food crops and fodder were used. Default food consumption data for a rural setting from CAP88-PC were also used. Nevertheless, it was found that radiation doses from the food ingestion pathways constituted only a small fraction of the total dose, which is dominated (>90%) by doses from inhalation (for airborne pathways).

CAP88-PC uses the EPA internal dose conversion factors to estimate internal doses (EPA 1988). The inhalation doses depend strongly on the solubilities of the inhaled chemicals. With high solubility, a chemical would be excreted from the human body within a shorter period of time and would result in less internal exposure. For U_3O_8, it was assumed to remain in the human body for years, thus resulting in greater radiation exposures. The ingestion doses were estimated by assuming that the uranium compounds would be absorbed by the gastrointestinal tract to the largest extent possible for uranium compounds; this would result in the maximum internal exposure.

Key Concepts in Estimating Risks from Low-Level Chemical Exposures

Reference Level

- Intake level of a chemical below which adverse effects are very unlikely.

Hazard Quotient

- A comparison of the estimated intake level or dose of a chemical with its reference dose.
- Expressed as a ratio of estimated intake level to reference dose.
- Example:
  - The EPA reference level (reference dose) for ingestion of soluble compounds of uranium is 0.003 mg/kg of body weight per day.
  - If a 150-lb (70-kg) person ingested 0.1 mg of soluble uranium per day, the daily rate would be 0.1 ÷ 70 ≈ 0.001 mg/kg, which is below the reference dose and thus unlikely to cause adverse health effects. This would yield a hazard quotient of 0.001 ÷ 0.003 = 0.33.

Hazard Index

- Sum of the hazard quotients for all chemicals to which an individual is exposed.
- A value less than 1 indicates that the exposed person is unlikely to develop adverse human health effects.

F.1.2 Chemical Impacts

The method used to assess the potential human health impacts from exposures to chemicals of concern emitted during normal operations was discussed in detail in the DUF_6 PEIS (DOE 1999). The chemicals of greatest concern are soluble and insoluble uranium compounds and hydrogen fluoride (HF). Uranium compounds can cause chemical toxicity to the kidneys; soluble compounds are more readily absorbed into the body and thus are more toxic to the kidneys. HF is a corrosive gas that can cause respiratory irritation in humans, with tissue destruction or death resulting from exposure to large concentrations. No deaths are known to have occurred as a result of short-term (i.e., 1 hour or less) exposures to 50 parts per million (ppm) or less of HF. Neither uranium compounds nor HF are chemical carcinogens; thus, cancer risk calculations were not applicable for this assessment.

For long-term, low-level (chronic) exposures to uranium compounds and HF emitted during normal operations, potential adverse health effects for the hypothetical MEI in the noninvolved worker and general public populations were calculated by estimating the intake levels associated with anticipated activities. Intake levels were then compared with reference levels below which adverse effects are very unlikely. Risks from normal operations were quantified as hazard quotients and hazard indices (see text box on previous page).

F.1.2.1 Receptors

The main source of impacts to noninvolved workers and members of the public would be the emission of trace amounts of uranium compounds or HF from exhaust stacks. Chemical exposures for involved workers would depend, in part, on detailed facility designs that have not yet been determined; however, the workplace environment would be monitored to ensure that airborne chemical concentrations were kept below applicable exposure limits.

F.1.2.2 Chemical Doses and Associated Health Effects

For normal operations, risks were expressed by using the hazard quotient concept for exposures to noncarcinogens (i.e., comparison of estimated receptor doses with reference levels or doses below which adverse effects would be very unlikely to occur). In general, the chemicals of concern for this EIS were uranium and fluoride compounds, especially HF gas. These substances would not be chemical carcinogens; thus, cancer risk calculations were not applicable. The toxicity of the exposures for relevant receptors was estimated through comparison with oral and inhalation reference levels (levels below which adverse effects would be very unlikely to occur). The oral reference dose of 0.003 mg/kg-d was used for evaluating risks from ingestion of soluble uranium compounds; the EPA derived this value on a the basis of a lowest-observed-adverse-effect level in rabbits of 3 mg/kg-d of uranyl nitrate hexahydrate, combined with an uncertainty factor of 1,000 (Maynard and Hodge 1949; EPA 2003a). Because of conflicting results concerning absorption of insoluble uranium compounds such as U_3O_8 from the gastrointestinal tract, the oral reference dose of 0.003 mg/kg-d was also used in this analysis for calculating hazard quotients for this compound. This assumption is conservative because the gastrointestinal tract would absorb a smaller amount of insoluble than soluble uranium compounds.

Inhalation reference concentrations for uranium compounds and HF are not currently available from standard EPA sources. To assess potential risks from inhalation of these compounds, derived reference levels were developed from proposed Occupational Safety and Health Administration (OSHA) permissible exposure limits (PELs) (29 CFR Part 1910.1000, Subpart Z, as of February 2003). The 8-hour time-weighted-average PEL for soluble uranium compounds is 0.05 mg/m^3; for insoluble uranium compounds, it is 0.25 mg/m^3; and for HF, it is 3 ppm (2.5 mg/m^3). These values were converted to assumed inhalation reference level values for noninvolved workers in mg/kg-d by assuming an inhalation rate of 20 m^3/d and a body weight of 70 kg (154 lb), resulting in derived worker inhalation reference level values of 0.014 and 0.71 mg/kg-d for soluble uranium compounds and HF, respectively.

The inhalation reference level calculated for soluble compounds was also used for insoluble uranium compounds. To generate derived inhalation reference level values for the general public, these worker values were adjusted to account for increased exposure duration of the general public (assumed to be 168 hours per week rather than 40 hours per week); an additional uncertainty factor of 10 was used to account for sensitive subpopulations in the general public. This results in derived inhalation reference levels for the general public of 0.0003 and 0.02 mg/kg-d for uranium compounds and HF, respectively.

The reference levels used for preliminary evaluation of general public hazard quotients and carcinogenic risks from the existing environment were obtained from the EPA's Integrated Risk Information System (IRIS) when available (EPA 2003a). The derived reference concentration levels for uranium compounds and HF discussed above were used as reference levels for evaluating inhalation of these substances.

F.1.2.3 Exposure Pathways and Parameters

As described in Section F.1.1 (radiological impacts for normal facility operations), the chemical exposures for the noninvolved worker and general public MEIs would result mainly from airborne releases from the conversion facility. The maximum downwind air concentrations of uranium compounds and HF emitted from the conversion facility were calculated. These maximum downwind concentrations would be the same for the three alternative locations at Portsmouth, although the exact location of the maximum level would be different. The maximum concentrations were used to estimate maximum exposures for both the noninvolved worker MEI and the general public MEI, although the maximum concentration location could be either within or outside the gaseous diffusion plant boundaries, depending on the location of the conversion facility. This simplified approach to the analysis of potential chemical impacts is justified because the exposures and hazard indices calculated on the basis of these maximum possible exposures are very low. In other words, the identification of very small differences in hazard indices for the MEI receptors for the three alternative locations at the site would not be helpful in differentiating chemical exposure impacts for the locations, because all the exposures would be very small and would not result in adverse effects (see the results in Chapter 5 of this EIS).

Differences in estimated exposures and hazard indices for the noninvolved worker MEI and the general public MEI result from differences in assumed exposure times (e.g., the general public MEI is assumed to be a resident exposed continually, whereas the noninvolved worker MEI would be exposed for only 8 hours per day) and from differences in reference doses for workers and the general public.

For the MEI receptors, it was also assumed that exposure could occur through incidental soil ingestion. Similar to the approach used to assess inhalation exposures, it was assumed that both the noninvolved worker MEI and the general public MEI could be exposed to the maximum estimated soil concentration of contaminants associated with conversion plant emissions, whether that location was inside or outside the gaseous diffusion plant boundaries. No waterborne release of uranium is expected from construction and operation of the conversion facility (UDS 2003b); therefore, potential impacts resulting from use of contaminated water were not estimated. For the no action alternative analyses, potential chemical exposures from runoff water contaminated through cylinder breaches were calculated by using the estimated surface or groundwater concentrations obtained through water quality analyses.

F.1.2.4 Exposure Modeling and Risk Evaluation

Media-specific concentrations of contaminants associated with the normal operation of the facility for the various options were modeled on the basis of effluent data provided in the NEPA data report (UDS 2003b). For airborne pathways, these effluent amounts were modeled by using either the CAP88-PC computer code (see Section F.1.1) or the Industrial Source Complex (ISC) computer code (see Section F.4.1).

Modeled concentrations of contaminants in the various environmental media were used to estimate average daily intakes for the various receptors examined. The ratios of the daily intakes to appropriate reference levels were calculated to generate hazard quotients. Hazard quotients were summed for individual contaminants and across all appropriate exposure routes (e.g., inhalation, soil ingestion) to generate hazard indices for the noninvolved worker MEI and the general public MEI. These hazard indices were compared with the reference hazard index of 1. A hazard index of less than 1 is interpreted to indicate that adverse noncancer effects are unlikely; a hazard index of greater than 1 indicates that adverse effects are possible for the MEI and that further investigation of potential exposures and additivity of individual contaminant toxicity are warranted.

When no adverse effects are expected for the MEI of a given population (i.e., the hazard index is less than 1), then, by definition, no adverse effects are expected in that population. Therefore, calculation of population risks is not applicable when MEI hazard indices are less than 1.

F.2 HUMAN HEALTH AND SAFETY — FACILITY ACCIDENTS

F.2.1 Radiological Impacts

The DUF_6 PEIS (DOE 1999) discussed in detail the analysis of facility accidents that potentially could cause radiological health impacts (PEIS Sections 4.3.2 and A.4.2). Specifically, it addressed the consequences, frequencies, and risks from the accident scenarios postulated to occur at a conversion facility as well as at the current cylinder storage locations. The analysis involved the application of the following three radiological and air dispersion software packages: GENII (Napier et al. 1988), HGSYSTEM (Hanna et al. 1994; Post et al. 1994a,b) and FIREPLUME (Brown et al. 1997).

In the DUF_6 PEIS (DOE 1999), the accident analyses assumed that the accident would occur in the center of the storage yard site (i.e., Portsmouth and ETTP). For collective exposures, radiation doses were assessed for the population within a distance of 50 mi (80 km) from the release point. Because the distance between the possible facility locations and the center point of the sites is much smaller than the assessment distance of 50 mi (80 km), the location of the conversion facility would have very little impact on the off-site collective exposures. Individual and population impacts were estimated for the public and noninvolved workers. Impacts to involved workers during accidents were not quantified because it was recognized that, depending on the accident conditions and the exact location and response of the workers, the involved workers would also be subject to severe physical and thermal (fire) hazards and that the impacts from such hazards might be greater than the impacts from radiological or chemical exposure. Therefore, injuries and fatalities among involved workers would be possible from chemical, radiological, and physical forces if an accident did occur.

Since the population distribution estimate would not vary significantly with the specific location of the conversion facility, the methodology used to analyze the collective public dose in the PEIS also would apply for this EIS analysis. Similarly, the assumptions made in the PEIS for estimating the MEI doses were kept the same. For ground-level releases, the MEI was assumed to be located at a distance of 328 ft (100 m) from the release point. For releases from a stack, the MEI was assumed to be at the point of maximum ground concentration. Current on-site and off-site population distributions were used to estimate the collective noninvolved worker and off-site public impact.

Since trace transuranic (TRU) elements were identified in the DUF_6 cylinder inventory after the PEIS analysis was performed, their contribution to additional radiological impact was considered in the analysis for this EIS. A conservative concentration was assumed for the accidents, since the TRU elements are not distributed evenly through the DUF_6 inventory. Comparisons of the relative hazards from this TRU concentration with the hazards from DUF_6 considered in the DUF_6 PEIS were used to determine their radiological impact in the accident analyses conducted for this EIS. Appendix B contains a discussion of the methodology used to assess the impacts associated with the presence of trace TRU contamination in cylinders.

F.2.2 Chemical Impacts

General data used in the accident predictions included the following:

- Release amount (source term) for each chemical released,
- Chemical-specific health impact levels,
- Number of workers on site and population off site by direction, and
- Locations of sources and receptors for both workers and members of the general public.

Two meteorological conditions, D stability with a 4-m/s (9-mph) wind speed and F stability with a 1-m/s (2-miles-per-hour [mph]) wind speed, were assumed for all scenarios except the tornado accident scenario, which assumed D stability and 20-m/s (45-mph) wind.

The same approach used for the DUF_6 PEIS was adopted in this EIS for the chemical facility accident analysis under the no action alternative and the action alternatives. Accident consequences were estimated by using the HGSYSTEM (Version 3) model for the nonfire scenarios and the FIREPLUME model for the fire scenarios. For each scenario and each of the two meteorological conditions, hazard zones were generated for two health indices (i.e., adverse effects and irreversible adverse effects). These zones were overlain on worker and general public geographic information system (GIS) layers, with the zone origin located at the centroid of each of the identified conversion plant site alternatives (Locations A, B, and C; see Figure 2.2-3). Updated data on current Portsmouth GDP workers (2002) and updated general population data (based on the 2000 census) were used to estimate the consequences and associated risk of each accident scenario. The dispersion conditions (i.e., meteorology, accident frequencies, and, for most scenarios, release quantities or source terms) were identical to those developed and used in the DUF_6 PEIS. For the estimated chemical accident risks for the proposed conversion facility, variations in this EIS from values reported in the DUF_6 PEIS are attributable to variations in the candidate locations for the conversion facility, changes in the numbers and locations of workers and the general public, and some changes in the source term values.

Of the nearly eight dozen postulated chemical accidents considered and evaluated in this EIS, a total of eight bounding chemical accidents were identified for detailed risk analysis. These accidents are listed in Table 5.2-8.

F.2.2.1 Nonfire Accident Scenario Modeling

The nonfire accident scenarios were treated as either liquid spills on the ground followed by evaporation and/or pressurized releases from tanks. The DUF_6 PEIS assumed the same temperature for both day and night spill conditions. This analysis differs in that it accounts for evaporation rate reduction not only due to the assumed very conservative (from an air dispersion perspective) low wind speed and F-stability condition combination but also due to what would be typically lower ambient air temperatures during these conditions. The evaporation rate from spilled chemical pools depends on pool temperature and saturation vapor pressure. The pool temperature was conservatively assumed to be constant for the entire release duration and was set equal to the assumed ambient temperature. The saturation vapor pressure was set equal to the partial pressure over the pool. The saturation vapor pressure or the partial pressures of the vapors emanating from the pool depend on the pool temperature. For the aqueous HF spill scenarios, the partial vapor pressures were determined for two temperatures, 77°F (25°C for the F-1 conditions, representative of nighttime conditions during July or August) and 95°F (35°C for D-4 conditions, representative of daytime conditions during July or August). For a 70% HF solution, the partial vapor pressure over the pool is 20 kPa (T_p = 77°F [25°C]) and 31.7 kPa (T_p = 95°F [35°C]), determined empirically. Table F-1 gives the spill assumptions and the source term for the bounding aqueous HF spill scenario.

TABLE F-1 Bounding Aqueous (70%) HF Spill Source Term

Berm Area (m^2)	Evaporative Spill Duration[a] (h)	Evaporation Rate (kg/s) F-1	Evaporation Rate (kg/s) D-4	Spill Amount (kg) F-1	Spill Amount (kg) D-4
412	2	0.13	0.58	933	4,211

[a] Unmitigated.

The evaporative emissions were estimated by using a simplified evaporative model (EPA 1999). The model uses the molecular diffusion of water and the kinematic viscosity of air to calculate the mass transfer coefficient. A less conservative estimate of the evaporative release rate would be expected if chemical-specific molecular diffusivities and kinematic viscosities were used. Because of the change in quantity and chemical composition of the spill, the spill hazard zone changed in this assessment. A scaling procedure was adopted to recalculate the hazard zone, as detailed below.

For a ground-level release, the simplified Gaussian expression for estimating downwind concentrations can be rearranged to solve for the product of horizontal and vertical plume spread. This expression is shown below:

$$\sigma_y \sigma_z = \frac{Q \text{ (mg/s)}}{\pi u \text{ (m/s) } \chi_{LOC} \text{ (mg/m}^3\text{)}} \quad . \qquad \text{(F.1)}$$

The level of concern, χ_{LOC}, is set to the HF Emergency Response Planning Guideline (ERPG)-1 and ERPG-2 levels. With the source term and wind speeds already known, the respective LOC σ_y σ_z products can be calculated. The hazard distance can than be obtained from the already tabulated sigma products (Turner 1994, Table 2-5). The next step in identifying the hazard area or zone is to estimate the hazard width for each contour. This is done by estimating the approximate contour width at the mid-point or half the hazard distance. With these distances, the respective sigma product and σ_y values in Table F-1 can be used in Equation F.1 to solve for the midpoint centerline concentration. The hazard width can than be estimated by using the following expression:

$$HW = \sigma_y \text{ @ } 0.5\ HD\ \{2ln[\chi(x,0,0)/\ \chi_{LOC}]\}^2 \quad . \qquad \text{(F.2)}$$

By using the same procedure described above, hazard zone dimensions can also be estimated for the HF tank release analyzed for the PEIS. The new hazard distances and hazard widths can than be calculated by multiplying the original model-derived values by the ratios of the new to old values calculated by using the above method.

F.2.2.2 Fire Accident Scenario Modeling

In the fire accident scenarios, the release quantities were presented as a function of time for the three phases of the release: puff, fire release, and cooldown. The 48G cylinder fire and vapor temperatures, as reported in Brown et. al. (1997), were used in the FIREPLUME simulations to estimate buoyant and smoldering plume rise and the resulting downwind concentration contours.

F.2.2.3 Pressurized Release Accident Scenario Modeling

The anhydrous ammonia (NH_3) rupture scenario was treated as a pressurized release tank rupture. Some of the key release parameters used for the scenario are listed in Table F-2 (Vincent 2003).

The pressurized release was modeled with the HGSYSTEM AEROPLUME source module and the HGSYSTEM HEGADAS dispersion module (Hanna et al. 1994; Post et al. 1994a,b), which handled the subsequent dispersion and transport of the dense liquid-vapor aerosol mixture emanating from the tank rupture. AEROPLUME is a multicomponent two-phase thermodynamic aerosol jet model that simulates steady-state release rates from a rupture or a leaking pressurized vessel and the near-field vapor cloud development of the flashed vapor and aerosol components in expelled jet release. Upon formation of the flow field from the release point and establishment of a heavy aerosol-laden cloud, the release is linked to the HEGADAS model to simulate dense vapor cloud dispersion and entrainment of ambient air as the cloud moves and disperses downwind.

F.2.2.4 Health Impact Levels

Assessing the consequences from accidental releases of chemicals differs from assessing routine chemical exposures, primarily because the reference doses used to generate hazard indices for long-term, low-level exposures were not intended for use in evaluating the short-term (e.g., duration of several hours or less), higher-level exposures that often accompany accidents. In addition, the analysis of accidental releases often requires the evaluation of different effects: for example, irritant gases can cause tissue damage at the higher levels associated with accidental releases but are not generally associated with adverse effects from chronic, low-level exposures.

TABLE F-2 Anhydrous NH_3 Tank Rupture Spill Parameters

Tank Size (gal)	Fill Level (%)	Tank Fill Amt. (gal)	Release Amt. (lb)	Tank Pressure (psig)[a]	Relief Valve (psig)	Berm Area (ft^2)
6,565	85%	5,580	29,500	209	265	324

[a] psig = pound(s) per square inch gauge.

To estimate the consequences of chemical accidents, two potential health effects endpoints were evaluated: (1) adverse effects and (2) irreversible adverse effects. Evaluation of these two health endpoints was consistent with the accident evaluations typically conducted to assess industrial risks (American Industrial Hygiene Association [AIHA] 2002). Potential adverse effects range from mild and transient effects — such as respiratory irritation, redness of the eyes, and skin rash — to more serious and potentially irreversible effects. Potential irreversible adverse effects are defined as effects that generally occur at higher concentrations and are permanent in nature — including death, impaired organ function (such as damaged central nervous system or lungs), and other effects that may impair everyday functions.

For uranium compounds, an intake of 10 mg or more was assumed to cause potential adverse effects (McGuire 1991). An intake of 30 mg of uranium was used as the health criterion for potential irreversible adverse effects for exposure to uranium as either U_3O_8 or as UO_2F_2. The background document for the U.S. Nuclear Regulatory Commission (NRC) regulations for the Certification of Gaseous Diffusion Plants (10 CFR Part 76) states that "in assessing the adequacy of protection of the public health and safety from potential accidents, the NRC will consider whether the potential consequences of a reasonable spectrum of postulated accident scenarios exceed 0.25 Sv (25 rem), or uranium intakes of 30 mg, taking into account the uncertainties associated with modeling and estimating such consequences" (NRC 1994). According to these regulations, the selection of the 30-mg uranium intake level as an evaluation guideline level for irreversible injury was based on information provided in Fisher et al. (1994).

In applying the 30-mg uranium intake to accident analysis for the uranium compounds, the following parameters were accounted for: molecular weight, solubility, inhalation rate, and duration of predicted exposure. On the basis of an inhalation rate of 1.5 m^3/h as the ventilation rate during light exercise (ICRP 1994), and on appropriate adjustments to account for the percent uranium in each compound, air concentrations corresponding to an intake level of 30 mg were calculated for modeled exposure durations. For example, the air concentration of 26 mg/m^3 of uranyl fluoride (UO_2F_2) corresponding to a 30-mg uranium intake for a 60-minute exposure to UO_2F_2 would be calculated as follows:

$$\frac{30 \text{ mg uranium} \times 308/238 \text{ (molecular weight } UO_2F_2\text{/molecular weight uranium)}}{1.5 \text{ m}^3\text{/h} \times \text{modeled exposure duration (h)}} \quad (F.3)$$

In addition, for the insoluble uranium compounds, an uptake factor was incorporated into the calculated air concentrations, on the basis of ICRP guidance that 0.2% absorption be assumed for inhalation of less soluble uranium compounds that have biological half-lives of years (i.e., triuranium octaoxide or U_3O_8), as compared with 5% absorption for soluble and slightly soluble compounds such as UO_2F_2 (ICRP 1979).

For HF and NH_3, potential adverse effect levels were assumed to occur at levels that correspond to ERPG-1 levels, and potential irreversible adverse effects levels were assumed to occur at levels that correspond to ERPG-2 levels. ERPG 1 levels are defined as "the maximum airborne concentration below which it is believed nearly all individuals could be exposed for up to 1 hour without experiencing or developing any but mild transient adverse health effects or perceiving a clearly defined objectionable odor" (AIHA 2002). ERPG 2 levels are defined as "the maximum airborne concentration below which it is believed nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair their abilities to take protective action" (AIHA 2002). The ERPG values were generated by toxicologist teams who review all published (as well as some unpublished) data for a given chemical (AIHA 2002). The levels used in this assessment were as follows: ERPG-1 values of 2 ppm for HF and 25 ppm for NH_3 for adverse effects, and ERPG-2 values of 20 ppm for HF and 150 ppm for NH_3 for irreversible adverse effects (AIHA 2002).

The chemicals evaluated exhibit irritant characteristics; the toxicity of these substances is generally not linearly proportional to the intake amount. For example, the toxic effect of exposure to 32 mg/m^3 HF for 30 minutes would actually be greater than the toxic effect of exposure to 16 mg/m^3 HF for 60 minutes, because the irritant action of the HF is greater at higher air concentrations. Data on the appropriate adjustments of HF concentrations for evaluation of shorter exposure times are presented and discussed in various documents dealing with the toxicity of UF_6 (Fisher et al. 1994; McGuire 1991). On the basis of these data, for modeled exposure durations of between 5 and 60 minutes, the air concentrations of HF and NH_3 corresponding to the ERPG-2 value were calculated from:

$$C = C_{\text{ERPG-2}}(60/t)^{0.5} , \qquad \text{(F.4)}$$

where:

C = adjusted exposure guideline value and

t = modeled exposure duration (min).

It was conservatively assumed that the 5-minute adjusted exposure guideline value would be applied even for modeled exposure durations of less than 5 minutes.

It should be noted that human responses do not occur at precise exposure levels but can extend over a wide range of concentrations. The values used as guidelines for potential adverse effects and potential irreversible adverse effects in this EIS should not be expected to protect everyone but should be applicable to most individuals in the general population. In all populations, there are hypersensitive individuals who will show adverse responses at exposure concentrations far below levels at which most individuals would normally respond (AIHA 2002). Alternatively, some individuals will show no adverse response even at exposure concentrations somewhat higher than the guideline levels.

F.2.2.5 Estimation of Population Impacted

Demographic data for the on-site worker population were compiled into a GIS layer by using building footprint polygons and records of the number of workers in the buildings. For the off-site population, 2000 U.S. Census Bureau TIGER (Topologically Integrated Geographic Encoding and Referencing) block group data were obtained. In each layer, population density was calculated for each building or block group by dividing the population for a polygon by the area of the polygon. The site boundary polygon was added to the off-site population layer, and the population inside the boundary was set to zero.

To estimate the population affected by a specific accident, its plume was loaded into the GIS as a polygon, moved to an origin location, and intersected with one of the population layers (either noninvolved worker or general public). The intersection process combined the plume polygon with the population data, thereby subdividing the polygons where the boundaries crossed and discarding portions of polygons falling outside the plume footprint. Next, the areas of the subdivided polygons were recalculated and multiplied by the population density to obtain a population total for each. These values were summed to obtain an estimate of the total population within the plume footprint. An assumption of this approach was that the population was uniformly distributed within each building or block group.

For each accident, the impacts on noninvolved workers and the general population were estimated. No quantitative predictions of impacts were made for involved workers. Noninvolved workers and members of the general public were considered to be at risk for a given health endpoint if they were located within the plume contour (based on ERPG level or uranium intake level) for the wind direction that would lead to the largest population count. Individuals were assumed to be in the locations where they work or live and, for conservatism, the protection provided by the building structure was not included. This computation involved the overlay of the plume contour from the source point at Location A, B, or C and the rotation of the plume 30 to 100 times to identify the direction with the highest number of workers or general population. Those counts were reported in the impact evaluation. In most cases, the direction leading to the maximum worker count did not match the direction for the maximum general population count. The adverse effects and irreversible adverse effects contours were predicted for each accident, with the adverse effects contour being the larger of the two. For UF_6 releases, both the UO_2F_2 contour and the HF contour were predicted for both adverse effects and irreversible adverse effects levels; in general, the HF contours were larger than the uranium contours and led to larger population risks.

The MEI worker was assumed to be located 328 ft (100 m) from the accident location. The MEI for the general population was assumed to be located at the nearest fence line position, although there are currently no residences at these locations at the three current storage sites. Impacts for MEIs are presented as "yes" or "no" in Chapter 5 of this EIS, depending on whether air concentrations of chemicals greater than or equal to corresponding adverse effects and irreversible adverse effects were modeled at the MEI locations.

F.2.3 Accident Frequencies

The expected frequency of an accident is an estimate of the chance that it might occur during operations. Frequencies range from 0.0 (no chance of occurring) to 1.0 (certain to occur). If an accident is expected to happen once every 50 years, the frequency of occurrence is 0.02 per year: 1 occurrence every 50 years = 1 ÷ 50 = 0.02 occurrence per year. A frequency estimate can be converted to a probability statement. If the frequency of an accident is 0.02 per year, the probability of the accident occurring sometime during a 10-year program is 0.2 (10 years × 0.02 occurrence per year).

The accidents evaluated in this EIS were anticipated to occur over a wide range of frequencies, from once every few years to less than once in 1 million years. In general, the more unlikely it would be for an accident to occur (the lower its probability), the greater the expected consequences. Accidents were evaluated for four frequency categories: likely, unlikely, extremely unlikely, and incredible (see text box). To interpret the importance of a predicted accident, the analysis considered the estimated frequency of occurrence of that accident. Although the predicted consequences of an incredible accident might be high, the lower consequences of a likely accident (i.e., one much more likely to occur) might be considered more important.

> **Accident Categories and Frequency Ranges**
>
> **Likely (L):** Accidents estimated to occur once or more in 100 years of facility operations (frequency of $\geq 1 \times 10^{-3}$/yr).
>
> **Unlikely (U):** Accidents estimated to occur between once in 100 years and once in 10,000 years of facility operations (frequency from 1×10^{-2}/yr to 1×10^{-4}/yr).
>
> **Extremely Unlikely (EU):** Accidents estimated to occur between once in 10,000 years and once in 1 million years of facility operations (frequency from 1×10^{-4}/yr to 1×10^{-6}/yr).
>
> **Incredible (I):** Accidents estimated to occur less than one time in 1 million years of facility operations (frequency of $<1 \times 10^{-6}$/yr).

F.2.4 Accident Risk

The term "accident risk" refers to a quantity that considers both the severity of an accident (consequence) and the probability that the accident will occur. Accident risk is calculated by multiplying the consequence of an accident by the accident probability. For example, if a facility accident has an estimated frequency of occurrence of once in 100 years (0.01 per year) and if the accident occurred with an estimated consequence of 10 people suffering from irreversible health effects (IHEs), then the annual risk of the accident would be reported as 0.1 IHE per year (0.01 per year × 10 IHEs). If the facility was operated for a period of 20 years, the accident risk over the operational phase of the facility would be 2 IHEs (20 years × 0.1 IHE per year).

This definition of accident risk was used to compare accidents that have different frequencies and consequences. Certain high-frequency accidents that have relatively low consequences might pose a larger overall risk than low-frequency accidents that have potentially high consequences. In calculations of accident risk, the consequences are expressed in terms of IHEs and adverse health effects for chemical releases and in terms of expected LCFs for radiological releases.

F.2.5 Physical Hazard Accidents

Physical hazards, unrelated to radiation or chemical exposures, were assessed for each alternative by estimating the number of on-the-job fatalities and injuries that could occur to workers. The expected numbers of worker fatalities and injuries associated with each option were calculated on the basis of statistics available from the Bureau of Labor Statistics (BLS), as reported by the National Safety Council (2002), and on estimates of total worker hours required for construction and operational activities.

Construction and manufacturing annual fatality and injury rates were used for the construction and operational phases of each option, which were computed separately because these activities have different incidence statistics. The injury incidence rates were for injuries involving lost workdays, including days away from work and/or days of restricted work activity. The specific rates used in calculations for each option were as follows: fatalities during construction, 13.3 per 100,000 workers; fatalities during operations, 3.3 per 100,000 workers; injuries during construction, 4.1 per 100 full-time workers; injuries during operations, 4.5 per 100 full-time workers (National Safety Council 2002).

Fatality and injury risks were calculated as the product of the appropriate incidence rate (given above), the number of years for construction and operations, and the number of FTEs for construction and operations. The available fatality and injury statistics by industry are not refined enough to warrant an analysis of involved and noninvolved workers as separate classes.

The calculation of risks of fatality and injury from industrial accidents was based solely on historical industrywide statistics and therefore did not consider a threshold (i.e., any activity that would result in some estimated risk of fatality and injury). All DUF_6 activities would be implemented in accordance with DOE or industry best management practices, thereby reducing the risk of fatalities and injuries.

F.3 HUMAN HEALTH AND SAFETY — TRANSPORTATION

The methodology and assumptions used in this transportation risk assessment were based on two previous analyses conducted for the transportation of depleted uranium compounds (DOE 1999; Biwer et al. 2001). The approach is described below.

F.3.1 Scope of the Analysis

The transportation risk assessment involved estimating the potential human health risks to both crew members (i.e., truck drivers and rail crew) and members of the public during transportation of various forms of depleted uranium and other materials. Impacts that could arise from the radioactive or chemical nature of the cargo and also from the nature of transportation itself, independent of the cargo, were addressed. Transportation risks were evaluated for all of the materials that could potentially be transported for each alternative, including UF_6 cylinders, uranium conversion products, HF and other chemicals, and process waste. A summary of the materials transported is provided in Table F-3. Transportation impacts were estimated for shipment by both truck and rail modes for most materials. The impacts were assessed on a route-specific basis, but unit risks per kilometer were developed for shipments of the conversion

TABLE F-3 Potential Shipments of Material Analyzed for the DUF_6 Conversion EIS[a]

Material	Origin	Destination
Depleted U_3O_8	Portsmouth	Envirocare, NTS
LLW, empty cylinders	Portsmouth	Envirocare, NTS
CaF_2	Portsmouth	Envirocare, NTS
HF	Portsmouth	User facility
Non-DUF_6 cylinders	ETTP	Portsmouth
DUF_6 cylinders	ETTP	Portsmouth

[a] CaF_2 = calcium fluoride, ETTP = East Tennessee Technology Park, LLW = low-level radioactive waste, NTS = Nevada Test Site,.

products for use because the locations of user facilities are not yet known. In the latter case, the unit risk factors were used to estimate transportation impacts for sample distances of 250, 1,000, and 5,000 km (260, 620, and 3,100 mi); average route characteristics were assumed. In the case of depleted uranium conversion products, impacts from shipment to two alternate disposal sites were also estimated.

The transportation-related risks to human health were assessed from both vehicle- and cargo-related causes. Cargo-related risks arising from both the radiological and chemical hazards of the depleted uranium shipments were assessed when appropriate.

With regard to the radioactive nature of depleted uranium, the cargo-related impacts on human health during transportation would be caused by exposure to ionizing radiation. Exposures to radiation could occur during both routine (i.e., incident-free) transportation and during accidents. During routine operations, the external radiation field in the vicinity of a shipment must be below limits specified in federal regulations. During transportation-related accidents, human exposures may occur following the release and dispersal of radioactive materials via multiple environmental pathways, such as exposure to contaminated ground or contaminated air or ingestion of contaminated food.

In contrast, the chemical nature of depleted uranium and other hazardous chemicals does not pose cargo-related risks to humans during routine transportation-related operations. Transportation operations are generally well regulated with respect to packaging, such that small spills or seepages during routine transport are kept to a minimum and do not result in exposures. Potential cargo-related health risks to humans can occur only if the integrity of a container is compromised during an accident (i.e., if a container is breached). Under such conditions, some chemicals may cause an immediate health threat to exposed individuals, primarily through inhalation exposure.

Vehicle-related risks result from the nature of transportation itself, independent of the radioactive and chemical characteristics of the cargo. For example, increased levels of pollution from vehicular exhaust and fugitive dust emissions may affect human health. Similarly, accidents during transportation may cause injuries and fatalities from physical trauma.

Vehicle-related health impacts and health impacts from the radioactive and chemical nature of the depleted uranium are presented separately in the tables of this EIS. No attempt has been made (even in cases where both radioactive and chemical characteristics must be considered) to sum the estimated radioactive, chemical, and vehicle-related risks. To understand and interpret the estimated health impacts presented in this report, readers must keep in mind the fundamental differences between the radioactive, chemical, and vehicle-related hazards discussed below.

The technical approach for estimating transportation risks uses several computer models and databases. Transportation risks were assessed for both routine and accident conditions. For the routine assessment, risks were calculated for the collective populations of all potentially exposed individuals, as well as for a small set of MEI receptors. The accident assessment consisted of two components: (1) an accident risk assessment, which considered the probabilities and consequences of a range of possible transportation-related accidents, including low-probability accidents that have high consequences and high-probability accidents that have low consequences, and (2) an accident consequence assessment, which considered only the radiological consequences of low-probability accidents that were postulated to result in the largest releases of radioactive material. The release fractions used in the accident risk assessment were based on the data in NUREG-0170 (NRC 1977) and independent engineering analyses.

F.3.2 Radiological Impacts

All radiological impacts are calculated in terms of dose and associated health effects in the exposed populations. The radiation dose calculated is the total effective dose equivalent as specified in 10 CFR Part 20, which is the sum of the deep dose equivalent from exposure to external radiation and the 50-year committed effective dose equivalent (ICRP 1977) from exposure to internal radiation. Doses of radiation are calculated in units of rem for individuals and in units of person-rem for collective populations.

The potential exposures to the general population from transportation of radioactive materials, whether during routine operations or from postulated accidents, are usually at a low dose, such that the primary adverse health effect is the potential induction of latent cancers (i.e., cancers that occur after a latency period of several years from the time of exposure). The correlation of radiation dose and human health effects for low doses has been traditionally based on what is termed the "linear/no-threshold hypothesis," which has been described by various international authorities on protection against radiation. This hypothesis implies, in part, that even small doses of radiation cause some risk of inducing cancer and that doubling the radiation dose would mean doubling the expected number of cancers. The data on the health risk from radiation have been derived primarily from human epidemiological studies of past exposures, such as Japanese survivors of the atomic bomb in World War II and persons exposed during medical applications. The types of cancer induced by radiation are similar to "naturally occurring" cancers and can be expressed later in the lifetimes of the exposed individuals.

On the basis of the analyses conducted for this report, transportation-related operations are not expected to cause acute (short-term) radiation-induced fatalities or to produce immediately observable effects in exposed individuals. Acute radiation-induced fatalities occur at doses well in excess of 100 rem (ICRP 1991), which generally would not occur for a wide range of transportation activities, including routine operations and accidents.[1] For all severe accident scenarios analyzed, other short-term effects, such as temporary sterility and changes in blood chemistry, are not expected.

In this EIS, the radiological impacts are expressed as health risks in terms of the number of estimated LCFs for each alternative. The health risk conversion factors (expected LCFs per dose absorbed) were taken from ICRP Publication 60 (ICRP 1991). The health risk conversion factors used were 5×10^{-4} LCF per person-rem for members of the general public and 4×10^{-4} LCF per person-rem for occupational workers.

The RADTRAN 4 computer code (Neuhauser and Kanipe 1992) was used for the routine and accident cargo-related risk assessments to estimate the radiological impacts to collective populations. As a complement to the RADTRAN calculations, the RISKIND computer code (Yuan et al. 1995) was used to estimate scenario-specific radiological doses to MEIs during both routine operations and accidents and to estimate population impacts for the accident consequence assessment.

F.3.3 Chemical Impacts

In contrast to radioactive hazards, chemical hazards do not pose cargo-related risks to humans during routine transportation-related operations. Transportation operations are generally well regulated with respect to packaging, such that small spills or seepages during routine transport are kept to a minimum and do not result in exposures. With respect to chemical hazards, the cargo-related impacts to human health during transportation would be caused by exposure occurring as a result of container failure and chemical release during an accident (i.e., a collision with another vehicle or road obstacle). Therefore, chemical risks (i.e., risks that result from the toxicology of the chemical composition of the material transported) are assessed for cargo-related transportation accidents. The chemical risk from transportation-related accidents lies in the potential release, transport, and dispersion of chemicals into the environment and the subsequent exposure of people primarily through inhalation exposure.

An accidental release of UF_6 to the atmosphere would result in the formation of UO_2F_2 and HF from the reaction of UF_6 with moisture in the atmosphere. Both compounds are highly water soluble and toxic to humans.

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1 In general, individual acute whole-body doses in the range of 300 to 500 rem are expected to cause fatality in 50% of the exposed individuals within 30 to 60 days (ICRP 1991).

The risks from exposure to hazardous chemicals during transportation-related accidents could be either acute (immediate impact) or latent (result in cancer that would present itself after a latency period of several years). The severity of the immediate health effects would depend strongly on the toxicity and exposure concentration of the specific chemical(s) released. The severity of the immediate (i.e., acute) health effects could range from slight irritation to fatality for the exposed individuals. Neither the uranium compounds nor HF are carcinogens or suspected carcinogens. Therefore, latent cancer incidences and fatalities from chemical exposure are not expected and not assessed in this report for potential accidents.

In this assessment, the endpoint for acute health effects that was assessed is the potential for irreversible adverse health effects (from permanent organ damage or the impairment of everyday functions up to and including lethality). A nonlinear or threshold correlation between the exposure concentration and the toxicity was assumed for the evaluation of this acute effect; that is, it was assumed that some low level of exposure could be tolerated without affecting health. In many cases, data on human toxicity that relate acute health effects to chemical exposures did not exist. When data on toxicity in humans were not available, chemical risk estimators were derived from levels that are toxic to laboratory animals. The use of animal data to predict toxic concentrations in humans added uncertainty to the risk estimates.

In addition to understanding the results in terms of the health endpoint described above, it is of interest to understand how it relates to potential fatalities. Exposure to HF or uranium compounds is estimated to be fatal to approximately 1% or less of those persons experiencing irreversible adverse effects (Policastro et al. 1997).

The chemical transportation accident risk assessment was performed by using the HGSYSTEM and FIREPLUME models (Brown et al. 1997) for uranium compounds (DUF_6, U_3O_8, and cylinder heels) and the Chemical Accident Stochastic Risk Assessment Model (CASRAM) (Brown et al. 1996, 2000) for HF. Chemical accident consequences were assessed by using HGSYSTEM/FIREPLUME for uranium compounds and HGSYSTEM for HF.

F.3.4 Vehicle-Related Impacts

In addition to the cargo-related risks posed by transportation-related activities, vehicle-related risks were also assessed for the same routes. These risks, which are independent of the radioactive nature of the cargo, would be incurred for similar shipments of any commodity. The vehicle-related risks were assessed for both routine conditions and accidents.

Vehicle-related risks during routine transportation are incremental risks caused by potential exposure to airborne particulate matter from fugitive dust and vehicular exhaust emissions. These risks are based on epidemiological data that associate mortality rates with ambient air particulate concentrations. A discussion of the basis for the emissions risk factors and the uncertainty associated with them is provided in Section F.3.5.3.

The vehicle-related accident risk refers to the potential for transportation-related accidents that could result in fatalities due to physical trauma that are not related to the cargo in the shipment. State average rates for transportation-related fatalities were used in the assessment. Vehicle-related risks are presented here in terms of estimated fatalities for the truck and rail options considered.

F.3.5 Routine Risk Assessment Method

The RADTRAN 4 computer code (Neuhauser and Kanipe 1992) was used for the routine risk assessments to estimate the radiological impacts to collective populations. The RISKIND computer code (Yuan et al. 1995) was used to estimate scenario-specific doses to MEIs during routine operations. Routine risks from hazardous chemical shipments are not expected. It is assumed that the shipping packages would not leak during routine transportation operations.

F.3.5.1 Collective Population Risk

The radiological risk associated with routine transportation results from the potential exposure of people to low-level external radiation in the vicinity of loaded shipments. Because the radiological consequences (dose) occur as a direct result of normal operations, the probability of routine consequences is taken to be unity in the RADTRAN 4 code. Therefore, the dose risk is equivalent to the estimated dose.

For routine transportation, the RADTRAN 4 computer code considers all major groups of potentially exposed persons. The RADTRAN 4 calculations of risk for routine highway and rail transportation include exposures of the following population groups:

- *Persons along the route (off-link population).* Collective doses were calculated for all persons living or working within 0.5 mi (0.8 km) of each side of a transportation route. The total number of persons within the 1-mi (1.6-km) corridor was calculated separately for each route considered in the assessment.

- *Persons sharing the route (on-link population).* Collective doses were calculated for persons in all vehicles sharing the transportation route. This group includes persons traveling in the same or opposite directions as the shipment, as well as persons in vehicles passing the shipment.

- *Persons at stops.* Collective doses were calculated for people who might be exposed while a shipment was stopped en route. For truck transportation, these stops include stops for refueling, food, and rest. For rail transportation, stops were assumed to occur for purposes of classification.

- *Crew members.* Collective doses were calculated for truck and rail transportation crew members involved in the actual shipment of material.

The doses calculated for the first three population groups were added together to yield the collective dose to the general public; the dose calculated for the fourth group represents the collective dose to workers. The RADTRAN 4 models for routine dose are not intended for use in estimating specific risks to individuals.

For the DUF_6 cylinder shipments, route-specific data were used to estimate the collective routine risks using the input assumptions as given in Biwer et al. (2001). For this EIS, the route data were updated with population data from the 2000 census.

F.3.5.2 Maximally Exposed Individual Risk

In addition to assessing the routine collective population risk, RISKIND was used to estimate the risks to MEIs for a number of hypothetical exposure scenarios. Receptors included transportation crew members, departure inspectors, and members of the public exposed during traffic delays, while working at a service station, or while living near a facility.

RISKIND was used to calculate the dose to each MEI considered for an exposure scenario defined by an exposure distance, duration, and frequency specific to that receptor. The distances and durations of exposure were similar to those given in previous transportation risk assessments (DOE 1990b, 1995, 1996, 1997b, 1999) The scenarios were not meant to be exhaustive but were selected to provide a range of potential exposure situations.

The RISKIND external dose model considers direct external exposure and exposure from radiation scattered from the ground and air. RISKIND was used to calculate the dose as a function of distance from a shipment on the basis of the dimensions of the shipment (millirems per hour for stationary exposures and millirems per event for moving shipments). The code approximates the shipment as a cylindrical volume source, and the calculated dose includes contributions from secondary radiation scattering from buildup (scattering by the material contents), cloudshine (scattering by the air), and groundshine (scattering by the ground). The dose rate curve (relative dose rate as a function of distance) specific to depleted uranium was determined by using the MicroShield code (Negin and Worku 1992) for input into RISKIND. As a conservative measure, credit for potential shielding between the shipment and the receptor was not considered.

F.3.5.3 Vehicle-Related Risk

Vehicle-related health risks resulting from routine transportation might be associated with the generation of air pollutants by transport vehicles during shipment; such risks are independent of the radioactive or chemical nature of the shipment. The health endpoint assessed under routine transportation conditions was the excess latent mortality due to inhalation of vehicular emissions. These emissions consist of particulate matter in the form of diesel engine exhaust and fugitive dust raised from the road/railway by the transport vehicle.

Risk factors for pollutant inhalation in terms of latent mortality were generated by Biwer and Butler (1999) for transportation risk assessments. These risks are based on epidemiological data that associate mortality rates with particulate concentrations in ambient air. Increased latent mortality rates resulting from cardiovascular and pulmonary diseases have been linked to incremental increases in particulate concentrations in air. Thus, the increase in ambient air particulate concentrations caused by a transport vehicle, with its associated fugitive dust and diesel exhaust emissions, is related to such premature latent fatalities in the form of risk factors. In this EIS, values of 8.36×10^{-10} latent fatality/km for truck transport and 1.20×10^{-10} latent fatality/railcar-km for rail transport were used. The truck value is for heavy combination trucks (truck class VIIIB). Because of the conservatism of the assumptions made to reconcile results among independent epidemiological studies, the latent fatality risks estimated by using these values may be considered to be near an upper bound (Biwer and Butler 1999). The risk factors are for areas with an assumed population density of 1 person/km^2. One-way shipment risks were obtained by multiplying the appropriate risk factor by the average population density along the route and the route distance. The risks reported for routine vehicle risks in this EIS are for round-trip travel of the transport vehicle.

The vehicle risks reported here are estimates based on the best available data. However, as is true for the radiological risks, there is a large degree of uncertainty in the vehicle emission risk factors that is not readily quantifiable. For example, large uncertainties exist with regard to the extent of increased mortality that occurs with an incremental rise in particulate air concentrations and with regard to whether there are threshold air concentrations that are applicable. Also, estimates of the particulate air concentrations caused by transport vehicles depend on location, road conditions, vehicle conditions, and weather.

F.3.6 Accident Risk Assessment Methodology

The radiological transportation accident risk assessment used the RADTRAN 4 code for estimating collective population risks and the RISKIND code for estimating MEI and population consequences. The HGSYSTEM model (Post et al. 1994a,b) was used to assess the hazardous chemical transportation accident risks for both the collective population and individuals. The model is a widely applied code recognized by the EPA for chemical accident consequence predictions.

The collective accident risk for each type of shipment was determined in a manner similar to that described for routine collective population risks. For the DUF_6 cylinder shipments, route-specific data were used to estimate the collective accident risks on the basis of the input assumptions given in Biwer et al. (2001). For this EIS, the route data were updated with population data from the 2000 census.

F.3.6.1 Radiological Accident Risk Assessment

The risk analysis for potential accidents differs fundamentally from the risk analysis for routine transportation because occurrences of accidents are statistical in nature. The accident risk assessment is treated probabilistically in RADTRAN 4 and in the HGSYSTEM approach used to estimate the hazardous chemical component of risk. Accident risk is defined as the product of the accident consequence (dose or exposure) and the probability of the accident occurring. In this respect, both RADTRAN 4 and HGSYSTEM estimate the collective accident risk to populations by considering a spectrum of transportation-related accidents. The spectrum of accidents was designed to encompass a range of possible accidents, including low-probability accidents that have high consequences and high-probability accidents that have low consequences (such as "fender benders"). The total collective radiological accident dose risk was calculated as:

$$R_{Total} = D \times A \times \sum_{i=1,n} (P_i \times C_i) \ , \qquad \text{(F.5)}$$

where:

R_{Total} = total collective dose risk for a single shipment distance D (person-rem),

D = distance traveled (km),

A = accident rate for transport mode under consideration (accidents/km),

P_i = conditional probability that the accident is in Severity Category i, and

C_i = collective dose received (consequence) should an accident of Severity Category i occur (person-rem).

The results for collective accident risk can be directly compared with the results for routine collective risk because the latter results implicitly incorporate a probability of occurrence of 1 if the shipment takes place.

The RADTRAN 4 calculation of collective accident risk employs models that quantify the range of potential accident severities and the responses of transported packages to accidents. The spectrum of accident severity is divided into a number of categories. Each category of severity is assigned a conditional probability of occurrence — that is, the probability that an accident will be of a particular severity if an accident occurs. The more severe the accident, the more remote the chance of such an accident. Release fractions, defined as the fraction of the material in a package that could be released in an accident, are assigned to each accident severity category on the basis of the physical and chemical form of the material. The model takes into account the mode of transportation and the type of packaging being considered. The accident rates, the definition of accident severity categories, and the release fractions used in this analysis are discussed further in Biwer et al. (1997, 2001). The approach for hazardous chemicals incorporates the same accident severity categories and release fractions as those used by RADTRAN 4.

For accidents involving the release of radioactive material, RADTRAN 4 assumes that the material is dispersed in the environment according to standard Gaussian diffusion models. For the risk assessment, default data for atmospheric dispersion were used, representing an instantaneous ground-level release and a small-diameter source cloud (Neuhauser and Kanipe 1995). The calculation of the collective population dose following the release and dispersal of radioactive material included the following exposure pathways:

- External exposure to the passing radioactive cloud,
- External exposure to contaminated ground,
- Internal exposure from inhalation of airborne contaminants, and
- Internal exposure from the ingestion of contaminated food.

For the ingestion pathway, national-average food transfer factors, which relate the amount of radioactive material ingested to the amount deposited on the ground, were calculated in accordance with the methods described by NRC Regulatory Guide 1.109 (NRC 1977) and used as input to the RADTRAN code. Doses of radiation from the ingestion or inhalation of radionuclides were calculated by using standard dose conversion factors (DOE 1988a,b).

F.3.6.2 Chemical Accident Risk Assessment

The risks from exposure to hazardous chemicals during transportation-related accidents can be either acute (result in immediate injury or fatality) or latent (result in cancer that would present itself after a latency period of several years). Both population risks and risks to the MEI were evaluated for transportation accidents. The acute health endpoint — potential irreversible adverse effects — was evaluated for the assessment of cargo-related population impacts from transportation accidents. Accidental releases during transport of UF_6, U_3O_8, and HF were evaluated quantitatively.

The acute effects evaluated were assumed to exhibit a threshold nonlinear relationship with exposure; that is, some low level of exposure could be tolerated without inducing a health effect. To estimate risks, chemical-specific concentrations were developed for potential irreversible adverse effects. All individuals exposed at these levels or higher following an accident were included in the transportation risk estimates. In addition to acute health effects, the cargo-related risk of excess cases of latent cancer from accidental chemical exposures could be evaluated. However, none of the chemicals that might be released in any of the accidents would be carcinogenic. As a result, no predictions for excess latent cancers are presented in this report for accidental chemical releases.

In addition, to address MEIs, the locations of maximum hazardous chemical concentrations were identified for shipments with the largest potential releases. Estimates of exposure duration at those locations were obtained from modeling output and used to assess whether MEI exposure to uranium and other compounds exceeded the criteria for potential irreversible adverse effects.

The primary exposure route of concern with respect to an accidental release of hazardous chemicals would be inhalation. Although direct exposure to hazardous chemicals via other pathways, such as ingestion or dermal absorption, would also be possible, these routes would be expected to result in much lower exposure than the inhalation pathway doses for the chemicals of concern in this assessment. The likelihood of acute effects would be much less for the ingestion and dermal pathways than for inhalation.

The chemical transportation risks for shipment of the depleted uranium compounds were estimated by using FIREPLUME and HGSYSTEM accident consequences multiplied by the appropriate accident rate probabilities, population densities, and distance traveled in a similar fashion to that used by RADTRAN, as discussed in Section F.3.6.1 for the radiological transportation risks.

The chemical accident transportation risk and consequences for shipment of aqueous HF were estimated using the CASRAM and HGSYSTEM models, respectively. For the risk assessment, 24 generic but representative routes were selected for hazardous commodity shipments in the region of interest (ROI). The generic HF routes were derived from historical shipments of five chemicals, in addition to HF, that are typically shipped in similar corrosive chemical container tank trucks. Temperature-dependent vapor pressures and densities for aqueous HF properties were derived with an empirically derived formulation (Pratt 2003) and experimentally generated plots (Honeywell International, Inc. 2002). The heat of vaporization was calculated from vapor pressure relationships. These parameters were used in estimating the evaporation rate from the HF pool and the HF that spilled onto the surface. Rail and highway accident rates, spill fraction, and population densities along the shipment routes were incorporated into CASRAM from statistics reported in the Hazardous Material Information System (HMIS) database and from census data. For each shipment, CASRAM calculates the probabilities of a release, given an accident and the risk of adverse (ERPG-1) and irreversible (ERPG-2) effects associated with the shipment. The overall risks are estimated by summing over all shipments and routes. The risks are normalized by shipment distance and weight, so that the calculations can be applied to specific shipment destinations and shipment quantities. For consequence assessment, procedures that are the same or similar to those used for fixed facilities are used (e.g., aqueous HF tank rupture). A description of the method can be found in Section F.2.2.1, Nonfire Accident Scenario Modeling. It was assumed for both the risk and consequence assessment that aqueous HF would be shipped in nonpressurized corrosive liquid tank cars with a 20,000-gal (76,000-L) capacity for rail shipments, and in corrosive liquid cargo tanker (MC312) trucks with a 5,000-gal (19,000-L) capacity.

F.3.7 Accident Consequence Assessment

Because predicting the exact location of a severe transportation-related accident is impossible when estimating population impacts, separate accident consequences were calculated for accidents occurring in three population density zones: rural, suburban, and urban. Moreover, to address the effects of the atmospheric conditions existing at the time of an accident, two atmospheric conditions were considered: neutral (i.e., unstable) and stable.

The MEI for severe transportation accidents was considered to be located at the point of highest hazardous material concentration that would be accessible to the general public. This location was assumed to be 100 ft (30 m) or farther from the release point at the location of highest air concentration as determined by the HGSYSTEM and FIREPLUME models. Only the shipment accident resulting in the highest contaminant concentration was evaluated for the MEI.

F.3.7.1 Radiological Accident Consequence Assessment

The RISKIND code was used to provide a scenario-specific assessment of radiological consequences from severe transportation-related accidents. Whereas the RADTRAN 4 accident risk assessment considered the entire range of accident severities and their related probabilities, the RISKIND accident consequence assessment focused on accidents that result in the largest releases of radioactive material to the environment. Accident consequences were presented for each type of shipment that might occur under any given option for each alternative. The accident consequence assessment was intended to provide an estimate of the potential impacts posed by a severe transportation-related accident.

The severe accidents considered in the consequence assessment were characterized by extreme mechanical and thermal forces. In all cases, these accidents would result in a release of radioactive material to the environment. The accidents correspond to those within the highest accident severity category, as described previously. These accidents represent low-probability, high-consequence events. The probability of accidents of this magnitude would depend on the number of shipments and the total shipping distance for the options considered; however, accidents of this severity are expected to be extremely rare.

The severe accidents involving solid radioactive material that would result in the highest impacts would generally be related to fire. The fire would break down and distribute the material of concern. Air concentrations of radioactive contaminants at receptor locations following a hypothetical accident were determined by using the FIREPLUME model. On the basis of these air concentrations, RISKIND was used to calculate the radiological impacts for the accident consequence assessment.

The accident consequences were calculated for both local populations and MEIs. The population dose included the population within 50 mi (80 km) of the site of the accident. The exposure pathways considered were similar to those discussed previously for the accident risk assessment. Although remedial activities after the accident (e.g., evacuation or ground cleanup) would reduce the consequences of an accident, these activities were not accounted for in the consequence assessment.

F.3.7.2 Chemical Accident Consequence Assessment

HGSYSTEM Version 3.0 was used to estimate the potential consequences from severe hazardous chemical accidents. FIREPLUME was used to predict the consequences of transportation accidents involving fires. The HGSYSTEM model is discussed in Section F.2.2.

F.3.7.3 Vehicle-Related Accident Risk Assessment

The vehicle-related accident risk refers to the potential for transportation-related accidents that could directly result in fatalities not related to the cargo in the shipment. This risk represents fatalities from mechanical causes. National-average rates for transportation-related fatalities (Saricks and Tompkins 1999) were used in the assessment for shipments without a defined origin or destination site (e.g., the use location of the conversion HF products). For truck transport, 1.49×10^{-8} fatality per truck-km was assumed. For rail transport, 7.82×10^{-8} fatality per railcar-km was assumed. State average fatality rates from Saricks and Tompkins (1999) were used in the assessment for the DUF_6 shipments that had known origin and destination sites. Vehicle-related accident risks were calculated by multiplying the total distance traveled by the rate for transportation-related fatalities. In all cases, the vehicle-related accident risks were calculated by using distances for round-trip shipment.

F.4 AIR QUALITY AND NOISE

F.4.1 Air Quality

Potential air quality impacts under each alternative were evaluated by estimating potential air pollutant emissions from the activities associated with facility construction and operations, followed by atmospheric dispersion modeling of these emissions to assess impacts on ambient air quality.

Air emissions resulting from activities associated with construction (e.g., construction equipment, engine exhaust, and fugitive dust emissions) and with operations (e.g., boiler[2] and emergency generator stack emissions) were estimated by using applicable emission factors (EPA 2002) and emission and activity level data provided by UDS (UDS 2003b). The significance of project-related emissions was evaluated by comparing the estimated project-related emissions with countywide or statewide emissions.

Atmospheric dispersion modeling of pollutant emissions was performed by using the EPA-recommended ISC short-term model (EPA 1995). In addition to project-related emission data, model input data included stack and building downwash data, meteorological data, receptor data, and terrain elevation data. Emissions from construction activities were assumed to occur during one daytime 8-hour shift, while the emissions from facility operations were assumed to occur 24 hours per day and 7 days per week.[3] Effects of building downwash on stack plumes

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2 UDS is currently proposing to use electrical heating in the conversion facility but is evaluating other options. If natural gas was used, either furnaces or boilers could be selected. The air emissions from boilers are greater than those for residential-type furnaces for carbon monoxide (CO) and nitrogen oxides (NO_x), and the same for other criteria pollutants and volatile organic compounds (VOCs). To assess bounding air quality impacts, a boiler option was analyzed.

3 The backup generator is assumed to be operating for 192 hours per year, which represents 4 hours per month for testing and 3 days of operation twice per year in response to a power outage.

were considered for the emission sources during the operational period. The meteorological data selected for the Portsmouth site are the 1999 on-site surface data (30-m [99-ft] level), combined with mixing height data at Wilmington, Ohio. For construction impact analysis, initial receptor grids were placed at distances of 100 m (328 ft) from the construction site (because heavy equipment operators would not allow public access any closer for safety reasons) and extended up 50 km (31 mi) beyond existing boundaries. For operation impact analysis, receptor grids were set along and beyond the existing and planned conversion facility boundaries up to 50 km (31 mi). The grid intervals ranged from 25 m (82 ft) near the facility to 5 km (3.1 mi) outmost. To model the effects of terrain elevation, elevation data for the emission sources and receptors were also input to the model.

For assessing potential air quality impacts, the estimated maximum ground-level concentration increments due to these pollutant emissions beyond site boundaries were compared with allowable PSD increments. Total maximum concentrations, obtained by adding the background concentration levels representative of the site to the estimated maximum ground-level concentration increments, were compared with applicable national and state ambient air quality standards.

F.4.2 Noise

Potential noise impacts under each alternative were assessed by estimating the sound levels from noise-emitting sources associated with facility construction and operations, followed by noise propagation modeling. Examples of noise-emitting sources include heavy equipment used in earthmoving and other activities during construction; process equipment and emergency generators during operations; and train whistles and on-site and off-site traffic during construction and operations. Potential noise levels due to these sources were obtained from the literature (Harris Miller Miller & Hanson, Inc. [HMMH] 1995) and data provided by UDS (UDS 2003b). For construction of the conversion facility, detailed information on the types and number of construction equipment required is not available. Therefore, for construction impact analysis, it was assumed that the two noisiest sources would operate simultaneously at the center of the construction site (HMMH 1995). For operations impact analysis, the highest noise levels (inside buildings) measured at the Framatome ANP Richland, Washington, facility, similar to the proposed facility at Portsmouth, were assumed to be those at a distance of 15 m (50 ft) from the facility.

Noise levels at the nearest residence from the alternative sites were estimated by using a simple noise propagation model on the basis of estimated sound levels at the source. The significance of estimated potential noise levels at the nearest residence was assessed by comparing them with the EPA noise guideline (EPA 1974) and measured background noise levels.

F.5 WATER AND SOIL

Potential impacts to surface water, groundwater, and soil during facility construction, normal operations, and potential accidents were evaluated. Methods of quantitative and qualitative impact analyses are described in the following paragraphs.

For surface water, impacts were assessed in terms of runoff, floodplain encroachment, and water quality. Changes in runoff were assessed by comparing runoff areas with and without the proposed facility. Floodplain encroachment was assessed by evaluating the location of the proposed facility in terms of known floodplains. Inputs to the floodplain evaluation included estimated facility effluent volumes and estimates of flow volumes in nearby streams and rivers. Water quality impacts were estimated by using the proposed drinking water standard of 30 µg/L (EPA 2003b) as a guideline. When data were unavailable, assessment models that account for the different types of contaminants and dilution estimates for the surface water features were used to estimate surface water conditions.

Potential impacts on groundwater were assessed in terms of changes in recharge to underlying aquifers, depth to groundwater, direction of groundwater flow, and groundwater quality. Changes to recharge of groundwater were evaluated by comparing the increase in the impermeable area produced by construction and operations with the recharge area available at actual or representative sites. Impacts on the depth to groundwater were evaluated by comparing existing water use with modified water needs. Changes in the direction of groundwater flow were evaluated by examining the potential effects produced by the increased water demand. A model that considers movement, dispersion, adsorption, and decay of the contaminant source material over time was used to estimate the migration of contaminants from source areas to the groundwater (i.e., groundwater quality). Details of the model are provided in Tomasko (1997).

Potential impacts to soil were assessed in terms of changes in topography, permeability, quality, and erosion potential. Erosion potential was evaluated in terms of disturbed land area. Changes in soil quality were evaluated on the basis of the amounts of contaminants deposited as a result of certain activities. No standard is available for limiting soil concentrations of uranium; a health-based guideline value of 230 µg/g (EPA 1995a), applicable for residential settings, was used as a guideline for comparison in this EIS.

F.6 SOCIOECONOMICS

F.6.1 Scope of the Analysis

For this EIS, the analysis of the socioeconomic impacts under the no action alternative and the action alternatives was based on the analysis performed for the DUF_6 PEIS (DOE 1999), which used cost engineering data provided by Dubrin et al. (1997), with additional information provided by UDS (UDS 2003b).

For the action alternatives and the no action alternative, impacts were estimated for the ROIs at Portsmouth and ETTP. The analysis estimated the impacts of continued storage and conversion on regional economic activity, including direct (on-site) and indirect (off-site) employment and income. In addition, the impact of each conversion technology on (1) population in-migration, (2) local housing markets, (3) local public service employment, and (4) local jurisdictional revenues and expenditures was also calculated. Additional details on the analysis of socioeconomic impacts undertaken for the DUF_6 PEIS are provided in Allison and Folga (1997). Updated data on the affected environment at each site were used to revise the impacts from continued storage and conversion facilities on the economy and community at each site that were described in the DUF_6 PEIS (DOE 1999) and in Hartmann (1999a,b,c).

An assessment of the socioeconomic impacts from transporting DUF_6 was not included in the DUF_6 PEIS analysis or in this EIS. The transportation of DUF_6 would likely not lead to significant en route socioeconomic impacts because the total expenditures for transportation related to DUF_6 would be small compared with expenditures related to total shipments of all other goods for any of the routes that might be used. The analysis might also have considered the socioeconomic impacts of potential accidents, particularly for DUF_6-related transportation activities. However, because it is unlikely that any potential accident would release large quantities of hazardous or radioactive material into the environment, accidents are expected to create only minor local economic disruption, and a substantial commitment of fiscal resources for accident remediation would probably not be necessary at any of the current storage sites or along transportation routes.

F.6.2 Technical Approach for the Analysis

F.6.2.1 Regional Economy

The analysis of regional economic impacts used engineering cost data for facilities that would be constructed and operated and input-output economic data for the ROI surrounding the site. The ROI was defined as the counties in which 90% of site employees currently reside (see Section 3.1.8). Additional data from the U.S. Bureau of the Census (2002a,b) were used to forecast economic data to provide the basis for the presentation of relative impacts.

The analysis was performed by using the engineering cost data of Dubrin et al. (1997) for the construction and operation of the conversion facility, which were then updated by using UDS data (UDS 2003b). Direct (on-site) employment and income impacts were then calculated on the basis of average total labor costs (i.e., fully loaded labor costs, including site overhead, contractor profit, and employee benefits) in each category. Estimates of direct income impacts were calculated by adjusting average fully loaded labor costs to exclude the various components of site overhead, state and federal income taxes, and other payroll deductions. This process produced a measure of disposable wage and salary income that would likely be spent in the regional economy at each of the sites.

Indirect (off-site) impacts were based on detailed item-specific procurement data for material and on adjusted direct and indirect labor costs. Cost information was associated with the relevant standard industrial classification (SIC) codes and construction and operation schedule information to provide estimates of procurement and wage and salary expenditures for each sector in the local economy for the year in which expenditures would be made. Information on the expected pattern of local and nonlocal procurement for the various materials and labor expenditures by SIC code was then calculated on the basis of local shares of national employment in each material and labor procurement category and information provided for the site. Expenditures by SIC code by year occurring in the ROI were then mapped into the Bureau of Economic Analysis (BEA) sectors used in an IMPLAN input-output model (Minnesota IMPLAN Group, Inc. 2003) specified for the ROI (see Section 3.1.1.8). Each model was used to produce employment and income multipliers for each sector where procurement and labor expenditures occur. Indirect impacts were then calculated by multiplying expenditures in each sector by the input-output multipliers produced by the model for the ROI.

Impacts were presented in terms of the (1) direct, indirect, and total employment impacts; (2) direct and total income impacts; and (3) relative employment impact, or the magnitude of the absolute impact compared with the growth in the local economic employment baseline. Construction impacts for the facility were presented for the peak construction year. Operations impacts were presented for the first year of operations.

F.6.2.2 Regional Economy Assessment Model

The analysis used county-level IMPLAN input-output economic data for 2000 (Minnesota IMPLAN Group, Inc. 2003) to measure the regional economic impacts of conversion facilities at the site. The IMPLAN input-output model is a microcomputer-based program that allows construction of input-output models for counties or combinations of counties for any location in the United States. Input-output data are the economic accounts of any given region and show the flow of commodities to industries from producers and institutional consumers. The accounts also show consumption activities by workers, owners of capital, and imports from outside the region. The model contains 528 sectors, representing industries in agriculture, mining, construction, manufacturing, wholesale and retail trade, utilities, finance, insurance and real estate, and consumer and business services. The model also includes information for each sector on employee compensation; proprietary and property income; personal consumption expenditure; federal, state, and local expenditures; inventory and capital formation; and imports and exports. The model can be used to produce accurate estimates of the impact of changes in expenditures in specific local activities on employment and income in any given year. The analysis of regional economic impacts used the model to calculate multipliers for each sector in the ROI for which procurement and wage and salary expenditures would be likely to occur. These multipliers were calculated for the year 2000, the latest year available.

For this EIS, data from the 2000 census were used to modify and update the data presented in the data compilation reports (Hartmann 1999a-c) for both the affected environment and impact sections. In addition to using 2000 population data to describe population trends in the ROI, counties, and important cities near the site, these data were used to provide information on per capita personal income at the county level and on the number of employees per capita at the county and city level for key public services, including police, fire protection, general government, education, medical facilities, and hospitals. Housing data from the 2000 census were also used to establish trends in housing growth over the period 1990 to 2000; details were presented for both the owner-occupied and rental markets, including vacancy rates. The 2000 census data were used in this EIS to update the impacts that were described in the data compilation reports for each alternative.

F.6.2.3 Population

The construction and operation of a conversion facility would likely lead to in-migration into the ROI. In-migration would be both direct, related to new employment created on site, and indirect, related to changes in employment opportunities in the ROI as a whole. In the DUF_6 PEIS (DOE 1999) analysis, the number of direct employees in-migrating was based on information on employment in existing DOE programs and on the level of contractor support. Indirect in-migration that would occur for each ROI was calculated by using assumed in-migration rates associated with changes in employment in the local industries most significantly affected indirectly by construction and operation expenditures, with residual in-migration rates assumed for the remaining industries in the economy indirectly affected. As in the DUF_6 PEIS, population impacts in this EIS are presented in terms of the (1) absolute total (direct and indirect) in-migration impact and (2) relative population impact, or the magnitude of the absolute impact compared with the growth in the local economic population baseline.

F.6.2.4 Local Housing Markets

In-migration that would occur with the construction and operation of a conversion facility could affect the local housing market in the ROI. The DUF_6 PEIS (DOE 1999) analysis considered these impacts by estimating the increase in demand for housing units in each year of construction and operation on the basis of the number of in-migrating workers to the area surrounding each site and average household size. The results were compared with forecasts for housing supply and demand and owner-occupied and rental vacancy rates for each year during construction and operation, on the basis of information provided by the U.S. Bureau of the Census (1994, 2002a).

F.6.2.5 Local Jurisdictions

The construction and operation of a conversion facility would likely lead to some in-migration into the area surrounding the site, which would change the demand for educational services provided by school districts and for public services (police, fire protection, health services, etc.) provided by cities and counties. The DUF_6 PEIS (DOE 1999) analysis used estimates of in-migration (see above) as the basis for estimating impacts on public service employment and impacts on revenues and expenditures for the various counties, cities, and school districts in the ROI. Revenue and expenditure data were based on the annual comprehensive financial reports produced by individual jurisdictions surrounding each site and on demographic information provided by the U.S. Bureau of the Census (2002a). Impacts were presented in terms of the number of (1) new public service employees required and (2) percentage change in forecasted revenues and expenditures for counties, cities, and school districts. Impacts were estimated for the peak year of construction and the first year of operation for the conversion facility.

F.7 ECOLOGY

Potential impacts on terrestrial and aquatic biota — including vegetation and wildlife, wetlands, and federal- and state-listed threatened and endangered species — were evaluated. The impact analysis focused on the radiological and chemical toxicity effects to biota that would result from exposure to DUF_6 and related compounds and from physical disturbance to biota and habitats. The conversion of DUF_6 was evaluated on the basis of the UDS technology for converting DUF_6 to depleted U_3O_8. The analysis considered potential impacts on biota in the vicinity of the Portsmouth site.

The analysis of impacts on wildlife addressed the effects of facility construction (including physical disturbance and habitat loss) and facility operations (including air quality, radiological, and chemical toxicity effects through the exposure pathways of inhalation, dermal contact, and ingestion). Exposures were based on predicted concentrations of contaminants in air, surface water, groundwater, and soil. Radiological dose rate estimates (in rad/d) were calculated for aquatic biota (fish and shellfish) on the basis of undiluted concentrations (in pCi/L), energy released per decay (MeV) for depleted uranium, and a bioconcentration factor (factors of 2 and 60 were applied for fish and shellfish, respectively). These dose rate estimates were compared with the dose limit of 1 rad/d specified in DOE Order 5400.5 (DOE 1990a). The screening level for potential ecological effects is 4.55×10^3 pCi/L for fish (Bechtel Jacobs Company LLC 1998). In addition, concentrations of uranium, uranium compounds, and HF in air, water, and/or soil were compared with published benchmark values (levels with no effects or lowest observed effects) to determine potential toxicity effects. Benchmark values for air concentration lowest observable effects due to inhalation were 7 mg/m^3 for HF and 17 mg/m^3 for U_3O_8. The benchmark values for aquatic toxicity were a screening level of 2.6 µg/L, the Tier II secondary chronic value for potential adverse effects (Suter and Tsao 1996), and a lowest observable effect level of 150 µg/L for total uranium (Hyne et al. 1992). Potential impacts analyzed included impacts on individuals (such as mortality, injury, or physical disturbance) and potential changes in biotic communities.

The analysis of ecological impacts on plant species addressed the effects of facility construction (such as effects from the removal of vegetation) and operations (such as chemical toxicity effects). Estimated concentrations of uranium in soil were compared with a benchmark value of 5 µg/g, which is the lowest observed effects concentration (Will and Suter 1994). Potential impacts analyzed included impacts on individuals (such as injury or mortality) and potential changes in biotic communities.

Physical disturbances to biota and habitats were also evaluated. The general guidelines used to assess impacts of habitat loss and wildlife disturbance were as follows: (1) negligible impacts were those that would affect less than 10 acres (4 ha) of required land; (2) moderate impacts would affect 10 to 100 acres (4 to 40 ha) of required land; and (3) potential large impacts would affect more than 100 acres (40 ha) of required land.

The potential impacts on wetlands were based on the direct impacts that could result from construction (such as filling) or the indirect impacts that could result from changes in water quality or the hydrologic regime or from soil compaction or runoff. The potential impacts on federal- and state-listed threatened and endangered species were based on the direct impacts that could result from habitat loss or modification or the indirect impacts that could result from disturbance.

Input for the impact analysis included data on plant and animal species either known to occur or that could potentially occur at the site and in ecosystems (such as wetland, forest, grassland) in the vicinity of the site.

F.8 WASTE MANAGEMENT

Potential impacts to waste management programs at Portsmouth and ETTP were evaluated for the alternatives considered in this EIS. The categories of waste evaluated were LLW, TRU, hazardous waste, and nonhazardous solid and liquid waste. Current (as of fiscal year [FY] 2002) projected total generation volumes for each of the categories of waste for the period covering FYs 2002 through 2025 were obtained from a database maintained by the DOE Oak Ridge Office for the site (Cain 2002). These volumes included wastes generated from routine site operations and from planned environmental restoration activities; they are summarized in Table F-4.

For this EIS, annualized generation volumes were derived for use in evaluating potential impacts from the conversion facility. These volumes were derived by dividing the forecasted total volumes from FY 2002 through FY 2025 by 24 years. These annualized generation volumes are included in Table F-4 and are also presented in Sections 3.1.9 and 3.2.9 for Portsmouth and ETTP, respectively. Potential impacts were then evaluated (see Chapter 5) by comparing the waste volumes that would be generated (from the conversion to U_3O_8 considered in this EIS) with the annualized generation volumes.

The majority of the wastes generated from the conversion facility would be LLW and nonhazardous wastes (wastewater and solids). At both Portsmouth and ETTP, all LLW is transported off site for disposal except Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) or environmental restoration LLW solid wastes generated at ETTP. (These wastes are disposed of at the disposal cell located within the Oak Ridge Reservation [ORR] complex.) Nonhazardous wastewater is treated at on-site treatment facilities and discharged to permitted outfalls. It appears that the wastewater treatment facilities at these sites would have adequate remaining capacities to treat the additional wastewater that

TABLE F-4 Environmental Management Waste Generation Forecast[a] for Fiscal Years 2002 through 2025

		Waste Volume (m^3)			
Site	Waste Type	Inventory at End of FY 2001	Forecast of Newly Generated Waste, FY 2002–2025	Total Managed Waste, FY 2002–2025	Annualized Projection[c]
ETTP[b]	Hazardous	0	8,288	8,288	1,381
	LLW	20,595	953,059	973,654	162,276
	LLMW	2,572	62,608	65,180	10,863
	TRU	0	0	0	0
	Nonhazardous (sanitary/industrial)				
	Wastewater	0	1,131,169	1,131,169	188,528
	Solids	0	280,911	280,911	46,819
Portsmouth	Hazardous	0	2,587	2,587	112
	LLW	13,587	1,727,409	1,740,996	75,695
	LLMW	6,147	129,124	135,271	5,881
	TRU	0	0	0	0
	Nonhazardous (sanitary/industrial)				
	Wastewater	0	0	0	0
	Solids	0	76,358	76,358	3,320

a Source: DOE Oak Ridge Operations Office (Cain 2002). Volume projections include wastes from routine site operations and environmental restoration. A large portion of the waste would be from environmental restoration activities.

b For ETTP, it is projected that the majority of the waste would be generated by FY 2008, consistent with the site's accelerated schedule.

c Annualized projections were obtained by dividing volumes by 6 years for ETTP and 23 years for Portsmouth.

would be generated from the conversion facility (see Section 3). Nonhazardous solids at Portsmouth are disposed of at an on-site landfill. At ETTP, nonhazardous solids generated from environmental restoration activities are disposed of at the landfill located within the ORR complex, and the remaining waste (from other site activities) is transported to an off-site facility. All low-level mixed (radioactive and hazardous) waste (LLMW) and hazardous waste at these sites are transported off site for disposal, except for waste from environmental restoration activities at ETTP, which is sent to the disposal cell located within the ORR complex. TRU waste would most likely be transported to the Waste Isolation Pilot Plant (WIPP) in New Mexico.

F.9 RESOURCE REQUIREMENTS

The evaluation of resource requirements identified the major resources required that could be determined at this level of analysis. The commitment of material and energy resources during the entire life cycles of the facility considered in this EIS would include construction materials that could not be recovered or recycled, materials rendered radioactive that could not be decontaminated, and materials consumed or reduced to unrecoverable forms or waste. For construction, materials required would include wood, concrete, sand, gravel, steel, and other metals. Materials consumed during operations could include operating supplies, miscellaneous chemicals, and gases. Strategic and critical materials, or resources with small reserves, were also identified and considered.

Energy resources irretrievably committed during construction and operations would include the fossil fuels used to generate heat and electricity (if furnaces or boilers were used for heating; current plans are for electrical heating of facilities). Energy in the form of diesel fuel, gasoline, and oil would also be used for construction equipment and transportation vehicles.

The assessment of potential resource requirements for continued storage (no action) and the action alternatives was based on comparing the resource requirements needed for building and operating the proposed facility with the existing resource capacities of on-site infrastructure systems and with current off-site demand for resources at the three current storage sites. A variation of the methodology applied in the Waste Management Programmatic Environmental Impact Statement (WM PEIS) (DOE 1997a) was utilized in this EIS study. The effects of the various options on on-site infrastructure systems (such as electrical demand) were assessed qualitatively by comparing the new demand with the existing maximum capacity. The demand on the off-site infrastructure that would result from new resource requirements was compared with the estimated current demand.

F.10 LAND USE

The evaluation of land use impacts under the action alternatives and the no action alternative employed a similar approach. A baseline description for 2003 outlined the land use patterns currently occurring on the Portsmouth site, providing a sense of what is both typical and acceptable in this locale. A complementary description of land use in Pike County, based on available interpreted satellite imagery, provides a sense of land use tendencies in the vicinity of the site (which remained relatively unchanged over the past decade). An analysis of the alternatives, in turn, enabled an assessment of how compatible (or incompatible) the various potential development scenarios would be with existing land use patterns. Although the analysis employed quantitative data when available — such as summaries of land use activities by the size of the area involved — the assessment ultimately was qualitative, being based on comparisons with existing land use patterns and current zoning and planning guidelines.

The assumptions underlying the assessment of impacts on land use for this EIS include these:

- Baseline conditions are assumed to be those that are occurring in 2003, although, in some cases, information on land use was available from prior years.
- The projected operating life of the proposed facility is assumed to be 25 years, beginning in about 2006.
- Under the no action alternative, continued storage of DUF_6 is assumed to occur over a 40-year period.

F.11 CULTURAL RESOURCES

Cultural resources include those portions of the natural and man-made environment that have significant historical or cultural meaning. These resources include archaeological sites, historic structures, cultural landscapes, and traditional cultural properties.

The DUF_6 conversion project activities that would have the greatest potential for affecting significant cultural resources would be those related to construction. It is anticipated that the operation and decommissioning of the conversion facility would have far fewer effects.

Three alternative locations for the conversion facility have been proposed for Portsmouth. The area of potential effect at each construction location was determined. This area would include the land within the boundary of each facility construction location, including access roads, laydown areas, parking areas, and any locations where upgrades to infrastructure (e.g., roads, power lines, and water lines) would be necessary. The land use history of these areas was reconstructed and evaluated to determine to what extent recent construction or earthmoving has altered the landscape and thus affected the likelihood of cultural resources being present.

A records search was conducted for each proposed construction location to determine if either unevaluated cultural resources or cultural resources eligible for inclusion in the *National Register of Historic Places* (NRHP) were known to exist. All classes of cultural resources were considered, ranging in date from the prehistoric to the contemporary. Sources included published documents, cultural resource surveys on file at the site, and files maintained by the relevant State Historic Preservation Officer (SHPO). Consultation was undertaken with the SHPO and Native American groups with historical ties to the area. This information was placed within a broader cultural and historical context. If cultural resource information was lacking, requiring new field studies before construction, the potential for encountering cultural resources in the projected area of effect was evaluated on the basis of the known distribution of cultural resources in the surrounding area.

The potential effects of chemical and radiological releases on cultural resources were investigated. There is a potential for an adverse effect on historic structures when secondary air quality standards for criteria pollutants are exceeded. Secondary standards set pollution limits to protect public welfare and include protection against damage to buildings (EPA 2002). Air quality models were used to estimate the potential that construction and operation of the conversion facility would result in pollution beyond these limits. In this model, the projected increase in emissions was added to the background levels for the pollutant, and the sum was compared with state and national secondary standards. The potential for adverse effects on cultural resources from the accident scenarios considered in this EIS was also evaluated.

F.12 ENVIRONMENTAL JUSTICE

The methods used to evaluate environmental justice impacts emphasized issues identified in Executive Order 12898 ("Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations"), which defines environmental justice as a topic that must be evaluated for federal actions. As such, the methods focused on identifying high and adverse impacts on low-income and minority populations under the action alternatives and the no action alternative. The impacts examined under environmental justice included those impacts identified in all disciplines considered in this EIS (human health, air quality, socioeconomics, etc.).

The evaluation of impacts under environmental justice was based on the following basic assumptions:

- Baseline conditions are those occurring in 2002. However, the data used to identify minority populations were from 2000, and the data used to identify low-income populations were from 1999.

- The anticipated operating life of the proposed facility is 25 years, beginning in 2006.

- The ROI for environmental justice varies by impact area, ranging from 50 mi (80 km) from the proposed facility to geographic areas close to the facilities.

Because the environmental justice evaluation relied heavily on analyses in other disciplines, it also incorporated the assumptions underlying these other inquiries. The data used to evaluate impacts related to environmental justice were of two types: (1) census data used to define disproportionality and (2) data on anticipated effects under the action alternatives and the no action alternative. Data from the most recent decennial census of population and housing, conducted in 2000, provided a recent, detailed basis for evaluating the distribution of minority and low-income populations. These two population groups are defined as follows:

- *Minority:* Individuals who classify themselves as belonging to any of the following racial groups: Black (including Black or Negro, African American, Afro-American, Black Puerto Rican, Jamaican, Nigerian, West Indian, or Haitian); American Indian, Eskimo, or Aleut; Asian or Pacific Islander; or "Other Race" (U.S. Bureau of the Census 1991; see CEQ 1997). In the 2000 census, many individuals categorized themselves as belonging to more than one race. This EIS considers individuals of multiple races to be minority, regardless of the races involved. This study also includes individuals identifying themselves as Hispanic in origin, technically an ethnic category, under minority. To avoid double counting, the analysis included only White Hispanics, since the above racial groups already accounted for Non-white Hispanics.

- *Low-income:* Individuals falling below the poverty line. For the 2000 census, the poverty line was defined by a statistical threshold based on a weighted average that considered both family size and the ages of individuals in a family. For example, the 1999 weighted average poverty threshold annual income for a family of three with one related child younger than 18 years was $13,410, while the poverty threshold for a family of five with one child younger than 18 years was $21,024 (U.S. Bureau of the Census 2000). If a family fell below the poverty line for its particular composition, the census considered all individuals in that family to be below the poverty line. Low income figures in the 2000 census reflect incomes in 1999, the most recent year for which entire annual incomes were known at the time of the most recent census.

This EIS examined minority and low-income populations with census data collected and presented for counties and for census tracts. Census tracts are small, relatively permanent statistical subdivisions of a county, usually containing between 2,500 and 8,000 persons (U.S. Bureau of the Census 1991). Through the use of these geographic units, the environmental justice analysis is geographically commensurate with analyses in two other impact areas of particular concern with regard to minority and low-income populations: socioeconomics (which used counties) and human health (which used census tracts).

Environmental justice is not itself an impact area, per se. Rather, it considers other impacts that are both high and adverse and affect minority and low-income populations disproportionally. As such, the results of assessments in these other disciplines were crucial in the evaluation of environmental justice — essentially preceding the environmental justice evaluation. The key type of data required to identify environmental justice concerns was the result of these other analyses.

F.13 CUMULATIVE IMPACTS

Cumulative effects or impacts result from the incremental impact of the action alternatives when added to other past, present, and reasonably foreseeable future actions, regardless of what government agency or private entity undertakes such actions. Cumulative effects may result from impacts that are minor individually but that, when viewed collectively over space and time, can produce significant impacts. The approach used for cumulative analysis in this EIS was based on the principles outlined by the Council on Environmental Quality (CEQ 1997) and on the guidance developed by the EPA (1999) for independent reviewers of EISs.

The analysis of cumulative impacts focused on specific impacts on the human or natural environment that could result from multiple actions in the vicinity of the Portsmouth site and the ETTP site. Generally, the geographic area for each cumulative impact analysis was defined by the specific resource or receptor of concern and the spatial extent of the interacting (cumulative) impact generators. Although the cumulative analysis acknowledged the past history of impacts at each site, its emphasis was on future cumulative impacts that could occur during the life of a conversion facility. This focus allows the decision maker to place the direct and indirect impacts of the action alternatives within the context of other potential stressors.

The cumulative impact analysis for this EIS was not meant to be a review of all potential environmental impacts at and near a site, nor was it meant to be a sitewide impact analysis. As a starting point, the cumulative analysis used the direct and indirect impacts from the action alternatives as evaluated for each technical subject. Then similar impacts from other actions (including DOE actions, United States Enrichment Corporation (USEC) actions, and the actions of others) were identified. These were added to determine the cumulative impact from all activities occurring together. Then meaningful trends in past, present, and future cumulative impacts were discussed.

For each cumulative impact, the significance of the consequences was assessed on the basis of the (1) likelihood of the impact, (2) geographic or spatial extent of the impact, (3) duration in time of the impact, (4) applicable regulatory considerations, (5) potential for recovery if the impact was temporary, and (6) potential for effective mitigation.

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APPENDIX G:

CONSULTATION LETTERS

U.S. DEPARTMENT OF ENERGY LETTERS TO STATE AGENCIES AND RECOGNIZED NATIVE AMERICAN GROUPS

Department of Energy

Oak Ridge Operations Office
P.O. Box 2001
Oak Ridge, Tennessee 37831—

July 18, 2002

Mr. Ron Sparkman
Chairperson
Shawnee Tribe
P.O. Box 189
Miami, OK 74355

Dear Mr. Sparkman:

The U.S. Department of Energy (DOE) is preparing an Environmental Impact Statement (EIS) presenting the likely effects of constructing and operating one or more plants to convert stored Depleted Uranium Hexafluoride (DUF_6) into a more stable form. As part of this process, the DOE is initiating consultations with Native American groups with historical ties to the areas under consideration for a conversion facility.

The EIS will evaluate plans to build and operate DUF_6 conversion facilities at the Paducah Gaseous Diffusion Plant (PGDP), McCracken County, Kentucky and the Portsmouth Gaseous Diffusion Plant (PORTS), Pike County, Ohio. Three possible construction locations will be evaluated at each site. The Notice of Intent to prepare the EIS was published on September 18, 2001 in the Federal Register. Public scoping for the DUF_6 conversion EIS took place between September 18, 2001 and January 11, 2001.

The enclosed maps show the location of the PORTS site and the alternative facility locations under consideration at PORTS. Cultural resource inventories have been initiated at PORTS. In most cases the likelihood of cultural resources being disturbed by construction activities is low. Only Location B includes some land with high archaeological sensitivity. The potential effects of the operation of the facilities on cultural resources located in the area surrounding PORTS will be evaluated in the EIS.

We have determined, in accordance with §800.3 of the Advisory Council on Historic Preservation's (Council) revised regulations for the protection of historic properties, that DOE's proposed action for the conversion of DUF_6 is: (1) an undertaking, as defined in 36 CFR §800.16(y); and (2) is a type of activity that has the potential to cause effects on historic properties. In accordance with §800.8(c) of the Council's regulations, we are notifying you, and the Council by copy of this letter, that we intend to use the process and documentation required to comply with the National Environmental Policy Act (NEPA) to comply with Section 106 of the National Historic Preservation Act (NHPA) for this undertaking. In using the NEPA process in lieu of the procedures set forth in §800.3 through §800.6 of the Council's regulations (i.e., the Section 106 process), we will ensure the standards set forth in §800.8(c)(1) through §800.8(c)(5) are met.

Mr. Ron Sparkman 2

Please contact us if you have any concerns or comments regarding the proposed project. Any information you provide regarding specific cultural resources will remain confidential as stipulated in 36 CFR Part 800.11. To ensure that your concerns receive full consideration, please submit any comments within 30 days of the receipt of this letter.

Thank you for your attention to our notification of initiation of consultation. If you have any questions or need additional information on this matter, please contact me at (865) 576-0273 or by email at hartmangs@oro.doe.gov.

Sincerely,

Gary S. Hartman

Gary S. Hartman, EIS Document Manager
DOE ORO Cultural Resources
Management Coordinator

Enclosures

cc w/enclosures:
Skip Gosling, HR-76, HQ/FORS
Tom McCulloch, Advisory Council on Historic Preservation
Lois Thompson, EH-232, HQ/FORS
Kristi Wiehle, PORTS Site Office

Department of Energy

Oak Ridge Operations Office
P.O. Box 2001
Oak Ridge, Tennessee 37831—

July 18, 2002

Mr. Ronald Froman
Principal Chief
Peoria Indian Tribe of Oklahoma
P.O. Box 1527
Miami, OK 74355

Dear Chief Froman:

The U.S. Department of Energy (DOE) is preparing an Environmental Impact Statement (EIS) presenting the likely effects of constructing and operating one or more plants to convert stored Depleted Uranium Hexafluoride (DUF_6) into a more stable form. As part of this process, the DOE is initiating consultations with Native American groups with historical ties to the areas under consideration for a conversion facility.

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The enclosed maps show the location of the PGDP site and the alternative facility locations under consideration at PGDP. Cultural resource inventories have been initiated at PGDP. In most cases the likelihood of cultural resources being disturbed by construction activities is low. Only Location B includes some land with high archaeological sensitivity. The potential effects of the operation of the facilities on cultural resources located in the area surrounding PDGP will be evaluated in the EIS.

We have determined, in accordance with §800.3 of the Advisory Council on Historic Preservation's (Council) revised regulations for the protection of historic properties, that DOE's proposed action for the conversion of DUF_6 is: (1) an undertaking, as defined in 36 CFR §800.16(y); and (2) is a type of activity that has the potential to cause effects on historic properties. In accordance with §800.8(c) of the Council's regulations, we are notifying you, and the Council by copy of this letter, that we intend to use the process and documentation required to comply with the National Environmental Policy Act (NEPA) to comply with Section 106 of the National Historic Preservation Act (NHPA) for this undertaking. In using the NEPA process in lieu of the procedures set forth in §800.3 through §800.6 of the Council's regulations (i.e., the Section 106 process), we will ensure the standards set forth in §800.8(c)(1) through §800.8(c)(5) are met.

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Sincerely,

Gary S. Hartman

Gary S. Hartman, EIS Document Manager
DOE ORO Cultural Resources
Management Coordinator

Enclosures

cc w/enclosures:
Skip Gosling, HR-76, HQ/FORS
Tom McCulloch, Advisory Council on Historic Preservation
Lois Thompson, EH-232, HQ/FORS
David Tidwell, Paducah Site Office

Department of Energy
Oak Ridge Operations Office
P.O. Box 2001
Oak Ridge, Tennessee 37831—

July 18, 2002

Dr. Joseph Garrison
Tennessee Historical Commission
Department of Environment and Conservation
2941 Lebanon Road
Nashville, Tennessee 37243-0442

Dear Dr. Garrison:

The U.S. Department of Energy (DOE), Depleted Uranium Hexafluoride (DUF_6) Management Program, is preparing an Environmental Impact Statement (EIS) concerning its plans to convert DUF_6 stored at the Portsmouth Gaseous Diffusion Plant (PORTS), located in Pike County, Ohio, the Paducah Gaseous Diffusion Plant (PGDP), located in McCracken County, Kentucky, and the East Tennessee Technology Park (ETTP), located at Oak Ridge, Tennessee. The EIS will also evaluate transporting DUF_6 from storage at ETTP, Oak Ridge, Tennessee. In some conversion scenarios a cylinder transfer facility would be built at ETTP. Locations at the PGDP and the PORTS are being considered for the conversion facility. In 1999, the DOE prepared a Programmatic EIS for Alternative Strategies for the Long-Term Management and Use of DUF_6. The current site specific EIS will evaluate the construction and operation of a facility to convert the stored DUF_6 to a more stable chemical form. The Notice of Intent to prepare the EIS was published on September 18, 2001 in the Federal Register. Public scoping for the DUF_6 EIS took place between September 18, 2001 and January 11, 2001 and included meetings and written and electronic correspondence. The enclosed map shows the location of the ETTP. No construction sites have been proposed at ETTP to date. The effects on cultural resources of constructing a transfer facility will be evaluated in a future document if and when specific construction sites are proposed. The potential effects of the operation of the facilities on cultural resources located in the area surrounding ETTP will be evaluated in this EIS.

We have determined, in accordance with §800.3 of the Advisory Council on Historic Preservation's (Council) revised regulations for the protection of historic properties, that DOE's proposed action for the conversion of DUF_6 is: (1) an undertaking, as defined in 36 CFR §800.16(y); and (2) is a type of activity that has the potential to cause effects on historic properties. In accordance with §800.8(c) of the Council's regulations, we are notifying you, and the Council by copy of this letter, that we intend to use the process and documentation required to comply with the National Environmental Policy Act (NEPA) to comply with Section 106 of the National Historic Preservation Act (NHPA) for this undertaking. In using the NEPA process in lieu of the procedures set forth in §800.3 through §800.6 of the Council's regulations (i.e., the Section 106 process), we will ensure the standards set forth in §800.8(c)(1) through §800.8(c)(5) are met.

Dr. Joseph Garrison 2

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Sincerely,

Gary S. Hartman

Gary S. Hartman, EIS Document Manager
DOE ORO Cultural Resources
Management Coordinator

Enclosure

cc w/enclosure:
Skip Gosling, HR-76, HQ/FORS
Tom McCulloch, Advisory Council on Historic Preservation
Lois Thompson, EH-232, HQ/FORS
Donna Perez, EM-911, ORO

Department of Energy

Oak Ridge Operations Office
P.O. Box 2001
Oak Ridge, Tennessee 37831—

July 18, 2002

Mr. Gary White Deer
Chickasaw Nation of Oklahoma
P.O. Box 1548
Ada, OK 74821

Dear Mr. White Deer:

The U.S. Department of Energy (DOE) is preparing an Environmental Impact Statement (EIS) presenting the likely effects of constructing and operating one or more plants to convert stored Depleted Uranium Hexafluoride (DUF_6) into a more stable form. As part of this process, the DOE is initiating consultations with Native American groups with historical ties to the areas under consideration for a conversion facility.

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Mr. Gary White Deer 2

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Sincerely,

Gary S. Hartman

Gary S. Hartman, EIS Document Manager
DOE ORO Cultural Resources
Management Coordinator

Enclosures

cc w/enclosures:
Skip Gosling, HR-76, HQ/FORS
Tom McCulloch, Advisory Council on Historic Preservation
Lois Thompson, EH-232, HQ/FORS
David Tidwell, Paducah Site Office

Department of Energy

Oak Ridge Operations Office
P.O. Box 2001
Oak Ridge, Tennessee 37831—

July 18, 2002

Mr. James Bird
THPO
Eastern Band of Cherokee Indians
Quallah Boundary
P.O. Box 455
Cherokee, NC 28719

Dear Mr. Bird:

The U.S. Department of Energy (DOE), Depleted Uranium Hexafluoride (DUF_6) Management Program, is preparing an Environmental Impact Statement (EIS) concerning its plans to convert DUF_6 stored at the Portsmouth Gaseous Diffusion Plant (PORTS), located in Pike County, Ohio, the Paducah Gaseous Diffusion Plant (PGDP), located in McCracken County, Kentucky, and the East Tennessee Technology Park (ETTP), located at Oak Ridge, Tennessee. The EIS will also evaluate transporting DUF_6 from storage at the ETTP, Oak Ridge, Tennessee. In some conversion scenarios a cylinder transfer facility would be built at ETTP. Locations at the PGDP and the PORTS are being considered for the conversion facility. In 1999, the DOE prepared a Programmatic EIS for Alternative Strategies for the Long-Term Management and Use of DUF_6. The current site specific EIS will evaluate the construction and operation of a facility to convert the stored DUF_6 to a more stable chemical form. The Notice of Intent to prepare the EIS was published on September 18, 2001 in the Federal Register. Public scoping for the DUF_6 EIS took place between September 18, 2001 and January 11, 2001 and included meetings and written and electronic correspondence. The enclosed map shows the location of the ETTP. No construction sites have been proposed at ETTP to date. The effects on cultural resources of constructing a transfer facility will be evaluated in a future document if and when specific construction sites are proposed. The potential effects of the operation of the facilities on cultural resources located in the area surrounding ETTP will be evaluated in this EIS.

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Mr. James Bird 2

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Sincerely,

Gary S. Hartman

Gary S. Hartman, EIS Document Manager
DOE ORO Cultural Resources
Management Coordinator

Enclosure

cc w/enclosure:
Skip Gosling, HR-76, HQ/FORS
Tom McCulloch, Advisory Council on Historic Preservation
Lois Thompson, EH-232, HQ/FORS
Donna Perez, EM-911, ORO

Department of Energy

Oak Ridge Operations Office
P.O. Box 2001
Oak Ridge, Tennessee 37831—

July 18, 2002

Mr. Kenneth Daugherty
Absentee-Shawnee Tribe of Oklahoma
2025 S. Gordon Cooper Dr.
Shawnee, OK 74801-99381

Dear Mr. Daugherty:

The U.S. Department of Energy (DOE) is preparing an Environmental Impact Statement (EIS) presenting the likely effects of constructing and operating one or more plants to convert stored Depleted Uranium Hexafluoride (DUF_6) into a more stable form. As part of this process, the DOE is initiating consultations with Native American groups with historical ties to the areas under consideration for a conversion facility.

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Mr. Kenneth Daugherty 2

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Gary S. Hartman, EIS Document Manager
DOE ORO Cultural Resources
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Enclosures

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Lois Thompson, EH-232, HQ/FORS
Kristi Wiehle, PORTS Site Office

Department of Energy

Oak Ridge Operations Office
P.O. Box 2001
Oak Ridge, Tennessee 37831—

July 18, 2002

Mr. Charles D. Enyart
Chief
Eastern Shawnee Tribe of Oklahoma
P.O. Box 350
Seneca, MO 64865

Dear Chief Enyart:

The U.S. Department of Energy (DOE) is preparing an Environmental Impact Statement (EIS) presenting the likely effects of constructing and operating one or more plants to convert stored Depleted Uranium Hexafluoride (DUF_6) into a more stable form. As part of this process, the DOE is initiating consultations with Native American groups with historical ties to the areas under consideration for a conversion facility.

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Mr. Charles D. Enyart 2

Please contact us if you have any concerns or comments regarding the proposed project. Any information you provide regarding specific cultural resources will remain confidential as stipulated in 36 CFR Part 800.11. To ensure that your concerns receive full consideration, please submit any comments within 30 days of the receipt of this letter.

Thank you for your attention to our notification of initiation of consultation. If you have any questions or need additional information on this matter, please contact me at (865) 576-0273 or by email at hartmangs@oro.doe.gov.

Sincerely,

Gary S. Hartman

Gary S. Hartman, EIS Document Manager
DOE ORO Cultural Resources
Management Coordinator

Enclosures

cc w/enclosures:
Skip Gosling, HR-76, HQ/FORS
Tom McCulloch, Advisory Council on Historic Preservation
Lois Thompson, EH-232, HQ/FORS
Kristi Wiehle, PORTS Site Office

Department of Energy

Oak Ridge Operations Office
P.O. Box 2001
Oak Ridge, Tennessee 37831—

July 18, 2002

Mr. Hawk Pope
Chief
Shawnee Nation, United Remnant Band
7092 State Route 540
Bellefontaine, OH 43311

Dear Chief Pope:

The U.S. Department of Energy (DOE) is preparing an Environmental Impact Statement (EIS) presenting the likely effects of constructing and operating one or more plants to convert stored Depleted Uranium Hexafluoride (DUF_6) into a more stable form. As part of this process, the DOE is initiating consultations with Native American groups with historical ties to the areas under consideration for a conversion facility.

The EIS will evaluate plans to build and operate DUF_6 conversion facilities at the Paducah Gaseous Diffusion Plant (PGDP), McCracken County, Kentucky and the Portsmouth Gaseous Diffusion Plant (PORTS), Pike County, Ohio. Three possible construction locations will be evaluated at each site. The Notice of Intent to prepare the EIS was published on September 18, 2001 in the Federal Register. Public scoping for the DUF_6 conversion EIS took place between September 18, 2001 and January 11, 2001.

The enclosed maps show the location of the PORTS site and the alternative facility locations under consideration at PORTS. Cultural resource inventories have been initiated at PORTS. In most cases the likelihood of cultural resources being disturbed by construction activities is low. Only Location B includes some land with high archaeological sensitivity. The potential effects of the operation of the facilities on cultiral resources located in the area surrounding PORTS will be evaluated in the EIS.

We have determined, in accordance with §800.3 of the Advisory Council on Historic Preservation's (Council) revised regulations for the protection of historic properties, that DOE's proposed action for the conversion of DUF_6 is: (1) an undertaking, as defined in 36 CFR §800.16(y); and (2) is a type of activity that has the potential to cause effects on historic properties. In accordance with §800.8(c) of the Council's regulations, we are notifying you, and the Council by copy of this letter, that we intend to use the process and documentation required to comply with the National Environmental Policy Act (NEPA) to comply with Section 106 of the National Historic Preservation Act (NHPA) for this undertaking. In using the NEPA process in lieu of the procedures set forth in §800.3 through §800.6 of the Council's regulations (i.e., the Section 106 process), we will ensure the standards set forth in §800.8(c)(1) through §800.8(c)(5) are met.

Mr. Hawk Pope 2

Please contact us if you have any concerns or comments regarding the proposed project. Any information you provide regarding specific cultural resources will remain confidential as stipulated in 36 CFR Part 800.11. To ensure that your concerns receive full consideration, please submit any comments within 30 days of the receipt of this letter.

Thank you for your attention to our notification of initiation of consultation. If you have any questions or need additional information on this matter, please contact me at (865) 576-0273 or by email at hartmangs@oro.doe.gov.

Sincerely,

Gary S. Hartman

Gary S. Hartman, EIS Document Manager
DOE ORO Cultural Resources
Management Coordinator

Enclosures

cc w/enclosures:
Skip Gosling, HR-76, HQ/FORS
Tom McCulloch, Advisory Council on Historic Preservation
Lois Thompson, EH-232, HQ/FORS
Kristi Wiehle, PORTS Site Office

Department of Energy

Oak Ridge Operations Office
P.O. Box 2001
Oak Ridge, Tennessee 37831—

July 12, 2002

Ms. Patricia Jones
Ohio Department of Natural Resources
Heritage Program
1889 Fountain Square, Bldg. F-1
Columbus, Ohio 43224

Dear Ms. Jones:

ENVIRONMENTAL IMPACT STATEMENT CONVERTING DUF6 STORED AT PORTSMOUTH GASEOUS DIFFUSION PLANT, PIKE COUNTY, OHIO

The U.S. Department of Energy (DOE), Depleted Uranium Hexafluoride (DUF6) Management Program, is preparing an Environmental Impact Statement (EIS) concerning its plans to convert DUF6 stored at the Portsmouth Gaseous Diffusion Plant (PORTS), located in Pike County, Ohio. The DOE prepared a Programmatic EIS for Alternative Strategies for the Long-Term Management and Use of DUF6 in 1999. This new EIS will evaluate the construction and operation of a facility to convert the DUF6 stored at the PORTS to a more stable chemical form. The conversion facility would be located within the existing PORTS site boundary. The conversion products would subsequently be used or disposed elsewhere. I have enclosed maps showing the location of the PORTS and potential construction sites.

We would appreciate receiving information on any state-protected species that may inhabit or visit the PORTS vicinity and could possibly be affected by construction or operation of a conversion facility. As part of the analysis of ecological impacts we will assess potential impacts to species listed by the state of Ohio as endangered, threatened, or candidate species. A list of these species and their residency status at PORTS or in the vicinity would be useful for the analysis.

Thank you in advance for your assistance. If you need further information regarding this request, please do not hesitate to call me at (865) 576-0938 or call Mr. Robert Van Lonkhuyzen at Argonne National Laboratory at (630) 252-5973.

Sincerely,

James L. Elmore

James L. Elmore, Ph.D.
Alternate NEPA Compliance Officer

Enclosure

Department of Energy

Oak Ridge Operations Office
P.O. Box 2001
Oak Ridge, Tennessee 37831—

July 12, 2002

Mr. Ken Lammers
Acting Field Supervisor
U.S. Fish and Wildlife Service
6950-H Americana Parkway
Reynoldsburg, Ohio 43068-4127

Dear Mr. Lammers:

ENVIRONMENTAL IMPACT STATEMENT CONVERTING DUF6 STORED AT PORTSMOUTH GASEOUS DIFFUSION PLANT, PIKE COUNTY, OHIO

The U.S. Department of Energy (DOE), Depleted Uranium Hexafluoride (DUF6) Management Program, is preparing an Environmental Impact Statement (EIS) concerning its plans to convert DUF6 stored at the Portsmouth Gaseous Diffusion Plant (PORTS), located in Pike County, Ohio. The DOE prepared a Programmatic EIS for Alternative Strategies for the Long-Term Management and Use of DUF6 in 1999. This new EIS will evaluate the construction and operation of a facility to convert the DUF6 stored at the PORTS to a more stable chemical form. The conversion facility would be located within the existing PORTS site boundary. The conversion products would subsequently be used or disposed elsewhere. I have enclosed maps showing the location of the PORTS and potential construction sites.

We would appreciate receiving information on any federally-protected species that may inhabit or visit the PORTS vicinity and could possibly be affected by construction or operation of a conversion facility. As part of the analysis of ecological impacts we will assess potential impacts to federally-listed endangered, threatened, and candidate species and critical habitat. A list of these species and their residency status at PORTS or in the vicinity, or critical habitat, would be useful for the analysis.

Thank you in advance for your assistance. If you need further information regarding this request, please do not hesitate to call me at (865) 576-0938 or call Mr. Robert Van Lonkhuyzen at Argonne National Laboratory at (630) 252-5973.

Sincerely,

James L. Elmore, Ph.D.
Alternate NEPA Compliance Officer

Enclosure

Department of Energy

Oak Ridge Operations Office
P.O. Box 2001
Oak Ridge, Tennessee 37831—

July 12, 2002

Mr. C. Thomas Bennett
Kentucky Department of
Fish and Wildlife Resources
#1 Game Farm Road
Frankfort, KY 40601

Dear Mr. Bennett:

ENVIRONMENTAL IMPACT STATEMENT CONVERTING DUF6 STORED AT PADUCAH GASEOUS DIFFUSION PLANT, MCCRACKEN COUNTY, KENTUCKY

The U.S. Department of Energy (DOE), Depleted Uranium Hexafluoride (DUF6) Management Program, is preparing an Environmental Impact Statement (EIS) concerning its plans to convert DUF6 stored at the Paducah Gaseous Diffusion Plant (PGDP), located in McCracken County, Kentucky. The DOE prepared a Programmatic EIS for Alternative Strategies for the Long-Term Management and Use of DUF6 in 1999. This new EIS will evaluate the construction and operation of a facility to convert the DUF6 stored at the PGDP to a more stable chemical form. If the Paducah location is selected, the conversion facility would be located either within or immediately outside the existing PGDP boundary. The conversion products would subsequently be used or disposed elsewhere. I have enclosed maps showing the location of the PGDP and potential construction sites. If the Paducah location is not selected for the conversion facility, the DUF6 materials at Paducah would be shipped to the Portsmouth Gaseous Diffusion Plant in Portsmouth, Ohio.

We would appreciate receiving information on any state-protected species that may inhabit or visit the PGDP vicinity and could possibly be affected by construction or operation of a conversion facility. As part of the analysis of ecological impacts we will assess potential impacts to species listed by the state of Kentucky as endangered, threatened, or candidate species. A list of these species and their residency status at PGDP or in the vicinity would be useful for the analysis.

Thank you in advance for your assistance. If you need further information regarding this request, please do not hesitate to call me at (865) 576-0938 or call Mr. Robert Van Lonkhuyzen at Argonne National Laboratory at (630) 252-5973.

Sincerely,

James L. Elmore

James L. Elmore, Ph.D.
Alternate NEPA Compliance Officer

Enclosure

Department of Energy

Oak Ridge Operations Office
P.O. Box 2001
Oak Ridge, Tennessee 37831—
July 12, 2002

Mr. Donald Dott
Kentucky State Nature
Preserves Commission
801 Schenkel Lane
Frankfort, KY 40601

Dear Mr. Dott:

ENVIRONMENTAL IMPACT STATEMENT CONVERTING DUF6 STORED AT PADUCAH GASEOUS DIFFUSION PLANT, MCCRACKEN COUNTY, KENTUCKY

The U.S. Department of Energy (DOE), Depleted Uranium Hexafluoride (DUF6) Management Program, is preparing an Environmental Impact Statement (EIS) concerning its plans to convert DUF6 stored at the Paducah Gaseous Diffusion Plant (PGDP), located in McCracken County, Kentucky. The DOE prepared a Programmatic EIS for Alternative Strategies for the Long-Term Management and Use of DUF6 in 1999. This new EIS will evaluate the construction and operation of a facility to convert the DUF6 stored at the PGDP to a more stable chemical form. If the Paducah location is selected, the conversion facility would be located either within or immediately outside the existing PGDP boundary. The conversion products would subsequently be used or disposed elsewhere. I have enclosed maps showing the location of the PGDP and potential construction sites. If the Paducah location is not selected, the DUF6 materials at PGDP would be shipped to the Portsmouth Gaseous Diffusion Plant in Portsmouth, Ohio for conversion.

We would appreciate receiving information on any state-protected species that may inhabit or visit the PGDP vicinity and could possibly be affected by construction or operation of a conversion facility.. As part of the analysis of ecological impacts we will assess potential impacts to species listed by the state of Kentucky as endangered, threatened, or candidate species. A list of these species and their residency status at PGDP or in the vicinity would be useful for the analysis.

Thank you in advance for your assistance. If you need further information regarding this request, please do not hesitate to call me at (865) 576-0938 or call Mr. Robert Van Lonkhuyzen at Argonne National Laboratory at (630) 252-5973.

Sincerely,

James L. Elmore, Ph.D.
Alternate NEPA Compliance Officer

Enclosure

Department of Energy

Oak Ridge Operations Office
P.O. Box 2001
Oak Ridge, Tennessee 37831—

July 12, 2002

Mr. David Snyder
Archaeology Reviews Manager
Resource Protection and Review
Ohio State Historic Preservation Office
567 East Hudson Street
Columbus, Ohio 432-11-1030

Dear Mr. Snyder,

The U.S. Department of Energy (DOE), Depleted Uranium Hexafluoride (DUF6) Management Program, is preparing an Environmental Impact Statement (EIS) concerning its plans to convert DUF6 stored at the Portsmouth Gaseous Diffusion Plant (PORTS), located in Pike County, Ohio, the Paducah Gaseous Diffusion Plant (PGDP), located in McCracken County, Kentucky, and the East Tennessee Technology Park (ETTP), located at Oak Ridge Tennessee. Locations at the PGDP and PORTS are being considered for the conversion facility. In 1999, the DOE prepared a Programmatic EIS for Alternative Strategies for the Long-Term Management and Use of DUF_6. The current site specific EIS will evaluate the construction and operation of a facility to convert the stored DUF_6 to a more stable chemical form. The Notice of Intent to prepare the EIS was published on September 18, 2001 in the Federal Register. Public scoping for the DUF_6 EIS took place between September 18, 2001 and January 11, 2001 and included meetings and written and electronic correspondence. The proposed conversion facility would be located within the existing PORTS site boundary. The conversion products would subsequently be used or disposed elsewhere. I have included maps showing the location of the PORTS and potential construction sites.

We have determined, in accordance with §800.3 of the Advisory Council on Historic Preservation's (Council) revised regulations for the protection of historic properties, that DOE's proposed action for the conversion of DUF_6 is: (1) an undertaking, as defined in 36 CFR §800.16(y); and (2) is a type of activity that has the potential to cause effects on historic properties. In accordance with §800.8(c) of the Council's regulations, we are notifying you, and the Council by copy of this letter, that we intend to use the process and documentation required to comply with the National Environmental Policy Act (NEPA) to comply with Section 106 of the NHPA for this undertaking. In using the NEPA process in lieu of the procedures set forth in §800.3 through §800.6 of the Council's regulations (i.e., the Section 106 process), we will ensure the standards set forth in §800.8(c)(1) through §800.8(c)(5) are met.

Mr. David Snyder 2

Thank you for your attention to our notification of initiation of consultation. If you have any questions or need additional information on this matter, please contact either me at (865) 576-0273 (hartmangs@oro.doe.gov) or Kristi Wiehle at (740) 897-5020.

Sincerely,

Gary S. Hartman

Gary S. Hartman
DOE ORO Cultural Resources
Management Coordinator

Enclosures

cc w/enclosures:
Skip Gosling, HR-76, HQ/FORS
Tom McCulloch, Advisory Council
Kristi Wiehle, PORTS Site Office

Department of Energy

Oak Ridge Operations Office
P.O. Box 2001
Oak Ridge, Tennessee 37831—

July 12, 2002

Mr. David L. Morgan
SHPO, Executive Director
Kentucky Heritage Council
300 Washington Street
Frankfort, KY 40601

Dear Mr. Morgan;

The U.S. Department of Energy (DOE), Depleted Uranium Hexafluoride (DUF_6) Management Program, is preparing an Environmental Impact Statement (EIS) concerning its plans to convert DUF_6 stored at the Portsmouth Gaseous Diffusion Plant (PORTS), located in Pike County, Ohio, the Paducah Gaseous Diffusion Plant (PGDP), located in McCracken County Kentucky, and the East Tennessee Technology Park (ETTP), located at Oak Ridge, Tennessee. Locations at the PGDP and the PORTS are being considered for the conversion facility. In 1999, the DOE prepared a Programmatic EIS for Alternative Strategies for the Long-Term Management and Use of DUF_6. The current site specific EIS will evaluate the construction and operation of a facility to convert the stored DUF_6 to a more stable chemical form. The Notice of Intent to prepare the EIS was published on September 18, 2001 in the Federal Register. Public scoping for the DUF_6 EIS took place between September 18, 2001 and January 11, 2001 and included meetings and written and electronic correspondence. The proposed conversion facility at the PDGP would be located within the existing PDGP site boundary. The conversion products would subsequently be used or disposed elsewhere. I have included maps showing the location of the PDGP and potential construction sites.

We have determined, in accordance with §800.3 of the Advisory Council on Historic Preservation's (Council) revised regulations for the protection of historic properties, that DOE's proposed action for the conversion of DUF_6 is: (1) an undertaking, as defined in 36 CFR §800.16(y); and (2) is a type of activity that has the potential to cause effects on historic properties. In accordance with §800.8(c) of the Council's regulations, we are notifying you, and the Council by copy of this letter, that we intend to use the process and documentation required to comply with the National Environmental Policy Act (NEPA) to comply with Section 106 of the NHPA for this undertaking. In using the NEPA process in lieu of the procedures set forth in §800.3 through §800.6 of the Council's regulations (i.e., the Section 106 process), we will ensure the standards set forth in §800.8(c)(1) through §800.8(c)(5) are met.

Mr. David L. Morgan 2

Thank you for your attention to our notification of initiation of consultation. If you have any questions or need additional information on this matter, please contact either me at (865) 576-0273 (hartmangs@oro.doe.gov) or Kristi Wiehle at (740) 897-5020.

Sincerely,

Gary S. Hartman

Gary S. Hartman
DOE ORO Cultural Resources
Management Coordinator

Enclosures

cc w/enclosures:
Skip Gosling, HR-76, HQ/FORS
Tom McCulloch, Advisory Council
David Tidwell, Paducah Site Office

Department of Energy

Oak Ridge Operations Office
P.O. Box 2001
Oak Ridge, Tennessee 37831—

July 12, 2002

Dr. Lee A. Barclay, PhD
Field Supervisor
U.S. Fish and Wildlife Service
446 Neal Street
Cookeville, TN 38501

Dear Dr. Barclay:

ENVIRONMENTAL IMPACT STATEMENT CONVERTING DUF6 STORED AT EAST TENNESSEE TECHNOLOGY PARK, OAK RIDGE RESERVATION, ROANE COUNTY, TENNESSEE; PADUCAH GASEOUS DIFFUSION PLANT, MCCRACKEN COUNTY, KENTUCKY AND PORTSMOUTH GASEOUS DIFFUSION PLANT IN PORTSMOUTH, OHIO

The U.S. Department of Energy (DOE), Depleted Uranium Hexafluoride (DUF6) Management Program, is preparing an Environmental Impact Statement (EIS) concerning its plans to convert DUF6 stored at the East Tennessee Technology Park (ETTP), located on the Oak Ridge Reservation in Roane County, Tennessee, as well as the Paducah Gaseous Diffusion Plant (PGDP), located in McCracken County, Kentucky, and the Portsmouth Gaseous Diffusion Plant in Portsmouth, Ohio. The DOE prepared a Programmatic EIS for Alternative Strategies for the Long-Term Management and Use of DUF6 in 1999. This new EIS will evaluate the construction and operation of a facility at Paducah and/or Portsmouth, to convert the DUF6 to a more stable chemical form. If the Paducah site is selected, the conversion facility would be located either within or immediately outside the existing PGDP boundary. The conversion products would subsequently be used or disposed elsewhere. I have enclosed maps showing the location of the PGDP and potential construction sites.

The DUF6 cylinders stored at the ETTP would be shipped to Portsmouth or Paducah. The only activities envisioned under the proposed action at ETTP are the continued storage of the cylinders until they are transported offsite and the cylinder preparations for offsite shipment. The cylinder preparation activities considered include placement of some cylinders in protective overpacks or transferring their contents into new or compliant cylinders. No construction related to DUF6 cylinder preparation and shipment is currently planned for ETTP. However, if the decision to construct a cylinder transfer facility is made, a separate environmental review would be conducted.

We would appreciate receiving information on any federally-protected species that may inhabit or visit the ETTP or PGDP vicinity and could possibly be affected by the proposed action. As part of the analysis of ecological impacts we will assess potential impacts to federally-listed

Dr. Lee A. Barclay, PhD 2

endangered, threatened, and candidate species and critical habitat. A list of these species and their residency status at ETTP or PGDP or in the vicinity, or critical habitat, would be useful for the analysis.

Thank you in advance for your assistance. If you need further information regarding this request, please do not hesitate to call me at (865) 576-0938 or call Mr. Robert Van Lonkhuyzen at Argonne National Laboratory at (630) 252-5973.

Sincerely,

James L. Elmore, PhD
Alternate NEPA Compliance Officer

Enclosure

RESPONSES TO U.S. DEPARTMENT OF ENERGY LETTERS TO STATE AGENCIES AND NATIVE AMERICAN GROUPS

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Ecological Services
6950 Americana Parkway, Suite H
Reynoldsburg, Ohio 43068-4127

September 23, 2002

OFFICIAL FILE COPY
AMESQ

Log No.
Date Received OCT 9 2002
File Code

James L. Elmore, Ph.D.
Department of Energy
Oak Ridge Operations Office
P.O. Box 2001
Oak Ridge, TN 37831

Dear Dr. Elmore:

This responds to your letter of July 12, 2002 regarding Federally listed endangered or threatened species that may occur in the vicinity of the Portsmouth Gaseous Diffusion Plant (PORTS) located in Pike County, Ohio.

ENDANGERED SPECIES COMMENTS:

The proposed project lies within the range of the Indiana bat (*Myotis sodalis*), a Federally listed endangered species. Summer habitat requirements for the Indiana bat are not well defined, but the following are thought to be of importance:

1. Dead trees and snags (especially those with exfoliating bark), split tree trunk and/or branches, or cavities which may be used as maternity roosts;
2. Live trees (such as shagbark hickory) which have exfoliating bark;
3. Stream corridors, riparian areas, and upland woodlots which provide forage sites.

We recommend that if potential bat roost trees with the above characteristics are encountered in the project area, they should be saved wherever possible. If they must be cut, they should not be cut between April 15 and September 15.

If desirable trees are present and if the above time restriction is unacceptable, mist net or other surveys should be conducted to determine if bats are present. Any survey should be designed and conducted in coordination with the endangered species coordinator for this office, Ms. Angela Boyer (614-469-6923 ext. 22). The survey should be conducted in June or July, the period when peak bat populations could be expected.

The project lies within the range of the timber rattlesnake, a large shy rattlesnake that is declining throughout its national range. No Federal listing status has been assigned to this species. Instead, the U.S. Fish and Wildlife Service has initiated a pre-listing Conservation Action Plan to support state and local conservation efforts. Your proactive efforts to conserve this species now may help avoid the need to list the species under the Endangered Species Act in the future. The timber rattlesnake is protected throughout much of its range and listed as endangered by the State of Ohio. Due to their rarity and reclusive nature, we encourage early project coordination to avoid potential impacts to timber rattlesnakes and their habitat.

In Ohio, the timber rattlesnake is restricted to the un-glaciated Allegheny Plateau and utilizes the specific habitat types, depending upon season. Winters are spent in dens usually associated with high, dry ridges. These dens may face any direction, but southeast to southwest are most common. Such dens usually consist of narrow crevices in the bedrock. Rocks may or may not be present on the surface. From these dens, timber rattlesnakes radiate throughout the surrounding hills and move distances as great as 4.5 miles. In the fall, timber rattlesnakes return to the same den. Intensive efforts to transplant timber rattlesnakes have not been successful. Thus protection of the winter dens is critical to the survival of this species. Some project management ideas include the following:

1) At a minimum, project evaluations should contain delineations of timber rattlesnake habitat within project boundaries. Descriptions should indicate the quality and quantity of timber rattlesnake habitat (den sites, basking sites, and foraging area, etc.) that may be affected by the project.

2) In cases where timber rattlesnakes are known to occur or where potential habitat is rated moderate to high, timber rattlesnake surveys may be necessary. If surveys are to be conducted, it may be helpful to inquire about timber rattlesnake sightings with local resource agency personnel or reliable local residents. In addition, local herpetologists may have knowledge of historical populations as well as precise knowledge of the habits, and the specific local types of habitats that may contain timber rattlesnakes. Surveys should be performed during the periods of spring emergence from dens (usually a short period in April or May) and throughout the active season until October. The species is often easiest to locate during the summer months when pregnant females seek open areas in early morning, especially after cool evenings.

3) In portions of projects where timber rattlesnakes will be affected, clearing and construction activities should occur at distances greater than 100 feet from known dens. Most importantly, tops of ridges and areas of exposed rock should be avoided.

4) In areas where timber rattlesnake dens are known or likely to exist, maintenance activities (mowing, cutting, burning, etc.) should be conducted from November 1 to March 1, when timber rattlesnakes are hibernating.

Two divisions of the Ohio Department of Natural Resources, the Division of Wildlife (614-265-6300) and the Division of Natural Areas and Preserves (614-265-6472), maintain lists of plants and animals of concern to the State of Ohio. If you have not already done so, you may wish to contact each of these agencies to obtain site-specific information about species of state concern.

If you have questions or we may be of further assistance in this matter please contact Mr. Bill Kurey of this office at 614-469-6923 ext. 14.

Sincerely,

Mary Knapp

Mary Knapp, Ph.D.
Supervisor

cc: R. Sanders, ODOW

COMMONWEALTH OF KENTUCKY
DEPARTMENT OF FISH AND WILDLIFE RESOURCES
C. THOMAS BENNETT, COMMISSIONER

July 26, 2002

OFFICIAL FILE COPY
AMESQ
Log No. 71283
Date Received AUG 2 2002
File Code

Mr. James L. Elmore
Department of Energy
Oak Ridge Operations Office
P.O. Box 2001
Oak Ridge, TN 37831

RE: Environmental Impact Statement Converting DUF6
Stored at Paducah Gaseous Diffusion Plant,
McCracken County, Kentucky

Dear Mr. Elmore:

I have reviewed the information provided on the above-referenced project. Accordingly, I offer the following comments and recommendations.

A review of the Kentucky Fish and Wildlife Information System indicates that several federal and/or state threatened and/or endangered species are known to occur within McCracken County that could be impacted by the project. That species list is attached. Please be aware that our database system is a dynamic one that only represents our current knowledge of the various species distributions. This information may also be obtained on the worldwide web at: www.kfwis.state.ky.us.

I would recommend that a habitat survey be conducted at the site of the proposed project and if any habitat that might harbor any of these species exists, then a specific survey for that species should be conducted. The results of those surveys will dictate if any additional surveys or analysis need to be conducted.

I appreciate the opportunity to comment.

Sincerely,

Wayne L. Davis
Environmental Section Chief

cc: Environmental Section Files

EDUCATION PAYS

Arnold L. Mitchell Bldg. #1 Game Farm Road Frankfort, Ky 40601

1 of 1

Alosa alabamae	Alabama shad	Osteichthyes	MCCRACKEN	C	E	Reference
Atractosteus spatula	alligator gar	Osteichthyes	MCCRACKEN		E	Reference
Cyprinella camura	bluntface shiner	Osteichthyes	MCCRACKEN		E	Reference
Hybognathus hayi	cypress minnow	Osteichthyes	MCCRACKEN		E	Reference
Myotis sodalis	Indiana myotis	Mammalia	MCCRACKEN	LE	E	Reference
Obovaria retusa	ring pink	Bivalvia	MCCRACKEN	LE	E	Reference
Notropis maculatus	taillight shiner	Osteichthyes	MCCRACKEN		T	Reference
Nyctanassa violacea	yellow-crowned night-heron	Aves	MCCRACKEN		T	Reference

United States Department of the Interior

FISH AND WILDLIFE SERVICE
446 Neal Street
Cookeville, TN 38501

September 18, 2002

Mr. James L. Elmore, Ph.D.
U.S. Department of Energy
Oak Ridge Operations Office
P.O. Box 2001
Oak Ridge, Tennessee 37831

Dear Dr. Elmore:

Thank you for your letter and enclosures received July 23, 2002, regarding the preparation of an Environmental Impact Statement (EIS) for the proposed construction and operation of a facility to convert DUF6 to a more stable chemical form at the Paducah Gaseous Diffusion Plant (PGDP) in McCracken County, Kentucky. The referenced maps of the PGDP and proposed facility locations were not included in your letter. U.S. Fish and Wildlife Service personnel have reviewed the information submitted and offer the following comments for consideration.

According to our records, the following federally listed endangered species may occur on or near the PGDP:

Indiana bat *Myotis sodalis*

A qualified biologist should assess potential impacts and determine if the proposed project may affect the species. We recommend that you submit a copy of your assessment and the draft EIS to this office for review and concurrence. A finding of "may affect" could require the initiation of formal consultation procedures.

These constitute the comments of the U.S. Department of the Interior in accordance with provisions of the Endangered Species Act (87 Stat. 884, as amended: 16 U.S.C. 1531 et seq.). We appreciate the opportunity to comment. Should you have any questions or need further assistance, please contact Steve Alexander of my staff at 931/528-6481, ext. 210, or via e-mail at *steven_alexander@fws.gov*.

Sincerely,

Lee A. Barclay, Ph.D.
Field Supervisor

xc: Wayne Davis, KDFWR, Frankfort
Laila Lienesch, FWS, Frankfort

DONALD S. DOTT, JR.
DIRECTOR

PAUL E. PATTON
GOVERNOR

COMMONWEALTH OF KENTUCKY
KENTUCKY STATE NATURE PRESERVES COMMISSION
801 SCHENKEL LANE
FRANKFORT, KENTUCKY 40601-1403
(502) 573-2886 VOICE
(502) 573-2355 FAX

August 12, 2002

James L. Elmore, Ph.D.
Department of Energy
Oak Ridge Operations Office
P.O. Box 2001
Oak Ridge, TN 37831-2001

Dear Dr. Elmore:

This letter is in response to your data request of July 12, 2002 for State-Listed species information in the vicinity of the Paducah Gaseous Diffusion Plant DUF6 Conversion facility project. We have reviewed our Natural Heritage Program Database to determine if any of the endangered, threatened, or special concern plants and animals or exemplary natural communities monitored by the Kentucky State Nature Preserves Commission occur in the area. Based on our most current information, we have determined that 68 occurrences of the plants or animals and one occurrence of the exemplary natural communities that are monitored by KSNPC are reported as occurring in the specified area. Please see the attached report for more information. I have included a separate report of the species known from McCracken County, Kentucky as well.

Data and data products received from the Kentucky State Nature Preserves Commission, including any portion thereof, may not be reproduced in any form or by any means without the express written authorization of the Kentucky State Nature Preserves Commission. The exact location of plants, animals, and natural communities, if released by the Kentucky State Nature Preserves Commission, may not be released in any document or correspondence. These products are provided on a temporary basis for the express project (described above) of the requester, and may not be redistributed, resold or copied without the written permission of the Kentucky State Nature Preserves Commission's Data Manager (801 Schenkel Lane, Frankfort, KY, 40601. Phone: (502) 573-2886).

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August 12, 2002

Please note that the quantity and quality of data collected by the Kentucky Natural Heritage Program are dependent on the research and observations of many individuals and organizations. In most cases, this information is not the result of comprehensive or site-specific field surveys; many natural areas in Kentucky have never been thoroughly surveyed, and new plants and animals are still being discovered. For these reasons, the Kentucky Natural Heritage Program cannot provide a definitive statement on the presence, absence, or condition of biological elements in any part of Kentucky. Heritage reports summarize the existing information known to the Kentucky Natural Heritage Program at the time of the request regarding the biological elements or locations in question. They should never be regarded as final statements on the elements or areas being considered, nor should they be substituted for on-site surveys required for environmental assessments. We would greatly appreciate receiving any pertinent information obtained as a result of on-site surveys.

If you have any questions or if I can be of further assistance, please do not hesitate to contact me.

Sincerely,

Sara Hines
Data Manager

Enclosures: Data Report and Interpretation Key, McCracken County List
Endangered, Threatened, and Special Concern Plants and Animals of Kentucky
Plants and Animals Presumed Extinct or Extirpated from Kentucky
Monitored Natural Communities of Kentucky

Data Key for Element and Occurrence Reports (v. 3.98)
Kentucky State Nature Preserves Commission
Natural Heritage Program Data Services

Many of the data fields on the enclosed report are easily understood. Other fields, however, use abbreviations and formats that are not always self-explanatory. A key to these fields follows. Your report may contain some or all of the following data fields.

BEARING:	Bearing in degrees from a center point to an occurrence's latitude and longitude. This field is masked for sensitive occurrences; contact KSNPC in these cases. Omitted for G, U, and Q precision occurrence records.
BESTSOURCE:	Best available reference to the occurrence: literature citation, collector, collection number, museum or herbarium code, etc.
COMMENTS:	Additional information about the occurrence including identification, taxonomy, or date of occurrence.
DIRECTIONS:	Directions to an occurrence. This field is masked for sensitive occurrences; contact KSNPC in these cases.
DISTANCE:	Distance from a center point to an occurrence's latitude and longitude. Units coded as M (miles), K (kilometers), and F (feet). This field is masked for sensitive occurrences; contact KSNPC in these cases. Omitted for G, U, and Q precision occurrence records.
ELCODE:	Element (species) code.
EOCODE:	Element (species) code, occurrence number (last three digits), and state.
EODATA:	Occurrence population data: date of observation, number of individuals, health, size of colony, flowering data, etc.
EORANK:	Judgement of occurrence quality: A = excellent, B = good, C = marginal, D = poor, E = verified extant but quality not judged, O = obscure (not found at reported site but more searching needed), H = historically known from site but no known observation or collection since 1975, X = extirpated from site.
FIRSTOBS:	Year of first known observation or collection.
GENDESC:	Description of an occurrence's habitat.
GRANK:	Estimate of element abundance on a global scale: G1 = extremely rare, G2 = rare, G3 = uncommon, G4 = common, G5 = very common, GH = historically known and expected to be rediscovered, GU = uncertain, GX = extinct. Subspecies and variety abundances are coded with a 'T' suffix; the 'G' portion of the rank then refers to the entire species.
HABITAT:	General description of the element's habitat across its range.
IDENT:	Whether the identification has been checked by a reliable individual and is believed to be correctly identified: Y = identification confirmed and believed correct, N = No, identification determined to be wrong despite reports to the contrary, ? = Whether identification is correct or not is confusing or disputed, blank or U = unknown whether identification correct or not, assumed correct.
KSNPC:	Kentucky State Nature Preserves Commission status: N or blank = none, E = endangered, T = threatened, S = special concern, H = historic, X = extirpated.
LASTOBS:	Year(-month-date) of most recent known observation or collection.
LAT:	Latitude. This field is masked for sensitive occurrences; contact KSNPC in these cases. Omitted for G, U and Q precision occurrences.
LONG:	Longitude. This field is masked for sensitive occurrences; contact KSNPC in these cases. Omitted for G, U and Q precision occurrences.
MAP NUMBER:	Number used to location the element on KSNPC Heritage maps.
MARGNUM:	See MAP NUMBER.
PREC:	See PRECISION.

Rare Species And Communities Recorded for the Proposed DUF6 Conversion Facility at the Paducah Gaseous Diffusion Plant

KSNPC
Data Request No. 03-022

EOCODE	SNAME	SCOMNAME	GRANK	SRANK	SPROT	USESA	IDENT	LASTOBS	PREC	EORANK	COUNTY	7.5 MINUTE QUADRANGLE	EPA WATERBODY	DIRECTIONS	HABITAT
***Vascular Plants															
PDFAB0G041*013*KY	BAPTISIA BRACTEATA VAR LEUCOPHAEA	CREAM WILD INDIGO	G4G5T4T5	S3	S		Y	1997-05-11	S	C	McCracken	HEATH		WEST KY WMA, RD AROUND NUCLEAR PLANT (DYKE RD).	PRAIRIES AND OPEN WOODS ON SANDY SOIL.
PDJUG01010*002*KY	CARYA AQUATICA	WATER HICKORY	G5	S2S3	T			1997-	M	D	McCracken	JOPPA		METROPOLIS LAKE.	BOTTOMLANDS AND FLOODPLAIN SWAMPS.
PDSTY01030*021*KY	HALESIA TETRAPTERA	MOUNTAIN SILVER-BELL	G5	S1S2	E		Y	2001-04-13	S	B	McCracken	JOPPA		METROPOLIS LAKE SNP; SW END OF METROPOLIS LAKE, CA 0.3 AIR MI E OF POWERPLANT LOCATED OFF OF KY 996.	RICH WOODS AND EDGES OF SLOUGHS AND OXBOW LAKES.
PDSTY01030*015*KY	HALESIA TETRAPTERA	MOUNTAIN SILVER-BELL	G5	S1S2	E		Y	1991-06-20	S	A	McCracken	JOPPA		CIRCA 1.0 AIR MI WNW OF N CORNER OF SETTLING PONDS FOR SHAWNEE STEAM PLANT ALONG RIDGE ABOVE OHIO RIVER.	RICH WOODS AND EDGES OF SLOUGHS AND OXBOW LAKES.
PDAST6C040*001*KY	MELANTHERA NIVEA	SNOW MELANTHERA	G5	S3?	S		Y	2001-07-23	S	B/A	McCracken	JOPPA		METROPOLIS LAKE, OFF KY 996, W OF PADUCAH.	FLOODPLAINS AND SANDY WOODS INCLUDING DISTURBED OPENINGS.
PMPOA480S0*005*KY	MUHLENBERGIA GLABRIFLORIS	HAIR GRASS	G4?	S2S3	S			1977-09-21	M	H	McCracken	JOPPA		ALONG METROPOLIS FERRY ROAD, OFF OF KY 1420.	DRY, DESSICCATED OR BAKED SOILS, PRAIRIES, GRAVELS, OR ROCKY SLOPES AND MEDLEY REPORTS WET WOODS, MARSH EDGES AND FIELDS.
PDAST8L082*015*KY	SILPHIUM LACINIATUM VAR ROBINSONII	COMPASS PLANT	G5T?	S2	T		Y	1993-07	S	B	McCracken	HEATH		725 BETWEEN KY 726 AND KY 1154 (MARGNUM 34, 370505N, 884838W), (MARGNUM 35, 370513N, 884859W), (MARGNUM 36, 370521N, 884906W), (MARGNUM 37, 370515N, 884908W), (MARGNUM 38, 370517N, 884916W); JCT OF MAGRUDER RD	PRAIRIES INCL. REMNANTS OF THIS FLORA ON ROADSIDES AND FIELDS.
PDAST8L082*025*KY	SILPHIUM LACINIATUM VAR ROBINSONII	COMPASS PLANT	G5T?	S2	T			1993-07	S	C	McCracken	HEATH		WEST KENTUCKY WILDLIFE MANAGEMENT AREA BETWEEN SPRING BAYOU (BAYOU CREEK) AND ACID RD, CA 0.5 AIR MI NNW OF SPRING BAYOU CHURCH.	PRAIRIES INCL. REMNANTS OF THIS FLORA ON ROADSIDES AND FIELDS.
PDAST8L082*016*KY	SILPHIUM LACINIATUM VAR ROBINSONII	COMPASS PLANT	G5T?	S2	T		Y	1993-07	S	A	McCracken	HEATH		BOTH SIDES OF UNNAMED GRAVEL RD, CA 0.1 AIR MI S OF SOUTH ACID RD (MARGNUM 23), (MARGNUM 32, 370610N, 884935W), (MARGNUM 40, 370553N, 884949W), (MARGNUM 41, 370548N, 884952W), (MARGNUM 42, 370546N, 884945W),	PRAIRIES INCL. REMNANTS OF THIS FLORA ON ROADSIDES AND FIELDS.
***Gastropod															
IMGASK5100*009*KY	LEPTOXIS PRAEROSA	ONYX ROCKSNAIL	G5	S3S4	S		Y	1980-10-18	S	H	McCracken	JOPPA		OHIO RIVER AT MILE 948.0, LITTLE CHAIN BAR.	CALL (1895) INDICATED THAT IN THE OHIO RIVER AT THE FALLS IT OCCURRED IN THE GREATEST PROFUSION WHERE THE BOTTOM IS CLEAN ROCK OR ROCK WITH ABUNDANT "CONFERVOID" VEGETATION.
IMGASK6100*023*KY	LITHASIA VERRUCOSA	VARICOSE ROCKSNAIL	G3G4	S3S4	S		Y	1980-10-08	S	H	McCracken	JOPPA		OHIO RIVER AT MILE 948.0, LITTLE CHAIN BAR.	OBSERVATIONS ON THE HABITAT INCLUDE SPECIMENS TAKEN FROM RECENTLY EXPOSED BARS AND POOLS WITH SAND, GRAVEL, AND ROCK SUBSTRATES (HAAG AND PALMER-BALL, PERS COMM).

Rare Species And Communities Recorded for the Proposed DUF6 Conversion Facility at the Paducah Gaseous Diffusion Plant.

KSNPC
Data Request No. 03-022

EOCODE	SNAME	SCOMNAME	GRANK	SRANK	SPROT	USESA	DENT	LASTOBS	PREC	EORANK	COUNTY	7.5 MINUTE QUADRANGLE	EPA WATERBODY	DIRECTIONS	HABITAT
***Bivalves															
IMBIV21110*054*KY	LAMPSILIS ABRUPTA	PINK MUCKET	G2	S1	E	LE	Y	2001-08-31	S	D	McCracken	JOPPA		OHIO RIVER MILE 948.4, CA 120 M FROM KY SHORE.	APPARENTLY MORE COMMONLY FROM GRAVEL AND COBBLE. COLLECTED FROM SHALLOW AND DEEP WATER WITH CURRENT VELOCITY RANGING FROM ZERO TO SWIFT (AHLSTEDT 1983, BOGAN AND PARMALEE 1983, BUCHANAN 1980), BUT NEVER STANDING POOLS OF WATER (LAURITSEN PARMALEE 1987, STANSBERY 1976), BUT OCCURS IN MEDIUM-SIZED STREAMS IN GRAVEL, SAND, OR EVEN MUD (PARMALEE 1967, JOHNSON 1970, GORDON AND LAYZER 1989). IN THE LOWER WABASH AND OHIO RIVERS SPECIMENS WERE TAKEN IN DEEP WATER (6-10 FEET OR MORE) IN CURRENT FROM SAND
IMBIV21130*079*KY	LAMPSILIS OVATA	POCKETBOOK	G5	S1	E			1954-06-30	G	H	McCracken	JOPPA		OHIO RIVER BETWEEN METROPOLIS AND JOPPA (PLOTTED AT MIDPOINT).	
IMBIV34020*032*KY	PLETHOBASUS COOPERIANUS	ORANGEFOOT PIMPLEBACK	G1	S1	E	LE	Y	1907-08-18	G	H	McCracken	BANDANA		OHIO RIVER AT HILLERMAN, IL.	USUALLY FOUND IN LARGE RIVERS IN SAND AND GRAVEL SUBSTRATES (AHLSTEDT 1983, BOGAN AND PARMALEE 1983, MILLER, A.C. ET AL. 1986).
IMBIV34020*053*KY	PLETHOBASUS COOPERIANUS	ORANGEFOOT PIMPLEBACK	G1	S1	E	LE	Y	1999-09-07	S	D	McCracken	JOPPA		OHIO R AT LITTLE CHAIN BAR CA R MI 948.	USUALLY FOUND IN LARGE RIVERS IN SAND AND GRAVEL SUBSTRATES (AHLSTEDT 1983, BOGAN AND PARMALEE 1983, MILLER, A.C. ET AL. 1986).
IMBIV34020*056*KY	PLETHOBASUS COOPERIANUS	ORANGEFOOT PIMPLEBACK	G1	S1	E	LE	Y	2001-08-31	S	D	McCracken	JOPPA		OHIO RIVER MILE 948.4, CA 120 M FROM KY SHORE.	USUALLY FOUND IN LARGE RIVERS IN SAND AND GRAVEL SUBSTRATES (AHLSTEDT 1983, BOGAN AND PARMALEE 1983, MILLER, A.C. ET AL. 1986).
IMBIV34030*090*KY	PLETHOBASUS CYPHYUS	SHEEPNOSE	G3	S3	S		Y	1954-06-30	G	H	McCracken	JOPPA		OHIO RIVER BETWEEN METROPOLIS AND JOPPA (PLOTTED AT MIDPOINT).	USUALLY FOUND IN LARGE RIVERS IN CURRENT ON MUD, SAND, OR GRAVEL BOTTOMS AT DEPTH OF 1-2 METERS OR MORE (BAKER 1928, PARMALEE 1967, GORDON AND LAYZER 1989).
IMBIV34030*087*KY	PLETHOBASUS CYPHYUS	SHEEPNOSE	G3	S3	S		Y	1955-05-17	G	H	McCracken	JOPPA		OHIO RIVER AT JOPPA.	USUALLY FOUND IN LARGE RIVERS IN CURRENT ON MUD, SAND, OR GRAVEL BOTTOMS AT DEPTH OF 1-2 METERS OR MORE (BAKER 1928, PARMALEE 1967, GORDON AND LAYZER 1989).
IMBIV34030*065*KY	PLETHOBASUS CYPHYUS	SHEEPNOSE	G3	S3	S		Y	1907-08-18	G	H	McCracken	BANDANA		OHIO RIVER AT HILLERMAN, IL.	USUALLY FOUND IN LARGE RIVERS IN CURRENT ON MUD, SAND, OR GRAVEL BOTTOMS AT DEPTH OF 1-2 METERS OR MORE (BAKER 1928, PARMALEE 1967, GORDON AND LAYZER 1989).
IMBIV34030*125*KY	PLETHOBASUS CYPHYUS	SHEEPNOSE	G3	S3	S		Y	1999-08	S	D	McCracken	JOPPA		OHIO RIVER AT LITTLE CHAIN BAR, CA MI 948.	USUALLY FOUND IN LARGE RIVERS IN CURRENT ON MUD, SAND, OR GRAVEL BOTTOMS AT DEPTH OF 1-2 METERS OR MORE (BAKER 1928, PARMALEE 1967, GORDON AND LAYZER 1989).
IMBIV37030*001*KY	POTAMILUS CAPAX	FAT POCKETBOOK	G1	S1	E	LE	Y	1907-08	G	H	McCracken	BANDANA		OHIO R, AT HILLERMAN, MASSAC CO., ILL.	BACK CHANNELS, AND SOMETIMES IN DITCHES, IN MUD (OOZE); MIXED SAND, MUD, AND CLAY; OR FINE SILT AND MUD IN FLOWING WATER AT DEPTHS OF A FEW INCHES UP TO EIGHT FEET (PARMALEE 1967, AHLSTEDT AND JENKINSON 1987, CUMMINGS AND MAYER 1993, CUMMINGS ET AL. 1990).
IMBIV37030*029*KY	POTAMILUS CAPAX	FAT POCKETBOOK	G1	S1	E	LE	Y	1999-09-07	S	D	McCracken	JOPPA		OHIO RIVER AT CA R MI 943.6; BAR AT POWERLINE CROSSING.	BACK CHANNELS, AND SOMETIMES IN DITCHES, IN MUD (OOZE); MIXED SAND, MUD, AND CLAY; OR FINE SILT AND MUD IN FLOWING WATER AT DEPTHS OF A FEW INCHES UP TO EIGHT FEET (PARMALEE 1967, AHLSTEDT AND JENKINSON 1987, CUMMINGS AND MAYER 1993, CUMMINGS ET AL. 1990).
IMBIV39041*041*KY	QUADRULA CYLINDRICA CYLINDRICA	RABBITSFOOT	G3T3	S2	T		Y	1907-08-18	G	H	McCracken	BANDANA		OHIO RIVER AT HILLERMAN, IL.	SMALL TO LARGE RIVERS WITH SAND, GRAVEL, AND COBBLE AND MODERATE TO SWIFT CURRENT, SOMETIMES IN DEEP WATER (PARMALEE 1967, BOGAN AND PARMALEE 1983).

Rare Species And Communities Recorded for the Proposed DUF6 Conversion Facility at the Paducah Gaseous Diffusion Plant.

KSNPC
Data Request No. 03-022

EOCODE	SNAME	SCOMNAME	GRANK	SRANK	SPROT	USESA	DENT	LASTOBS	PREC	EORANK	COUNTY	7.5 MINUTE QUADRANGLE	EPA WATERBODY	DIRECTIONS	HABITAT
IMBIV39041*030*KY	QUADRULA CYLINDRICA CYLINDRICA	RABBITSFOOT	G3T3	S2	T		Y	1987-05-21	S	O	McCracken	JOPPA		OHIO RIVER, ORM 945, AT END OF ROAD THAT PASSES E SIDE OF METROPOLIS LAKE, 10 MI WNW OF PADUCAH.	SMALL TO LARGE RIVERS WITH SAND, GRAVEL, AND COBBLE AND MODERATE TO SWIFT CURRENT, SOMETIMES IN DEEP WATER (PARMALEE 1967, BOGAN AND PARMALEE 1983).
***Crustaceans															
ICMAL11060*004*KY	ORCONECTES LANCIFER	A CRAYFISH	G5	S1	E		Y	1975-04-26	S	H	McCracken	JOPPA		METROPOLIS LAKE 4.8 KM N GRAHAMVILLE NEAR END OF HWY 305 (ACTUALLY END OF HWY 996 AND DRIVEWAY TO LAKE).	OXBOW LAKES AND STREAMS ON THE GULF COASTAL PLAIN (PAGE 1985), WHERE IT LIVES AMONG ORGANIC DEBRIS, USUALLY NEAR BALD CYPRESS (BURR AND HOBBS 1984).
***Fishes															
AFCBA02010*002*KY	ATRACTOSTEUS SPATULA	ALLIGATOR GAR	G3G4	S1	E			1975-06-27	G	H	McCracken	JOPPA		OHIO RIVER AT SHAWNEE STEAM PLANT, NEAR PADUCAH.	SLUGGISH POOLS AND BACKWATERS OF LARGE RIVERS, BACKWATERS, AND OXBOW LAKES (BURR AND WARREN 1986, PAGE AND BURR 1991, ETNIER AND STARNES 1993).
AFCJC05020*008*KY	ERIMYZON SUCETTA	LAKE CHUBSUCKER	G5	S2	T		Y		G	H	McCracken	JOPPA		OHIO RIVER, SHAWNEE STEAM PLANT W OF PADUCAH.	LOWLAND LENTIC HABITATS (WETLANDS AND FLOODPLAIN LAKES) WITH SUBMERGENT AND FLOATING VEGETATION (BURR AND WARREN 1986, ETNIER AND STARNES 1993).
AFCHD01040*003*KY	ESOX NIGER	CHAIN PICKEREL	G5	S3	S			1972-05-28	M	E	McCracken	JOPPA		METROPOLIS LAKE, 4.8 KM N GRAHAMVILLE.	COASTAL PLAIN WETLANDS, STREAMS, AND VEGETATED OXBOW LAKE SHORELINES, AND IT ALSO TOLERATES RESERVOIR CONDITIONS (BURR AND WARREN 1986, ETNIER AND STARNES 1993).
AFCJB16030*004*KY	HYBOGNATHUS HAYI	CYPRESS MINNOW	G5	S1	E		Y	1993-07-21	S	D	McCracken	JOPPA		METROPOLIS LAKE, 3 MI N GRAHAMVILLE.	COASTAL PLAIN AND SHAWNEE HILLS. USUALLY OVER MUD OR SAND BOTTOMS, BUT OCCASIONALLY ASSOCIATED WITH SUBMERGED AQUATIC VEGETATION OR OTHER COVER (BURR AND WARREN 1986, PFLIEGER 1975, SMITH 1979, GILBERT 1980, BURR ET AL. 1980). NEEDS WETLANDS ADJACENT
AFBAA01020*006*KY	ICHTHYOMYZON CASTANEUS	CHESTNUT LAMPREY	G4	S2	S			1951-	G	H	McCracken	JOPPA		OHIO RIVER AT JOPPA, ILLINOIS.	CONSISTS OF GRAVEL AND RUBBLE WITH AREAS OF SAND AND SILT. LARVAE REQUIRE CLEAR STREAMS WITH STABLE BARS OF SILT, SAND AND ORGANIC DETRITIS (BECKER 1983, PFLIEGER 1975, ROHDE AND LANTEIGNE-COURCHERE 1980, SCOTT AND CROSSMAN 1973, SMITH 1979).
AFBAA01020*007*KY	ICHTHYOMYZON CASTANEUS	CHESTNUT LAMPREY	G4	S2	S			1951-	G	H	McCracken	METROPOLIS		OHIO RIVER AT METROPOLIS, ILLINOIS.	CONSISTS OF GRAVEL AND RUBBLE WITH AREAS OF SAND AND SILT. LARVAE REQUIRE CLEAR STREAMS WITH STABLE BARS OF SILT, SAND AND ORGANIC DETRITIS (BECKER 1983, PFLIEGER 1975, ROHDE AND LANTEIGNE-COURCHERE 1980, SCOTT AND CROSSMAN 1973, SMITH 1979).
AFBAA01020*010*KY	ICHTHYOMYZON CASTANEUS	CHESTNUT LAMPREY	G4	S2	S			1974-04-17	G	E	McCracken	JOPPA		OHIO RIVER, AT SHAWNEE STEAM PLANT.	CONSISTS OF GRAVEL AND RUBBLE WITH AREAS OF SAND AND SILT. LARVAE REQUIRE CLEAR STREAMS WITH STABLE BARS OF SILT, SAND AND ORGANIC DETRITIS (BECKER 1983, PFLIEGER 1975, ROHDE AND LANTEIGNE-COURCHERE 1980, SCOTT AND CROSSMAN 1973, SMITH 1979).
AFCJC07030*016*KY	ICTIOBUS NIGER	BLACK BUFFALO	G5	S3	S		Y	1997-09-30	M	C	McCracken	JOPPA		OHIO RIVER, SHAWNEE STEAM PLANT, NW OF PADUCAH.	RESERVOIRS AND MEDIUM TO LARGE RIVERS WITH MODERATE TO LOW GRADIENT AND SOMETIME SWIFT CURRENT (BECKER 1983, PFLIEGER 1975, SMITH 1979, TRAUTMAN 1981, AND BURR AND WARREN 1986).
AFCJC07030*026*KY	ICTIOBUS NIGER	BLACK BUFFALO	G5	S3	S		Y	1996-04	S	D	McCracken	JOPPA		LITTLE BAYOU CREEK [AT UNNAMED RD NR HOOPER CEMETERY CA 2.0 AIR KM NW OF KY 996-KY 1420 JCT].	RESERVOIRS AND MEDIUM TO LARGE RIVERS WITH MODERATE TO LOW GRADIENT AND SOMETIME SWIFT CURRENT (BECKER 1983, PFLIEGER 1975, SMITH 1979, TRAUTMAN 1981, AND BURR AND WARREN 1986).

Rare Species And Communities Recorded for the Proposed DUF6 Conversion Facility at the Paducah Gaseous Diffusion Plant.

KSNPC
Data Request No. 03-022

EOCODE	SNAME	SCOMNAME	GRANK	SRANK	SPROT	USESA	IDENT	LASTOBS	PREC	EORANK	COUNTY	7.5 MINUTE QUADRANGLE	EPA WATERBODY	DIRECTIONS	HABITAT
AFCJC07030*027*KY	ICTIOBUS NIGER	BLACK BUFFALO	G5	S3	S		Y	1997-03	S	D	McCracken	JOPPA		BIG BAYOU CREEK (CA. 0.4 STREAM KM S OF WEST BOONE RD CROSSING).	RESERVOIRS AND MEDIUM TO LARGE RIVERS WITH MODERATE TO LOW GRADIENT AND SOMETIME SWIFT CURRENT (BECKER 1983, PFLIEGER 1975, SMITH 1979, TRAUTMAN 1981, AND BURR AND WARREN 1986).
AFCQB11120*032*KY	LEPOMIS MINIATUS	REDSPOTTED SUNFISH	G5	S2	T		Y	1997-03	S	D	McCracken	HEATH		LITTLE BAYOU CK AT KY 358 (SITE 12).	OCCURS IN WELL-VEGETATED SWAMPS, SLOUGHS, BOTTOMLAND LAKES, AND LOW GRADIENT STREAMS (BURR AND MAYDEN 1979, PFLIEGER 1975, SMITH 1979, BURR AND WARREN 1986, ETNIER AND STARNES 1993).
AFCQB11120*033*KY	LEPOMIS MINIATUS	REDSPOTTED SUNFISH	G5	S2	T		Y	1996-04	S	D	McCracken	JOPPA		LITTLE BAYOU AT UNNAMED RD (SITE 10) [NR HOOPER CEMETERY CA 2.0 AIR KM NW OF KY 966/KY 1420 JCT].	OCCURS IN WELL-VEGETATED SWAMPS, SLOUGHS, BOTTOMLAND LAKES, AND LOW GRADIENT STREAMS (BURR AND MAYDEN 1979, PFLIEGER 1975, SMITH 1979, BURR AND WARREN 1986, ETNIER AND STARNES 1993).
AFCQB11120*034*KY	LEPOMIS MINIATUS	REDSPOTTED SUNFISH	G5	S2	T		Y	1996-06	S	D	McCracken	JOPPA		BIG BAYOU CREEK AT BOLDRY RD, 2.8 RIVER KM FROM MOUTH (SITE 14).	OCCURS IN WELL-VEGETATED SWAMPS, SLOUGHS, BOTTOMLAND LAKES, AND LOW GRADIENT STREAMS (BURR AND MAYDEN 1979, PFLIEGER 1975, SMITH 1979, BURR AND WARREN 1986, ETNIER AND STARNES 1993).
AFCQB11120*007*KY	LEPOMIS MINIATUS	REDSPOTTED SUNFISH	G5	S2	T		Y	1998-04-02	S	A	McCracken	JOPPA		METROPOLIS LAKE, 4.8 KM N OF GRAHAMVILLE.	OCCURS IN WELL-VEGETATED SWAMPS, SLOUGHS, BOTTOMLAND LAKES, AND LOW GRADIENT STREAMS (BURR AND MAYDEN 1979, PFLIEGER 1975, SMITH 1979, BURR AND WARREN 1986, ETNIER AND STARNES 1993).
AFCND02010*007*KY	MENIDIA BERYLLINA	INLAND SILVERSIDE	G5	S2	T		Y	1992-08-04	M	C	McCracken	JOPPA		OHIO RIVER NEAR JOPPA.	SCHOOLING SURFACE FISH THAT OCCURS IN THE MISSISSIPPI RIVER AND FLOODPLAIN LAKES (BURR AND WARREN 1986, ETNIER AND STARNES 1993).
AFCND02010*009*KY	MENIDIA BERYLLINA	INLAND SILVERSIDE	G5	S2	T		Y	1992-09-25	M	C	McCracken	JOPPA		OHIO RIVER MILE 944-948, NEAR SHAWNEE STEAM PLANT.	SCHOOLING SURFACE FISH THAT OCCURS IN THE MISSISSIPPI RIVER AND FLOODPLAIN LAKES (BURR AND WARREN 1986, ETNIER AND STARNES 1993).
AFCND02010*012*KY	MENIDIA BERYLLINA	INLAND SILVERSIDE	G5	S2	T		Y	1993-07-21	S	A	McCracken	JOPPA		METROPOLIS LAKE AT BOAT RAMP.	SCHOOLING SURFACE FISH THAT OCCURS IN THE MISSISSIPPI RIVER AND FLOODPLAIN LAKES (BURR AND WARREN 1986, ETNIER AND STARNES 1993).
AFCJB28650*002*KY	NOTROPIS MACULATUS	TAILLIGHT SHINER	G5	S2S3	T		Y	1998-04-02	S	A	McCracken	JOPPA		METROPOLIS LAKE, 5 KM N GRAHAMVILLE.	LOW GRADIENT STREAMS, OXBOW LAKES, AND SLOUGHS IN AND AROUND CYPRESS KNEES, MARGINAL VEGETATION, AND ACCUMULATIONS OF STICKS AND DETRITUS (BURR AND PAGE 1975, BURR AND WARREN 1986, ETNIER AND STARNES 1993).
AFCKA02220*014*KY	NOTURUS STIGMOSUS	NORTHERN MADTOM	G3	S2S3	S				G	H	McCracken	JOPPA		OHIO RIVER AT SHAWNEE STEAM PLANT, NW OF PADUCAH.	LARGE STREAMS AND RIVERS IN MODERATE TO SWIFT CURRENT OVER GRAVEL AND SAND, AND SOMETIMES DEBRIS OR PONDWEED FOR COVER (BURR AND WARREN 1986, ETNIER AND STARNES 1993).
AFCKA02220*037*KY	NOTURUS STIGMOSUS	NORTHERN MADTOM	G3	S2S3	S		Y	1999-09-06	S	D	McCracken	JOPPA		OHIO R AT LITTLE CHAIN BAR.	LARGE STREAMS AND RIVERS IN MODERATE TO SWIFT CURRENT OVER GRAVEL AND SAND, AND SOMETIMES DEBRIS OR PONDWEED FOR COVER (BURR AND WARREN 1986, ETNIER AND STARNES 1993).
***Amphibians															
AAABC02060*035*KY	HYLA CINEREA	GREEN TREEFROG	G5	S3	S		Y	1991-06-28	S	B	McCracken	JOPPA		CIRCA 0.3 AIR MI SW OF W TIP OF SHAWNEE STEAM PLANT SETTLING PONDS.	FLOODPLAIN WETLANDS, PARTICULARLY THOSE DOMINATED BY BUTTONBUSH AND HERBACEOUS EMERGENT VEGETATION.

Rare Species And Communities Recorded for the Proposed DUF6 Conversion Facility at the Paducah Gaseous Diffusion Plant.

KSNPC
Data Request No. 03-022

EOCODE	SNAME	SCOMNAME	GRANK	SRANK	SPROT	USESA	IDENT	LASTOBS	PREC	EORANK	COUNTY	7.5 MINUTE QUADRANGLE	EPA WATERBODY	DIRECTIONS	HABITAT
AAABC02060*034*KY	HYLA CINEREA	GREEN TREEFROG	G5	S3	S		Y	1991-06-25	S	B	McCracken	JOPPA		WEST KENTUCKY WILDLIFE MANAGEMENT AREA, CA 1.4 AIR MI WNW OF THE N TIP OF THE N-MOST SHAWNEE STEAM PLANT SETTLING POND.	FLOODPLAIN WETLANDS, PARTICULARLY THOSE DOMINATED BY BUTTONBUSH AND HERBACEOUS EMERGENT VEGETATION.
AAABH01014*049*KY	RANA AREOLATA CIRCULOSA	NORTHERN CRAWFISH FROG	G4T4	S3	S		Y	1964-03-07	G	O	McCracken	PADUCAH WEST		US 62, 5.0 MI SW OF PADUCAH.	BREEDS IN PONDS IN FARMLAND AND EDGE. REMAINS UNDERGROUND THROUGHOUT MOST OF THE YEAR, USING CRAYFISH BURROWS IN MOIST GRASSLANDS AND MEADOWS.
AAABH01014*050*KY	RANA AREOLATA CIRCULOSA	NORTHERN CRAWFISH FROG	G4T4	S3	S		Y	1964-03-13	M	O	McCracken	HEATH		US 60, 0.6 MI E OF FUTURE CITY, 10 MI W OF PADUCAH.	BREEDS IN PONDS IN FARMLAND AND EDGE. REMAINS UNDERGROUND THROUGHOUT MOST OF THE YEAR, USING CRAYFISH BURROWS IN MOIST GRASSLANDS AND MEADOWS.
AAABH01014*011*KY	RANA AREOLATA CIRCULOSA	NORTHERN CRAWFISH FROG	G4T4	S3	S		Y	1991-03-18	S	C	McCracken	JOPPA		MARTIN CEMETERY, S SIDE KY 358 CA 0.6 RD MI E JCT BETHEL CHURCH RD.	BREEDS IN PONDS IN FARMLAND AND EDGE. REMAINS UNDERGROUND THROUGHOUT MOST OF THE YEAR, USING CRAYFISH BURROWS IN MOIST GRASSLANDS AND MEADOWS.
AAABH01014*007*KY	RANA AREOLATA CIRCULOSA	NORTHERN CRAWFISH FROG	G4T4	S3	S		Y	1991-03-20	S	C	McCracken	HEATH		CIRCA 0.2 AIR MI E OF KY 1154, CA 1.2 RD MI N OF ITS JCT W/ US 60.	BREEDS IN PONDS IN FARMLAND AND EDGE. REMAINS UNDERGROUND THROUGHOUT MOST OF THE YEAR, USING CRAYFISH BURROWS IN MOIST GRASSLANDS AND MEADOWS.
AAABH01014*013*KY	RANA AREOLATA CIRCULOSA	NORTHERN CRAWFISH FROG	G4T4	S3	S		Y	1991-03-18	S	C	McCracken	JOPPA		CIRCA 0.2 RD MI E OF BETHEL CHURCH RD, CA 1.0 RD MI S JCT KY 358 (MARGNUM 33). CA 1.0 AIR MI SSE JCT KY 358 AND BETHEL CHURCH ROAD (MARGNUM 34, 370748N, 884941W).	BREEDS IN PONDS IN FARMLAND AND EDGE. REMAINS UNDERGROUND THROUGHOUT MOST OF THE YEAR, USING CRAYFISH BURROWS IN MOIST GRASSLANDS AND MEADOWS.
AAABH01014*009*KY	RANA AREOLATA CIRCULOSA	NORTHERN CRAWFISH FROG	G4T4	S3	S		Y	1991-03-18	S	C	McCracken	HEATH		WEST KENTUCKY WILDLIFE MANAGEMENT AREA, N SIDE WATER WORKS RD JUST W OF FILTRATION PLANT.	BREEDS IN PONDS IN FARMLAND AND EDGE. REMAINS UNDERGROUND THROUGHOUT MOST OF THE YEAR, USING CRAYFISH BURROWS IN MOIST GRASSLANDS AND MEADOWS.
AAABH01014*010*KY	RANA AREOLATA CIRCULOSA	NORTHERN CRAWFISH FROG	G4T4	S3	S		Y	1991-03-20	S	C	McCracken	HEATH		MI NNW JCT KY 358 AND OGDEN LANDING RD (MARGNUM 14). WEST KY WMA, CA 1.3 RD MI W JCT KY 996 AND KY 358 ON N SIDE KY 358 (MARGNUM 15, 370723N, 884736W). WEST KY WMA, 1.5 RD MI W OF JCT KY 996 AND KY 358, 0.15 AIR MI S OF	BREEDS IN PONDS IN FARMLAND AND EDGE. REMAINS UNDERGROUND THROUGHOUT MOST OF THE YEAR, USING CRAYFISH BURROWS IN MOIST GRASSLANDS AND MEADOWS.
AAABH01014*015*KY	RANA AREOLATA CIRCULOSA	NORTHERN CRAWFISH FROG	G4T4	S3	S		Y	1998-02-27	S	C	McCracken	JOPPA		WEST KENTUCKY WILDLIFE MANAGEMENT AREA, CA 0.1 RD MI NW OF JCT KY 358 AND KY 995, DOWN ROAD JUST SE OF LODGE (MARGNUM 36), AND CA 0.15 RD MI NW OF JCT KY 358 AND KY 995, DOWN RD JUST SE OF LODGE (MARGNUM 39).	BREEDS IN PONDS IN FARMLAND AND EDGE. REMAINS UNDERGROUND THROUGHOUT MOST OF THE YEAR, USING CRAYFISH BURROWS IN MOIST GRASSLANDS AND MEADOWS.
AAABH01014*014*KY	RANA AREOLATA CIRCULOSA	NORTHERN CRAWFISH FROG	G4T4	S3	S		Y	1991-03-18	S	C	McCracken	JOPPA		WEST KENTUCKY WILDLIFE MANAGEMENT AREA, CA 0.6 RD MI SW OF JCT KY 995 AND KY 358, CA 0.15 AIR MI W OF KY 995, CA 0.5 RD MI SW OF AREA OFFICE (LODGE).	BREEDS IN PONDS IN FARMLAND AND EDGE. REMAINS UNDERGROUND THROUGHOUT MOST OF THE YEAR, USING CRAYFISH BURROWS IN MOIST GRASSLANDS AND MEADOWS.
AAABH01014*008*KY	RANA AREOLATA CIRCULOSA	NORTHERN CRAWFISH FROG	G4T4	S3	S		Y	1991-03-20	S	C	McCracken	HEATH		CIRCA 0.4 AIR MI NW OF SPRING BAYOU CHURCH ON KY 725 (MARGNUM 11). CA 0.7 RD MI W OF SPRING BAYOU CHURCH ON KY 725 ON N SIDE OF RD (MARGNUM 12, 370524N, 885030W).	BREEDS IN PONDS IN FARMLAND AND EDGE. REMAINS UNDERGROUND THROUGHOUT MOST OF THE YEAR, USING CRAYFISH BURROWS IN MOIST GRASSLANDS AND MEADOWS.
***Reptiles															
ARAAG01022*008*KY	APALONE MUTICA MUTICA	MIDLAND SMOOTH SOFTSHELL	G5T5	S3	S		Y	1986-07-18	G	E	McCracken	METROPOLIS		OHIO RIVER, NEAR BOAT RAMP ACROSS FROM JOPPA [ASSUMED TO MEAN METROPOLIS], ILL.	OPEN WATER HABITATS; MOST NUMEROUS IN OPEN RIVER SITUATIONS WITH GRAVEL OR SAND SUBSTRATES, BUT ALSO PRESENT IN SLOWER RIVERS AND IMPOUNDMENTS.

Rare Species And Communities Recorded for the Proposed DUF6 Conversion Facility at the Paducah Gaseous Diffusion Plant

KSNPC
Data Request No. 03-022

EOCODE	SNAME	SCOMNAME	GRANK	SRANK	SPROT	USESA	DENT	LASTOBS	PREC	EORANK	COUNTY	7.5 MINUTE QUADRANGLE	EPA WATERBODY	DIRECTIONS	HABITAT
***Birds															
ABPBX91050*039*KY	AIMOPHILA AESTIVALIS	BACHMAN'S SPARROW	G3	S1B	E		Y	1951-07-17	G	X	McCracken	PADUCAH WEST	;OHIO RIVER FROM TENNESSEE RIVER TO MISSISSIPPI RIVER	5 MI W OF PADUCAH.	OPEN PINE WOODS WITH SCATTERED BUSHES OR UNDERSTORY, BRUSHY OR OVERGROWN HILLSIDES, OVERGROWN FIELDS WITH THICKETS AND BRAMBLES, GRASSY ORCHARDS.
ABPAV10080*014*KY	CORVUS OSSIFRAGUS	FISH CROW	G5	S3B	S		Y	1980-06-27	G	H	McCracken	JOPPA	OHIO RIVER FROM TENNESSEE RIVER TO MISSISSIPPI RIVER	WEST KY WMA, ALONG OHIO RIVER AT EDGE OF BOTTOMLAND FOREST.	BEACHES, BAYS, LAGOONS, INLETS, SWAMPS, NEAR MARSHES, AND, LESS FREQUENTLY, DECIDUOUS OR CONIFEROUS WOODLAND, IN INLAND SITUATIONS PRIMARILY IN BALDCYPRESS SWAMPS AND ALONG MAJOR WATERCOURSES. ALSO GARBAGE DUMPS.
ABNJB20010*004*KY	LOPHODYTES CUCULLATUS	HOODED MERGANSER	G5	S1S2B,S3S4N	T		Y	1980-05-08	S	H	McCracken	JOPPA		WEST KENTUCKY WILDLIFE MANAGEMENT AREA, 3.9 MI NNW OF GRAHAMVILLE.	STREAMS, LAKES, SWAMPS, MARSHES, AND ESTUARIES; WINTERS MOSTLY IN FRESHWATER BUT ALSO REGULARLY IN ESTUARIES AND SHELTERED BAYS (B83COM01NA).
ABPBW01110*001*KY	VIREO BELLII	BELL'S VIREO	G5	S2S3B	S		Y	1980-06-27	M	H	McCracken	JOPPA		ALONG LITTLE BAYOU CREEK, ADJ TO THE W SIDE OF THE ASH SETTLING POND AT THE SHAWNEE STEAM PLANT, 6 MI NNW OF GRAHAMVILLE.	DENSE BRUSH, MESQUITE, STREAMSIDE THICKETS, AND SCRUB OAK, IN ARID REGIONS BUT OFTEN NEAR WATER (B83COM01NA); MOIST WOODLAND, BOTTONLANDS, WOODLAND EDGE, SCATTERED COVER AND HEDGEROWS IN CULTIVATED AREAS. OPEN WOODLAND, BRUSH IN WINT.
ABPBW01110*002*KY	VIREO BELLII	BELL'S VIREO	G5	S2S3B	S		Y	1994-05-05	S	C	McCracken	JOPPA		WEST KENTUCKY WMA, W SIDE OF MAIN GRAVEL RD, CA 1.0 MI S OF ENTRANCE ON KY 358.	DENSE BRUSH, MESQUITE, STREAMSIDE THICKETS, AND SCRUB OAK, IN ARID REGIONS BUT OFTEN NEAR WATER (B83COM01 NA); MOIST WOODLAND, BOTTONLANDS, WOODLAND EDGE, SCATTERED COVER AND HEDGEROWS IN CULTIVATED AREAS. OPEN WOODLAND, BRUSH IN WINT.
***Mammals															
AMACC01030*026*KY	MYOTIS AUSTRORIPARIUS	SOUTHEASTERN MYOTIS	G3G4	S1S2	E			1999-07-14	S	E	McCracken	HEATH		WEST KENTUCKY WMA, BAYOU CREEK JUST UPSTREAM OF SOUTH ACID RD.	THE SOUTHEASTERN MYOTIS USES PRIMARILY CAVES FOR HIBERNACULA AND SUMMER MATERNITY AND ROOSTING SITES.
AMACC01030*027*KY	MYOTIS AUSTRORIPARIUS	SOUTHEASTERN MYOTIS	G3G4	S1S2	E			1999-07-22	S	E	McCracken	JOPPA	;OHIO RIVER FROM TENNESSEE RIVER TO MISSISSIPPI RIVER	BAYOU CREEK RIDGE STATE NATURAL AREA, W END ON N-SIDE OF CREEK, CA 0.1 AIR MI SE OF END OF WMA RD TO OHIO RIVER.	THE SOUTHEASTERN MYOTIS USES PRIMARILY CAVES FOR HIBERNACULA AND SUMMER MATERNITY AND ROOSTING SITES.
AMACC01100*101*KY	MYOTIS SODALIS	INDIANA BAT	G2	S1S2	E	LE	Y	1999-07-28	S	E	McCracken	JOPPA	;OHIO RIVER FROM TENNESSEE RIVER TO MISSISSIPPI RIVER	WEST KENTUCKY WILDLIFE MANAGEMENT AREA, W OF BAYOU CREEK RIDGE SNA, CA 0.1 AIR MI SE OF END OF RD (MARGNUM 24), AND CA 0.15 RD MI SE OF BAYOU CREEK ALONG OLD RD (MARGNUM 58).	INDIANA BATS USE PRIMARILY CAVES FOR HIBERNACULA, ALTHOUGH THEY ARE OCCASIONALLY FOUND IN OLD MINE PORTALS.
AMACC06010*015*KY	NYCTICEIUS HUMERALIS	EVENING BAT	G5	S2S3	T		Y	1999-07-28	S	E	McCracken	JOPPA	;OHIO RIVER FROM TENNESSEE RIVER TO MISSISSIPPI RIVER	0.4 AIR MI SSE OF END OF RD TO OHIO RIVER (MARGNUM 26), AND JUST DOWNSTREAM OF GRAVEL RD CROSSING (MARGNUM 59), AND W OF BAYOU CR RIDGE, CA 0.1 AIR MI SE OF N END OF WMA ROAD TO THE OHIO RIVER (MARGNUM 26).	THE EVENING BAT IS A COLONIAL SPECIES THAT ROOSTS IN TREES AND HOUSES. IT APPARENTLY MIGRATES SOUTHWARD IN WINTER.
AMACC06010*047*KY	NYCTICEIUS HUMERALIS	EVENING BAT	G5	S2S3	T		Y	1999-08-02	S	E	McCracken	JOPPA		WEST KY WMA, ALONG BAYOU CREEK CA 0.8 AIR MI WSW OF HEADQUARTERS.	THE EVENING BAT IS A COLONIAL SPECIES THAT ROOSTS IN TREES AND HOUSES. IT APPARENTLY MIGRATES SOUTHWARD IN WINTER.
***Palustrine Communities															

Rare Species And Communities Recorded for the Proposed DUF6 Conversion Facility at the Paducah Gaseous Diffusion Plant.

KSNPC
Data Request No. 03-022

EOCODE	SNAME	SCOMNAME	GRANK	SRANK	SPROT	USESA	IDENT	LASTOBS	PREC	EORANK	COUNTY	7.5 MINUTE QUADRANGLE	EPA WATERBODY	DIRECTIONS	HABITAT
CPFOR00005*001*KY	FLOODPLAIN RIDGE/TERRACE FOREST			S1	N		Y	1991-06	S	B	McCracken	JOPPA		WEST KY WILDLIFE MANAGEMENT AREA, BAYOU CREEK WOODS, CA 2.0 AIR MI NW OF SHAWNEE STEAM PLANT.	

69 Records Processed.

COUNTY REPORT
OF
ENDANGERED, THREATENED, AND SPECIAL CONCERN PLANTS, ANIMALS, AND NATURAL COMMUNITIES
OF
KENTUCKY

KENTUCKY STATE NATURE PRESERVES COMMISSION
801 SCHENKEL LANE
FRANKFORT, KY 40601
(502) 573-2886 (phone)
(502) 573-2355 (fax)

www.kynaturepreserves.org

Data Current as of June 2002

Kentucky State Nature Preserves Commission
Key for County List Report

The attached report lists endangered, threatened, special concern, and historic plants, animals, and natural communities (elements) reported from each county in Kentucky. Within a county, elements are arranged first by taxonomic complexity (plants first, natural communities last), and second by scientific name. A key to status, ranks, and count data fields follows.

STATUS

KSNPC: Kentucky State Nature Preserves Commission status:
N or blank = none E = endangered T = threatened S = special concern H = historic X = extirpated

USESA: U.S. Fish and Wildlife Service status:
N or blank = none C = candidate LT = listed as threatened
LE = listed as endangered

LTNL = Listed Threatened in part of its range, but is not listed in Kentucky (Copperbelly water snake has a special conservation agreement in 14 Kentucky counties as an alternative to Federal Listing.)

RANKS

GRANK: Estimate of element abundance on a global scale:
G1 = extremely rare G2 = rare G3 = uncommon G4 = common G5 = very common
GU = uncertain GH = historically known and expected to be rediscovered GX = extinct

Subspecies and variety abundances are coded with a 'T' suffix; the 'G? portion of the rank then refers to the entire species.

SRANK: Estimate of element abundance in Kentucky:
S1 = extremely rare S2 = rare S3 = uncommon
S4 = many occurrences S5 = very common SA = accidental
SRF = reported falsely in literature SU = uncertain SX = extirpated
SE = exotic ? = unknown SH = historically known in state
SZ = not of significant conservation concern SR = reported but without persuasive documentation
S#B - breeding rank for non-resident species S#N - non-breeding rank for non-resident species

COUNT DATA FIELDS

OF OCCURRENCES: Number of occurrences of a particular element from a county. Column headings are as follows:

E - currently reported from the county
H - reported from the county but not seen since 1980 (at least 20 years)
F - reported from county & cannot be relocated but for which further inventory is needed (previously reported as "O")
X - known to have extirpated from the county
U - reported from a county but cannot be mapped to a quadrangle or exact location.

The data from which the county report is generated is continually updated. The date on which the report was created is in the report footer. Contact KSNPC for a current copy of the report, which is produced in this form annually.

Please note that the quantity and quality of data collected by the Kentucky Natural Heritage Program are dependent on the research and observations of many individuals and organizations. In most cases, this information is not the result of comprehensive or site-specific field surveys; many natural areas in Kentucky have never been thoroughly surveyed, and new species of plants and animals are still being discovered. For these reasons, the Kentucky Natural Heritage Program cannot provide a definitive statement on the presence, absence, or condition of biological elements in any part of Kentucky. Heritage reports summarize the existing information known to the Kentucky Natural Heritage Program at the time of the request regarding the biological elements or locations in question. They should never be regarded as final statements on the elements or areas being considered, nor should they be substituted for on-site surveys required for environmental assessments.

KSNPC appreciates the submission of any endangered species data for Kentucky from field observations. For information on data reporting or other data services provided by KSNPC, please contact the Data Manager at:

KY State Nature Preserves Commission
801 Schenkel Lane
Frankfort, KY 40601
phone: (502) 573-2886
fax: (502) 573-2355

County Report of Endangered, Threatened, and Special Concern Plants, Animals, and Natural Communities of Kentucky
Kentucky State Nature Preserves Commission

County	Taxonomic Group	Scientific name	Common name	Statuses	Ranks	# of Occurrences E H F X U
HABITAT						
McCracken	PLANTS	***AESCULUS PAVIA***	RED BUCKEYE	T	G5/S2S3	0 1 0 0 0
WOODS AND THICKETS.						
McCracken	PLANTS	***ASTER DRUMMONDII VAR TEXANUS***	TEXAS ASTER	T	G5T?/S2	0 0 0 0 1
BOTTOMLANDS AND OPEN WOODS.						
McCracken	PLANTS	***BAPTISIA BRACTEATA VAR LEUCOPHAEA***	CREAM WILD INDIGO	S	G4G5T4T5/S3	2 0 0 0 0
PRAIRIES AND OPEN WOODS ON SANDY SOIL.						
McCracken	PLANTS	***CAREX HYSTERICINA***	PORCUPINE SEDGE	H	G5/SH	0 1 0 0 0
SWAMPS, WET MEADOWS, SHORELINES.						
McCracken	PLANTS	***CARYA AQUATICA***	WATER HICKORY	T	G5/S2S3	1 0 0 0 0
BOTTOMLANDS AND FLOODPLAIN SWAMPS.						
McCracken	PLANTS	***HALESIA TETRAPTERA***	MOUNTAIN SILVER-BELL	E	G5/S1S2	2 0 0 0 1
RICH WOODS AND EDGES OF SLOUGHS AND OXBOW LAKES.						
McCracken	PLANTS	***HETEROTHECA SUBAXILLARIS VAR LATIFOLIA***	BROAD-LEAF GOLDEN-ASTER	T	G5T5/S2	1 0 0 0 0
DRY, OFTEN SANDY PLACES, PARTICULARLY DISTURBED SITES.						
McCracken	PLANTS	***HYDROLEA UNIFLORA***	ONE-FLOWER FIDDLELEAF	S	G5/S3?	0 1 0 0 0
SWAMPY WOODLANDS, POND AND SLOUGH MARGINS, WET DITCHES.						
McCracken	PLANTS	***HYPERICUM ADPRESSUM***	CREEPING ST. JOHN'S-WORT	H	G2G3/SH	0 0 0 0 1
MARSHES, SHORES, WET MEADOWS, SWALES AND DITCHES.						
McCracken	PLANTS	***LATHYRUS PALUSTRIS***	VETCHLING PEAVINE	T	G5/S2	0 0 0 0 1
WET MEADOWS, SWAMPS, WET WOODS, AND IN KY BOULDER COBBLE BARS ALONG CREEKS AND RIVERS, AND KNOWN FROM A ROADSIDE NEAR A RAILROAD. (MEDLEY).						
McCracken	PLANTS	***LESPEDEZA STUEVEI***	TALL BUSH-CLOVER	S	G4?/S3?	0 1 0 0 0
DRY HILLSIDE, WOODLAND.						
McCracken	PLANTS	***LILIUM SUPERBUM***	TURK'S CAP LILY	T	G5/S1S2	0 0 0 0 1
MOIST MEADOWS, MOIST/WET WOODS INLCUDING FLOODPLAINS, AND COVES						
McCracken	PLANTS	***MALUS ANGUSTIFOLIA***	SOUTHERN CRABAPPLE	S	G5?/S3	0 1 0 0 0
OPEN DRY - MESIC WOODS AND THICKETS.						
McCracken	PLANTS	***MELANTHERA NIVEA***	SNOW MELANTHERA	S	G5/S3?	1 0 0 0 0
FLOODPLAINS AND SANDY WOODS INCLUDING DISTURBED OPENINGS.						
McCracken	PLANTS	***MUHLENBERGIA GLABRIFLORIS***	HAIR GRASS	S	G4?/S2S3	0 1 0 0 0
DRY, DESSICCATED OR BAKED SOILS, PRAIRIES, GRAVELS, OR ROCKY SLOPES AND MEDLEY REPORTS WET WOODS, MARSH EDGES AND FIELDS.						
McCracken	PLANTS	***PRENANTHES ASPERA***	ROUGH RATTLESNAKE-ROOT	E	G4?/S1	1 1 0 0 0
DRY PRAIRIES AND BARRENS, LIMESTONE GLADES, DRY, OPEN ROCKY WOODS. USUALLY IN ACID SOILS.						
McCracken	PLANTS	***RUDBECKIA SUBTOMENTOSA***	SWEET CONEFLOWER	E	G5/S1	1 0 1 0 0
PRAIRIES AND LOW GROUNDS SUCH AS OPEN STREAM TERRACE WOODLANDS.						
McCracken	PLANTS	***SILPHIUM LACINIATUM VAR ROBINSONII***	COMPASS PLANT	T	G5T?/S2	5 0 0 0 0
PRAIRIES INCL. REMNANTS OF THIS FLORA ON ROADSIDES AND FIELDS.						
McCracken	PLANTS	***SOLIDAGO BUCKLEYI***	BUCKLEY'S GOLDENROD	S	G4/S2S3	0 1 0 0 0
WOODS AND BLUFFS.						

County Report of Endangered, Threatened, and Special Concern Plants, Animals, and Natural Communities of Kentucky
Kentucky State Nature Preserves Commission

County	Taxonomic Group	Scientific name	Common name	Statuses	Ranks	# of Occurrences E H F X U	HABITAT
McCracken	GASTROPODS	***LEPTOXIS PRAEROSA***	ONYX ROCKSNAIL	S	G5/S3S4	0 1 0 0 0	CALL (1895) INDICATED THAT IN THE OHIO RIVER AT THE FALLS IT OCCURRED IN THE GREATEST PROFUSION WHERE THE BOTTOM IS CLEAN ROCK OR ROCK WITH ABUNDANT CONFERVOID" VEGETATION."
McCracken	GASTROPODS	***LITHASIA ARMIGERA***	ARMORED ROCKSNAIL	S	G3G4/S3S4	0 0 0 0 1	BARS AND POOLS WITH SAND, GRAVEL, AND ROCK SUBSTRATES (KNPC), SLOPING ROCK OUTCROPS WITH POCKETS OF SAND, GRAVEL AND MUD, PARTIALLY BURIED LOGS, AND ROCK RIPRAP (SICKEL 1988).
McCracken	GASTROPODS	***LITHASIA GENICULATA***	ORNATE ROCKSNAIL	S	G3G4/S1	0 3 0 0 0	
McCracken	GASTROPODS	***LITHASIA VERRUCOSA***	VARICOSE ROCKSNAIL	S	G3G4/S3S4	0 2 0 0 1	OBSERVATIONS ON THE HABITAT INCLUDE SPECIMENS TAKEN FROM RECENTLY EXPOSED BARS AND POOLS WITH SAND, GRAVEL, AND ROCK SUBSTRATES (HAAG AND PALMER-BALL, PERS COMM).
McCracken	BIVALVES	***FUSCONAIA SUBROTUNDA SUBROTUNDA***	LONGSOLID	S	G3T3/S3	0 1 0 0 0	GRAVEL BARS AND DEEP POOLS IN LARGE RIVERS AND LARGE TO MEDIUM-SIZED STREAMS (AHLSTEDT 1984, GOODRICH AND VAN DER SCHALIE 1944, NEEL AND ALLEN 1964, PARMALEE 1967).
McCracken	BIVALVES	***LAMPSILIS ABRUPTA***	PINK MUCKET	E/LE	G2/S1	2 3 1 0 0	LARGE RIVERS IN HABITATS RANGING FROM SILT TO BOULDERS, BUT APPARENTLY MORE COMMONLY FROM GRAVEL AND COBBLE. COLLECTED FROM SHALLOW AND DEEP WATER WITH CURRENT VELOCITY RANGING FROM ZERO TO SWIFT (AHLSTEDT 1983, BOGAN AND PARMALEE 1983, BUCHANAN 1980), B
McCracken	BIVALVES	***LAMPSILIS OVATA***	POCKETBOOK	E	G5/S1	0 3 0 0 0	CONSIDERED A LARGE RIVER SPECIES (CLENCH AND VAN DER SCHALIE 1944, PARMALEE 1967, STANSBERY 1976), BUT OCCURS IN MEDIUM-SIZED STREAMS IN GRAVEL, SAND, OR EVEN MUD (PARMALEE 1967, JOHNSON 1970, GORDON AND LAYZER 1989). IN THE LOWER WABASH AND OHIO RIVERS
McCracken	BIVALVES	***OBOVARIA RETUSA***	RING PINK	E/LE	G1/S1	0 1 0 1 0	LARGE RIVER SPECIES THAT INHABITS GRAVEL AND SAND BARS (BOGAN AND PARMALEE 1983, GOODRICH AND VAN DER SCHALIE 1944, NEEL AND ALLEN 1964, STANSBERY 1976).
McCracken	BIVALVES	***PLETHOBASUS COOPERIANUS***	ORANGEFOOT PIMPLEBACK	E/LE	G1/S1	4 2 2 0 0	USUALLY FOUND IN LARGE RIVERS IN SAND AND GRAVEL SUBSTRATES (AHLSTEDT 1983, BOGAN AND PARMALEE 1983, MILLER, A.C. ET AL. 1986).
McCracken	BIVALVES	***PLETHOBASUS CYPHYUS***	SHEEPNOSE	S	G3/S3	3 5 1 0 0	USUALLY FOUND IN LARGE RIVERS IN CURRENT ON MUD, SAND, OR GRAVEL BOTTOMS AT DEPTH OF 1-2 METERS OR MORE (BAKER 1928, PARMALEE 1967, GORDON AND LAYZER 1989).
McCracken	BIVALVES	***PLEUROBEMA RUBRUM***	PYRAMID PIGTOE	E	G2/S1	0 1 0 0 0	INHABITS MEDIUM TO LARGE RIVERS AND USUALLY OCCURS IN SAND OR GRAVEL BOTTOMS IN DEEP WATERS (AHLSTEDT 1984, MURRAY AND LEONARD 1962, PARMALEE ET AT. 1982).
McCracken	BIVALVES	***POTAMILUS CAPAX***	FAT POCKETBOOK	E/LE	G1/S1	1 1 1 1 0	OCCURS IN MEDIUM TO LARGE-SIZED RIVERS OFTEN AROUND ISLAND AND BACK CHANNELS, AND SOMETIMES IN DITCHES, IN MUD (OOZE); MIXED SAND, MUD, AND CLAY; OR FINE SILT AND MUD IN FLOWING WATER AT DEPTHS OF A FEW INCHES UP TO EIGHT FEET (PARMALEE 1967, AHLSTEDT AN
McCracken	BIVALVES	***POTAMILUS PURPURATUS***	BLEUFER	E	G5/S1	1 0 0 0 0	DEEP STREAMS WITH DEEP MUD AND FAIRLY QUIET POOLS (MURRAY AND LEONARD 1962). IN MISSOURI BOOTHEEL STREAMS, IT IS FOUND IN SMALL TO MEDIUM GRAVEL WITH MUD OCCASIONALLY INTERSPERSED (OESCH 1984). IN THE ST. FRANCIS RIVER OF ARKANSAS AND MISSOURI, INDIVIDUA
McCracken	BIVALVES	***QUADRULA CYLINDRICA CYLINDRICA***	RABBITSFOOT	T	G3T3/S2	1 2 1 0 0	SMALL TO LARGE RIVERS WITH SAND, GRAVEL, AND COBBLE AND MODERATE TO SWIFT CURRENT, SOMETIMES IN DEEP WATER (PARMALEE 1967, BOGAN AND PARMALEE 1983).
McCracken	CRUSTACEANS	***CAMBARELLUS PUER***	A DWARF CRAYFISH	E	G4G5/S1	0 0 1 0 0	CYPRESS SWAMPS, STREAMS, AND LOWLANDS (DRAINED WETLANDS) ON THE MISSISSIPP ALLUVIAL PLAIN, USUALLY AMONG LIVING OR DEAD VEGETATION (PAGE 1985).
McCracken	CRUSTACEANS	***ORCONECTES LANCIFER***	A CRAYFISH	E	G5/S1	0 1 0 0 0	OXBOW LAKES AND STREAMS ON THE GULF COASTAL PLAIN (PAGE 1985), WHERE IT LIVES AMONG ORGANIC DEBRIS, USUALLY NEAR BALD CYPRESS (BURR AND HOBBS 1984).

County Report of Endangered, Threatened, and Special Concern Plants, Animals, and Natural Communities of Kentucky

Kentucky State Nature Preserves Commission

County	Taxonomic Group	Scientific name	Common name	Statuses	Ranks	# of Occurrences E H F X U	HABITAT
McCracken	INSECTS	***EUPHYES DUKESI***	DUKES' SKIPPER	S	G3/S1	3 0 0 1 0	SHADED TUPELO SWAMPS IN SOUTH, PARTIALLY SHADED MARSHES AND DITCHES IN MIDWEST (OPLER AND MALIKUL 1992). FEEDS ON SEDGES (CAREX LACUSTRIS AND C. HYALINOLEPIS) (L.D. GIBSON PERS COMM). ON THE ATLANTIC COAST IT ALSO FEEDS ON CAREX WALTERIANA (L.D. GIBSON P
McCracken	INSECTS	***SATYRIUM FAVONIUS ONTARIO***	NORTHERN HAIRSTREAK	S	G4T4/S1	0 1 0 0 0	S. FAVONIUS IS FOUND IN WOODS OR EDGES WITH EVERGREEN OR DECIDUOUS OAKS (OPLER AND MALIKUL 1992). MAIN HABITAT REQUIREMENTS ARE BLACK JACK OAK (QUERCUS MARILANDICA) AND A NECTAR SOURCE SUCH AS FARKLEBERRY (VACCINIUM ARBORETUM) OR DOGBANE (APOCYNUM CANNAB
McCracken	FISHES	***ACIPENSER FULVESCENS***	LAKE STURGEON	E	G3/S1	0 1 0 0 0	LAKES AND LARGE RIVERS WITH A FIRM SAND/GRAVEL BOTTOM (BURR AND WARREN 1986, ETNIER AND STARNES 1993).
McCracken	FISHES	***ATRACTOSTEUS SPATULA***	ALLIGATOR GAR	E	G3G4/S1	0 1 0 0 0	SLUGGISH POOLS AND BACKWATERS OF LARGE RIVERS, BACKWATERS, AND OXBOW LAKES (BURR AND WARREN 1986, PAGE AND BURR 1991, ETNIER AND STARNES 1993).
McCracken	FISHES	***CYPRINELLA VENUSTA***	BLACKTAIL SHINER	S	G5/S3	1 0 0 0 0	OCCURS IN CREEKS AND SMALL STREAMS OF THE COASTAL PLAIN OVER FIRM SAND AND GRAVEL OF RIFFLES AND RACEWAYS, AND ALONG UNDERCUT BANKS OR AMONG SUBMERGED STUMPS AND LOGS (BURR AND WARREN 1986). ALSO, OVER FIRM SAND OR GRAVEL IN THE MISSISSIPPI AND LOWER OHI
McCracken	FISHES	***ERIMYZON SUCETTA***	LAKE CHUBSUCKER	T	G5/S2	0 1 0 0 0	LOWLAND LENTIC HABITATS (WETLANDS AND FLOODPLAIN LAKES) WITH SUBMERGENT AND FLOATING VEGETATION (BURR AND WARREN 1986, ETNIER AND STARNES 1993).
McCracken	FISHES	***ESOX NIGER***	CHAIN PICKEREL	S	G5/S3	1 0 0 0 0	COASTAL PLAIN WETLANDS, STREAMS, AND VEGETATED OXBOW LAKE SHORELINES, AND IT ALSO TOLERATES RESERVOIR CONDITIONS (BURR AND WARREN 1986, ETNIER AND STARNES 1993).
McCracken	FISHES	***ETHEOSTOMA PROELIARE***	CYPRESS DARTER	T	G5/S2	1 0 0 0 0	SMALL TO MEDIUM-SIZE SLUGGISH STREAMS, OXBOWS, AND WETLANDS WHERE THE BOTTOM IS SOFT AND AQUATIC VEGETATION ABOUNDS (BURR AND MAYDEN 1979, KUEHNE AND BARBOUR 1983, PAGE 1983, BURR AND WARREN 1986).
McCracken	FISHES	***HYBOGNATHUS HAYI***	CYPRESS MINNOW	E	G5/S1	1 2 0 0 0	OXBOW LAKES AND QUIET WATER OF LOW GRADIENT STREAMS ON THE COASTAL PLAIN AND SHAWNEE HILLS. USUALLY OVER MUD OR SAND BOTTOMS, BUT OCCASIONALLY ASSOCIATED WITH SUBMERGED AQUATIC VEGETATION OR OTHER COVER (BURR AND WARREN 1986, PFLIEGER 1975, SMITH 1979, G
McCracken	FISHES	***ICHTHYOMYZON CASTANEUS***	CHESTNUT LAMPREY	S	G4/S2	1 2 0 0 0	MODERATE-SIZE CREEKS, LARGE RIVERS, AND RESERVOIRS. SUBSTRATE CONSISTS OF GRAVEL AND RUBBLE WITH AREAS OF SAND AND SILT. LARVAE REQUIRE CLEAR STREAMS WITH STABLE BARS OF SILT, SAND AND ORGANIC DETRITIS (BECKER 1983, PFLIEGER 1975, ROHDE AND LANTEIGNE-COU
McCracken	FISHES	***ICTIOBUS NIGER***	BLACK BUFFALO	S	G5/S3	4 0 0 0 0	RESERVOIRS AND MEDIUM TO LARGE RIVERS WITH MODERATE TO LOW GRADIENT AND SOMETIME SWIFT CURRENT (BECKER 1983, PFLIEGER 1975, SMITH 1979, TRAUTMAN 1981, AND BURR AND WARREN 1986).
McCracken	FISHES	***LEPOMIS MINIATUS***	REDSPOTTED SUNFISH	T	G5/S2	4 0 0 0 0	OCCURS IN WELL-VEGETATED SWAMPS, SLOUGHS, BOTTOMLAND LAKES, AND LOW GRADIENT STREAMS (BURR AND MAYDEN 1979, PFLIEGER 1975, SMITH 1979, BURR AND WARREN 1986, ETNIER AND STARNES 1993).
McCracken	FISHES	***LOTA LOTA***	BURBOT	S	G5/SU	1 0 0 0 0	KENTUCKY SPECIMENS GENERALLY COME FROM MEDIUM TO LARGE-SIZE RIVERS. IN THE NORTH, THEY INHABIT COOL, LARGE, AND DEEP RIVERS AND LAKES (BECKER 1983, PFLIEGER 1975, SCOTT AND CROSSMAN 1973, SMITH 1979, TRAUTMAN 1981).
McCracken	FISHES	***MENIDIA BERYLLINA***	INLAND SILVERSIDE	T	G5/S2	4 0 0 0 0	SCHOOLING SURFACE FISH THAT OCCURS IN THE MISSISSIPPI RIVER AND FLOODPLAIN LAKES (BURR AND WARREN 1986, ETNIER AND STARNES 1993).
McCracken	FISHES	***NOTROPIS MACULATUS***	TAILLIGHT SHINER	T	G5/S2S3	1 1 0 0 0	LOW GRADIENT STREAMS, OXBOW LAKES, AND SLOUGHS IN AND AROUND CYPRESS KNEES, MARGINAL VEGETATION, AND ACCUMULATIONS OF STICKS AND DETRITUS (BURR AND PAGE 1975, BURR AND WARREN 1986, ETNIER AND STARNES 1993).

County Report of Endangered, Threatened, and Special Concern Plants, Animals, and Natural Communities of Kentucky
Kentucky State Nature Preserves Commisison

County	Taxonomic Group	Scientific name	Common name	Statuses	Ranks	# of Occurrences E H F X U
HABITAT						
McCracken	FISHES	***NOTURUS STIGMOSUS***	NORTHERN MADTOM	S	G3/S2S3	2 1 0 0 0
LARGE STREAMS AND RIVERS IN MODERATE TO SWIFT CURRENT OVER GRAVEL AND SAND, AND SOMETIMES DEBRIS OR PONDWEED FOR COVER (BURR AND WARREN 1986, ETNIER AND STARNES 1993).						
McCracken	FISHES	***UMBRA LIMI***	CENTRAL MUDMINNOW	T	G5/S2S3	1 0 0 0 0
RESTRICTED TO DENSE BEDS OF SUBMERGENT AQUATIC VEGETATION OR ORGANIC DEBRIS PILES IN SPRING-FED WETLANDS, DITCHES, AND THE MARGINS OF LOWLAND LAKES OF THE COASTAL PLAIN (BURR AND WARREN 1986).						
McCracken	AMPHIBIANS	***AMPHIUMA TRIDACTYLUM***	THREE-TOED AMPHIUMA	E	G5/S1	0 0 0 0 1
THE AMPHIUMA IS FOUND IN LAKES, OPEN SPRING STREAMS OF RUNNING WATER, AND STREAMS FLOWING OVER CALCAREOUS ROCKS. ALSO RECORDED FROM DRAINAGE DITCHES, BAYOUS, AND WOODED ALLUVIAL SWAMPS (BISHOP 1974). PROBABLY ONLY THE LATTER IN KENTUCKY.						
McCracken	AMPHIBIANS	***HYLA CINEREA***	GREEN TREEFROG	S	G5/S3	2 0 0 0 0
FLOODPLAIN WETLANDS, PARTICULARLY THOSE DOMINATED BY BUTTONBUSH AND HERBACEOUS EMERGENT VEGETATION.						
McCracken	AMPHIBIANS	***RANA AREOLATA CIRCULOSA***	NORTHERN CRAWFISH FROG	S	G4T4/S3	17 1 6 0
BREEDS IN PONDS IN FARMLAND AND EDGE. REMAINS UNDERGROUND THROUGHOUT MOST OF THE YEAR, USING CRAYFISH BURROWS IN MOIST GRASSLANDS AND MEADOWS.						
McCracken	REPTILES	***APALONE MUTICA MUTICA***	MIDLAND SMOOTH SOFTSHELL	S	G5T5/S3	1 0 0 0 0
OPEN WATER HABITATS; MOST NUMEROUS IN OPEN RIVER SITUATIONS WITH GRAVEL OR SAND SUBSTRATES, BUT ALSO PRESENT IN SLOWER RIVERS AND IMPOUNDMENTS.						
McCracken	REPTILES	***MACROCLEMYS TEMMINCKII***	ALLIGATOR SNAPPING TURTLE	T	G3G4/S2	0 1 0 0 0
FLOODPLAIN SLOUGHS, BACKWATER AREAS OF LARGER RIVERS, IMPOUNDMENTS. SEEMS TO PREFER MUDDY SUBSTRATE WITH DARK RETREATS INCLUDING MUSKAT AND BEAVER DENS, LOGS, OR SHELTERING VEGETATION.						
McCracken	REPTILES	***THAMNOPHIS SAURITUS SAURITUS***	EASTERN RIBBON SNAKE	S	G5T5/S3	1 0 0 0 0
VARIETY OF SEMI-OPEN HABITATS, GENERALLY IN WEEDY OR BRUSHY GROWTH ALONG THE MARGINS OF SLOUGHS, MARSHES AND OTHER AQUATIC HABITATS.						
McCracken	BIRDS	***ACCIPITER STRIATUS***	SHARP-SHINNED HAWK	S	G5/S3B,S4N	1 0 0 0 0
FOREST AND OPEN WOODLAND, CONIFEROUS, MIXED, OR DECIDUOUS, PRIMARILY IN CONIF. IN MORE NORTHERN AND MOUNTAINOUS PORTION OF RANGE (B83COM01NA). MIGRATES THROUGH VARIOUS HABITATS, MAINLY ALONG RIDGES, LAKESHORES, & COASTLINES (B83NAT01NA).						
McCracken	BIRDS	***AIMOPHILA AESTIVALIS***	BACHMAN'S SPARROW	E	G3/SX?B	0 0 0 1 0
OPEN PINE WOODS WITH SCATTERED BUSHES OR UNDERSTORY, BRUSHY OR OVERGROWN HILLSIDES, OVERGROWN FIELDS WITH THICKETS AND BRAMBLES, GRASSY ORCHARDS.						
McCracken	BIRDS	***ARDEA HERODIAS***	GREAT BLUE HERON	S	G5/S3B,S4N	0 0 1 0 0
FRESHWATER AND BRACKISH MARSHES, ALONG LAKES, RIVERS, BAYS, LAGOONS, OCEAN BEACHES, MANGROVES, FIELDS, AND MEADOWS.						
McCracken	BIRDS	***CORVUS OSSIFRAGUS***	FISH CROW	S	G5/S3B	2 1 0 0 0
BEACHES, BAYS, LAGOONS, INLETS, SWAMPS, NEAR MARSHES, AND, LESS FREQUENTLY, DECIDUOUS OR CONIFEROUS WOODLAND, IN INLAND SITUATIONS PRIMARILY IN BALDCYPRESS SWAMPS AND ALONG MAJOR WATERCOURSES. ALSO GARBAGE DUMPS.						
McCracken	BIRDS	***ICTINIA MISSISSIPPIENSIS***	MISSISSIPPI KITE	S	G5/S2B	1 0 0 0 0
TALL FOREST, OPEN WOODLAND, PRAIRIE, SEMIARID RANGELAND, SHELTERBELTS, WOODED AREAS BORDERING LAKES AND STREAMS IN MORE OPEN REGIONS, SCRUBBY OAKS AND MESQUITE.						
McCracken	BIRDS	***LOPHODYTES CUCULLATUS***	HOODED MERGANSER	T	G5/S1S2B,S3S4N	0 1 0 0 0
STREAMS, LAKES, SWAMPS, MARSHES, AND ESTUARIES; WINTERS MOSTLY IN FRESHWATER BUT ALSO REGULARLY IN ESTUARIES AND SHELTERED BAYS (B83COM01NA).						
McCracken	BIRDS	***RIPARIA RIPARIA***	BANK SWALLOW	S	G5/S3B	0 0 1 0 0
OPEN AND PARTLY OPEN SITUATIONS, FREQUENTLY NEAR FLOWING WATER (B83COM01NA).						
McCracken	BIRDS	***TYTO ALBA***	BARN OWL	S	G5/S3	2 0 0 0 0
OPEN AND PARTLY OPEN COUNTRY IN A WIDE VARIETY OF SITUATIONS, OFTEN AROUND HUMAN HABITATION (B83COM01NA). IN NORTHERN WINTER OFTEN ROOSTS IN DENSE CONIFERS; ALSO ROOSTS IN NEST BOXES IF AVAILABLE (A85MAR01NA).						

County Report of Endangered, Threatened, and Special Concern Plants, Animals, and Natural Communities of Kentucky
Kentucky State Nature Preserves Commission

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McCracken	BIRDS	***VIREO BELLII***	BELL'S VIREO	S	G5/S2S3B	1 1 0 0 0	DENSE BRUSH, MESQUITE, STREAMSIDE THICKETS, AND SCRUB OAK, IN ARID REGIONS BUT OFTEN NEAR WATER (B83COM01NA); MOIST WOODLAND, BOTTONLANDS, WOODLAND EDGE, SCATTERED COVER AND HEDGEROWS IN CULTIVATED AREAS. OPEN WOODLAND, BRUSH IN WINT.
McCracken	MAMMALS	***MYOTIS AUSTRORIPARIUS***	SOUTHEASTERN MYOTIS	E	G3G4/S1S2	1 0 0 0 0	THE SOUTHEASTERN MYOTIS USES PRIMARILY CAVES FOR HIBERNACULA AND SUMMER MATERNITY AND ROOSTING SITES.
McCracken	MAMMALS	***MYOTIS SODALIS***	INDIANA BAT	E/LE	G2/S1S2	1 0 0 0 0	INDIANA BATS USE PRIMARILY CAVES FOR HIBERNACULA, ALTHOUGH THEY ARE OCCASIONALLY FOUND IN OLD MINE PORTALS.
McCracken	MAMMALS	***NYCTICEIUS HUMERALIS***	EVENING BAT	T	G5/S2S3	3 0 0 0 0	THE EVENING BAT IS A COLONIAL SPECIES THAT ROOSTS IN TREES AND HOUSES. IT APPARENTLY MIGRATES SOUTHWARD IN WINTER.
McCracken	COMMUNITIES	***FLOODPLAIN RIDGE/TERRACE FOREST***		N	S1	1 0 0 0 0	
McCracken	COMMUNITIES	***WET PRAIRIE***		N	S1	1 0 0 0 0	

EASTERN SHAWNEE TRIBE
OF OKLAHOMA

P.O. Box 350 · Seneca, MO 64865 · (918) 666-2435 · FAX (918) 666-3325

July 23, 2002

Department of Energy
Gary S. Hartman, EIS Document Manager
Oak Ridge Operations Office
PO Box 2001
Oak Ridge, Tennessee 37831

Re: Paducah Gaseous Diffusion Plant, McCracken County, Kentucky
Portsmouth Gaseous Diffusion Plant. Pike County, Ohio

Dear Mr. Hartman:

Thank you for notice of the referenced project. The Eastern Shawnee Tribe of Oklahoma is currently unaware of any documentation directly linking Indian Religious Sites to the proposed construction. In the event any items falling under the Native American Graves Protection and Repatriation Act (NAGPRA) are discovered during construction, the Eastern Shawnee Tribe request notification and further consultation.

The Eastern Shawnee Tribe has no objection to the proposed construction. However, if any human skeletal remains and/or any objects falling under NAGPRA are uncovered during construction, the construction should stop immediately, and the appropriate persons, including state and tribal NAGPRA representatives contacted.

Sincerely,

Charles Enyart

Charles Enyart, Chief
Eastern Shawnee Tribe of Oklahoma

PEORIA TRIBE OF INDIANS OF OKLAHOMA
118 S. Eight Tribes Trail (918) 540-2535 FAX (918) 540-2538
P.O. Box 1527
MIAMI, OKLAHOMA 74355

CHIEF
John P. Froman

SECOND CHIEF
Joe Goforth

July 26, 2002

Gary S. Hartman
Department of Energy
Oak Ridge Operations Office
P. O. Box 2001
Oak Ridge, Tennessee 37831

RE: DUF conversion facilities

Thank you for notice of the referenced project. The Peoria Tribe of Indians of Oklahoma is currently unaware of any documentation directly linking Indian Religious Sites to the proposed construction. In the event any items falling under the Native American Graves Protection and Repatriation Act (NAGPRA) are discovered during construction, the Peoria Tribe request notification and further consultation.

The Peoria Tribe has no objection to the proposed construction. However, if any human skeletal remains and/or any objects falling under NAGPRA are uncovered during construction, the construction should stop immediately, and the appropriate persons, including state and tribal NAGPRA representatives contacted.

John P. Froman
Chief

xc: Bud Ellis, Repatriation/NAGPRA Committee Chairman

July 26, 2002

TENNESSEE HISTORICAL COMMISSION
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
2941 LEBANON ROAD
NASHVILLE, TN 37243-0442
(615) 532-1550

Mr. Gary S. Hartman
Oak Ridge Operations/DP-80
Post Office Box 2001
Oak Ridge, Tennessee, 37831

RE: DOE, DUF MANAGEMENT/ETTP, OAK RIDGE, ANDERSON COUNTY

Dear Mr. Hartman:

In response to your request, received on Wednesday, July 24, 2002, we have reviewed the documents you submitted regarding your proposed undertaking. Our review of and comment on your proposed undertaking are among the requirements of Section 106 of the National Historic Preservation Act. This Act requires federal agencies or applicant for federal assistance to consult with the appropriate State Historic Preservation Office before they carry out their proposed undertakings. The Advisory Council on Historic Preservation has codified procedures for carrying out Section 106 review in 36 CFR 800. You may wish to familiarize yourself with these procedures (Federal Register, December 12, 2000, pages 77698-77739) if you are unsure about the Section 106 process.

Considering available information, we find that the project as currently proposed MAY AFFECT PROPERTIES THAT ARE ELIGIBLE FOR LISTING IN THE NATIONAL REGISTER OF HISTORIC PLACES. You should continue consultation with our office, designated consulting parties and invite them to participate in consultation, and provide us with appropriate survey documentation for review and comment. Please direct questions and comments to Joe Garrison (615) 532-1559. We appreciate your cooperation.

Sincerely,

Herbert L. Harper

Herbert L. Harper
Executive Director and
Deputy State Historic
Preservation Officer

HLH/jyg

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Ecological Services
6950 Americana Parkway, Suite H
Reynoldsburg, Ohio 43068-4127

(614) 469-6923/FAX (614) 469-6919
March 16, 2004

Dr. James L. Elmore
Oak Ridge Operations Office
Department of Energy
P.O. Box 2001
Oak Ridge, TN 37831

Dear Dr. Elmore:

This is in response to your January 9, 2004 letter (which we received on February 10, 2004) and attached <u>Biological Assessment of the Effects of Construction and Operation of a Depleted Uranium Hexafluoride Conversion Facility at the Portsmouth Site, January 2004</u>, regarding informal consultation under section 7 of the Endangered Species Act for the proposed depleted uranium hexafluoride conversion facility at the Portsmouth Gaseous Diffusion Plant located in Pike County, Ohio.

In response to our September 23, 2002 letter, you prepared and submitted a Biological Assessment (BA). The BA addresses two species, the Indiana bat, a Federally listed endangered species which is listed in all 88 counties of Ohio, and the timber rattlesnake, which has not been assigned a Federal listing status, but the Service has initiated a pre-listing Conservation Action Plan to support State and local conservation efforts.

Your BA provides a thorough assessment of habitat for the above two species. The BA concludes that most of the site was found to have poor summer habitat for the Indiana bat because of the small size, isolation, and insufficient maturity of the few woodlands on the site. Potential summer habitat for the Indiana bat was identified and sampled during surveys conducted in 1994 and 1996. No Indiana bats were collected during those surveys. Nevertheless, the Department agreed that any unavoidable cutting of trees, associated with the proposed facility, with summer roost characteristics would be done between September 15 and April 15. Thus, the proposed action is not likely to adversely affect the Indiana bat. Also, the Department concludes that habitat for the timber rattlesnake is not present on the Portsmouth site; therefore, the propose action would not affect the rattlesnake species.

We concur with the Department of Energy's conclusion regarding the above two species. Regarding the Indiana bat, we recommend your continued efforts to avoid impacting summer bat habitat and/or enhance other areas which could be developed into good summer habitat. The Indiana bat surveys were conducted at least seven years ago; new surveys on the Portsmouth site could result in the capture of this species.

These comments have been prepared under the authority of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.), the Endangered Species Act of 1973, as amended, and are consistent with the intent of the National Environmental Policy Act of 1969 and the U. S. Fish and Wildlife Service's Mitigation Policy.

If you have questions, or if we may be of further assistance in this matter, please contact Ken Lammers at extension 15 in this office.

Sincerely,

Mary Knapp

Mary Knapp, Ph.D.
Supervisor

cc: ODNR, Div. of Wildlife, SCEA Unit, Columbus, OH
ODNR, Div. of RELM, Columbus, OH
Ohio EPA, Water Quality Monitoring, Columbus, OH

United States Department of the Interior
FISH AND WILDLIFE SERVICE
3761 GEORGETOWN ROAD
FRANKFORT, KY 40601

March 2, 2004

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Date Received MAR 8 2004
File Code

Mr. James L. Elmore, Ph.D.
U.S. Department of Energy
Oak Ridge Operations Office
P.O. Box 2001
Oak Ridge, Tennessee 37831

Subject: FWS #04-0582; Biological Assessment for the Indiana bat, Informal Consultation for the Proposed Depleted Uranium Hexafluoride Conversion Facility, McCracken County, Kentucky

Dear Dr. Elmore:

Thank you for your letter and enclosures transmitting a biological assessment (BA) for the federally endangered Indiana bat in association with the Proposed Depleted Uranium Hexafluoride Conversion Facility in McCracken County, Kentucky. Fish and Wildlife Service (Service) biologists have reviewed the document, and we offer the following comments.

Based on the information provided in the BA, tree clearing will be necessary in one of the three proposed facility construction locations. Of the proposed sites, Location A covers 35 acres, with approximately 10 acres of mature hardwood; Location B covers 59 acres, with the southern half occupied by mature hardwood forest; Location C is 53 acres, with its western half recently disturbed and occupied by young growth (trees and saplings). Once construction begins on the selected location, the facility will occupy approximately 10 acres with up to 45 acres potentially affected by construction activities.

The project area is known to have Indiana bat summer foraging and roosting habitat (of varying quality) in the vicinity. Indiana bats typically roost under exfoliating bark, in cavities of dead and live trees, and in snags (i.e. dead trees or dead portions of live trees). Trees in excess of 16 inches in diameter at breast height (DBH) are considered optimal for maternity colony roosts, but trees in excess of 9 inches DBH appear to provide suitable roosting habitat. Male Indiana bats have been observed roosting in trees as small as 3 inches DBH. The BA states that tree removal would occur between September 15th and April 15th. However, to be fully protective of Indiana bat summer roosting and foraging seasons, we recommend that trees only be removed between October 15th and March 31st. There are no known or suspected Indiana bat hibernacula within 10 miles of the project area, therefore, hibernacula mitigation measures will not be necessary.

Provided that tree and vegetation clearing occurs during the above-specified interval of October 15 to March 31, the Service concurs that the proposed action is "not likely to adversely affect" the federally endangered Indiana bat. In view of this, we believe that the requirements of section 7 of the Endangered Species Act have been fulfilled for this project. Your obligations under section 7 must be reconsidered, however, if: (1) new information reveals that the proposed action may affect listed species in a manner or to an extent not previously considered, (2) the proposed action is subsequently modified to include activities which were not considered during this consultation, or (3) new species are listed or critical habitat designated that might be affected by the proposed action.

If you have any questions or if we can be of further assistance, please contact Anthony Velasco at (502)/695-0468 (ext.225).

Sincerely,

Virgil Lee Andrews, Jr.
Field Supervisor

APPENDIX H:

CONTRACTOR DISCLOSURE STATEMENT

APPENDIX H:

CONTRACTOR DISCLOSURE STATEMENT

Argonne National Laboratory (ANL) is the contractor assisting the U.S. Department of Energy (DOE) in preparing the environmental impact statement (EIS) for depleted UF_6 conversion. DOE is responsible for reviewing and evaluating the information and determining the appropriateness and adequacy of incorporating any data, analyses, or results in the EIS. DOE determines the scope and content of the EIS and supporting documents and will furnish direction to ANL, as appropriate, in preparing these documents.

The Council on Environmental Quality's regulations (40 CFR 1506.5(c)), which have been adopted by DOE (10 CFR Part 1021), require contractors who will prepare an EIS to execute a disclosure specifying that they have no financial or other interest in the outcome of the project. The term "financial interest or other interest in the outcome of the project" for the purposes of this disclosure is defined in the March 23, 1981, "Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations," 46 *Federal Register* 18026-18028 at Questions 17a and 17b. Financial or other interest in the outcome of the project includes "any financial benefit such as promise of future construction or design work on the project, as well as indirect benefits the consultant is aware of (e.g., if the project would aid proposals sponsored by the firm's other clients)," 46 *Federal Register* 18026-18038 at 10831.

In accordance with these regulations, Argonne National Laboratory hereby certifies that it has no financial or other interest in the outcome of the project.

Certified by:

Anthony J Dvorak

Signature

Anthony J. Dvorak

Name

Director, Environmental Assessment Division

Title

6/10/02

Date

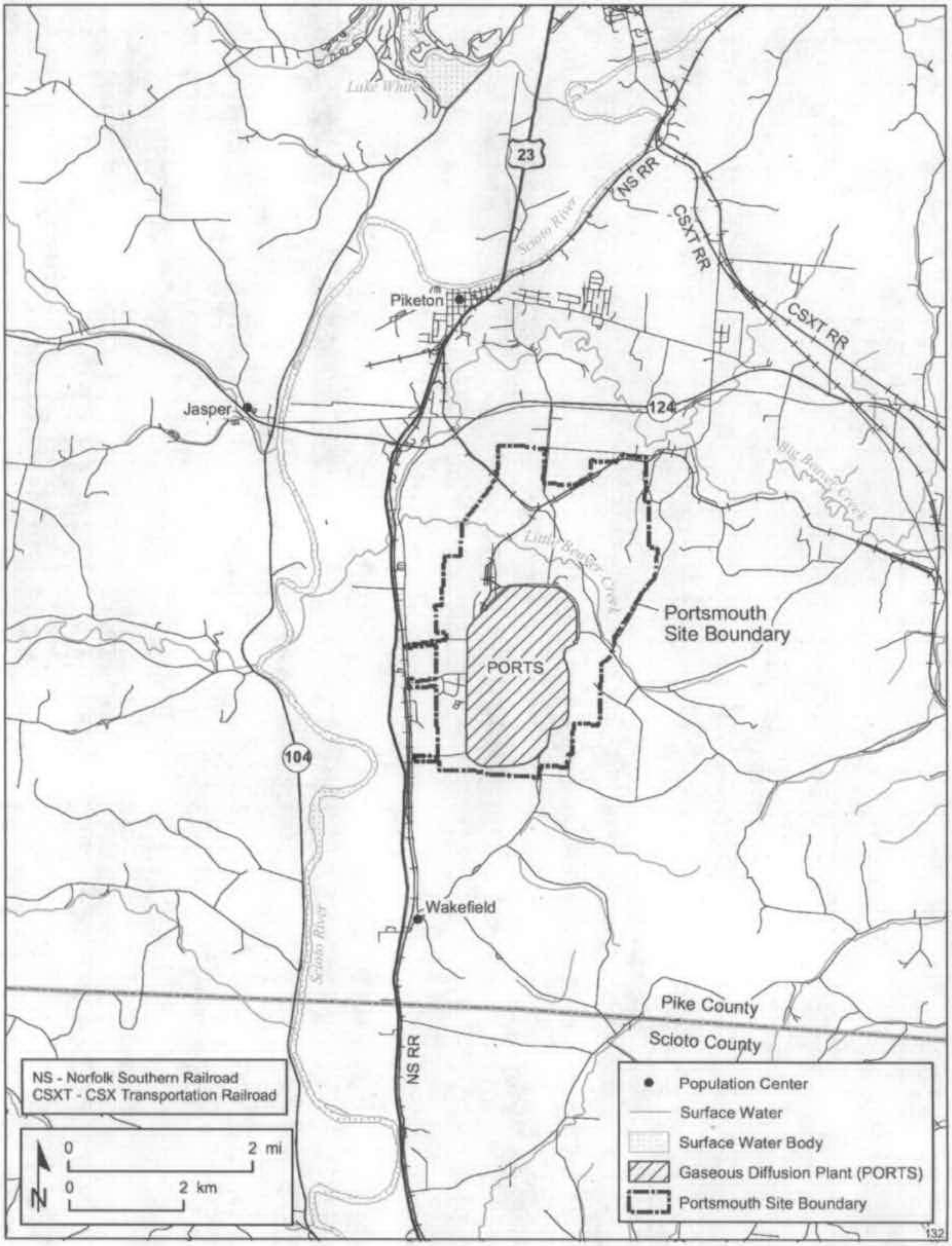

FIGURE S-1 Regional Map of the Portsmouth, Ohio, Site Vicinity

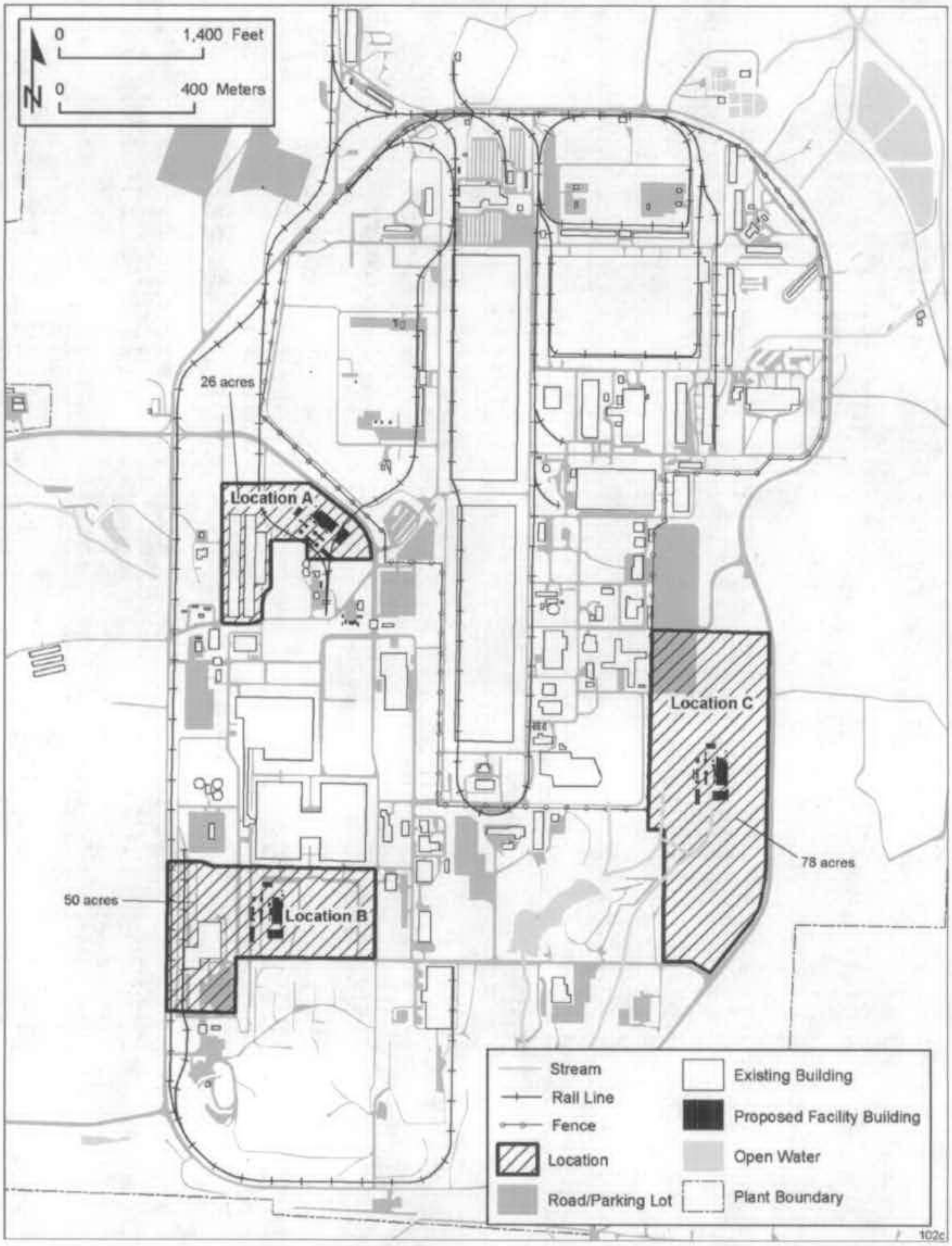

FIGURE S-3 Three Alternative Conversion Facility Locations within the Portsmouth Site, with Location A Being the Preferred Alternative (A representative conversion facility footprint is shown within each location.)

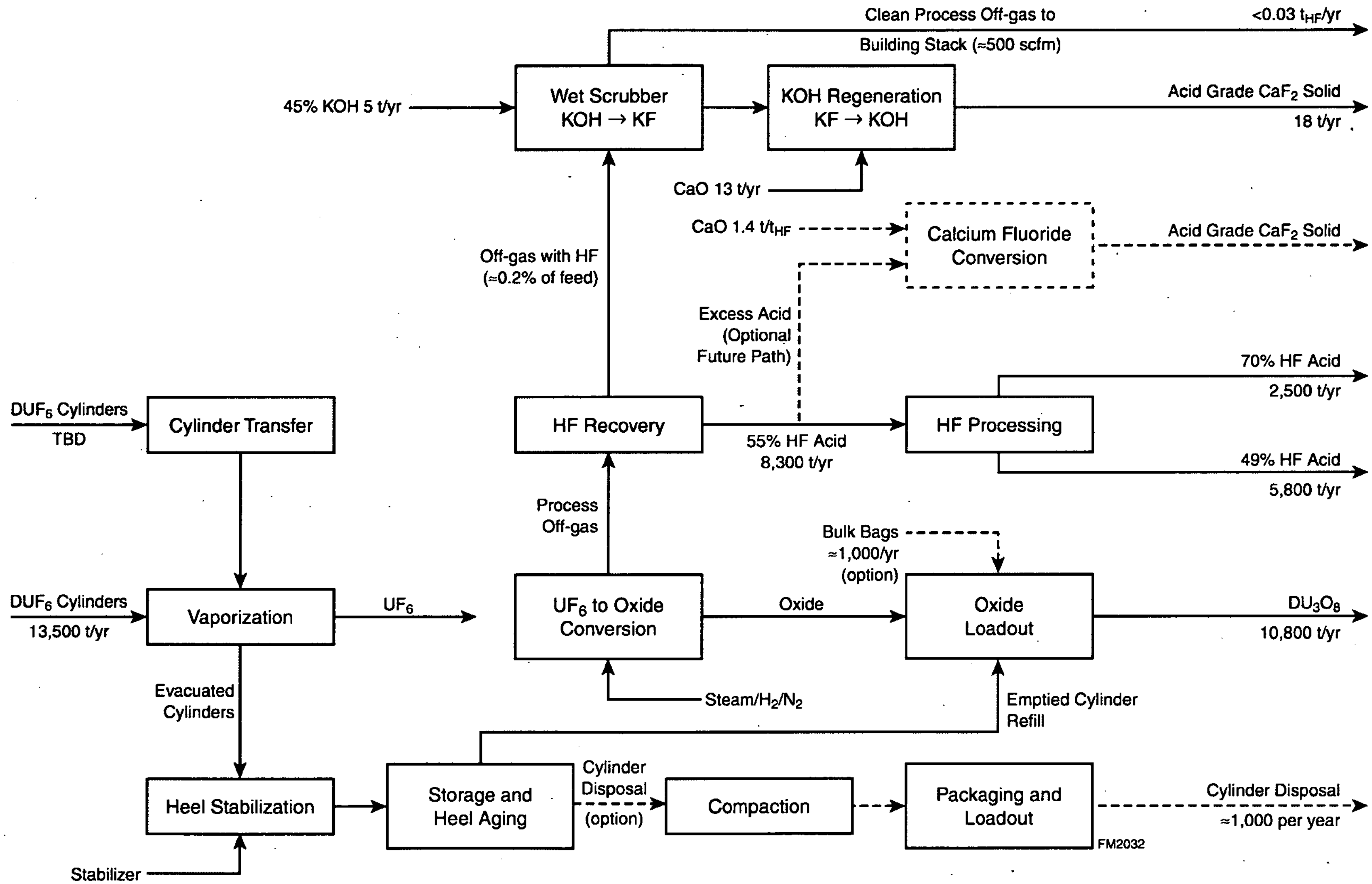

FIGURE S-4 Conceptual Overall Material Flow Diagram for the Portsmouth Conversion Facility

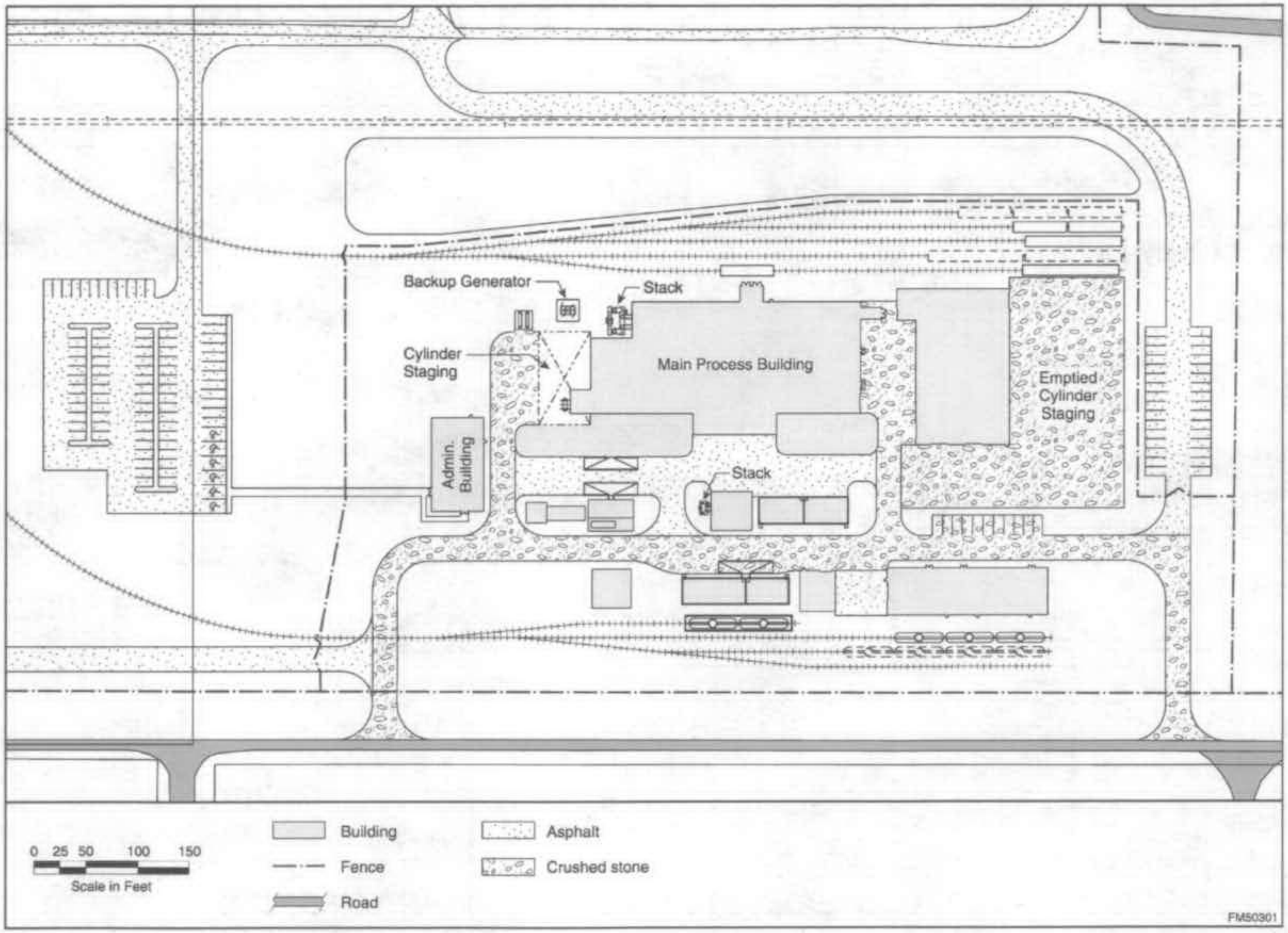

FIGURE S-5 Conceptual Conversion Facility Site Layout for Portsmouth

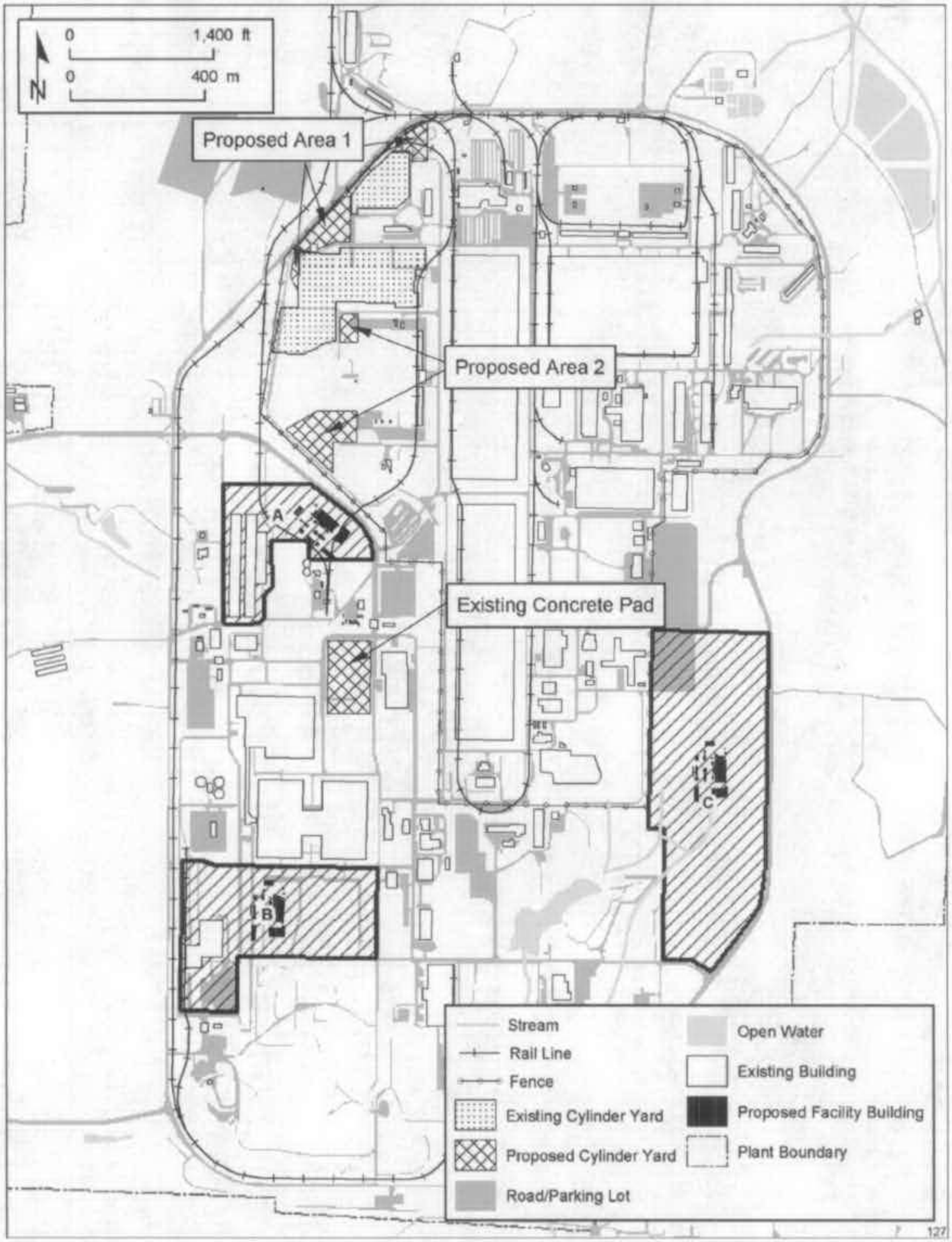

FIGURE S-6 Potential Locations for Construction of a New Cylinder Storage Yard at Portsmouth

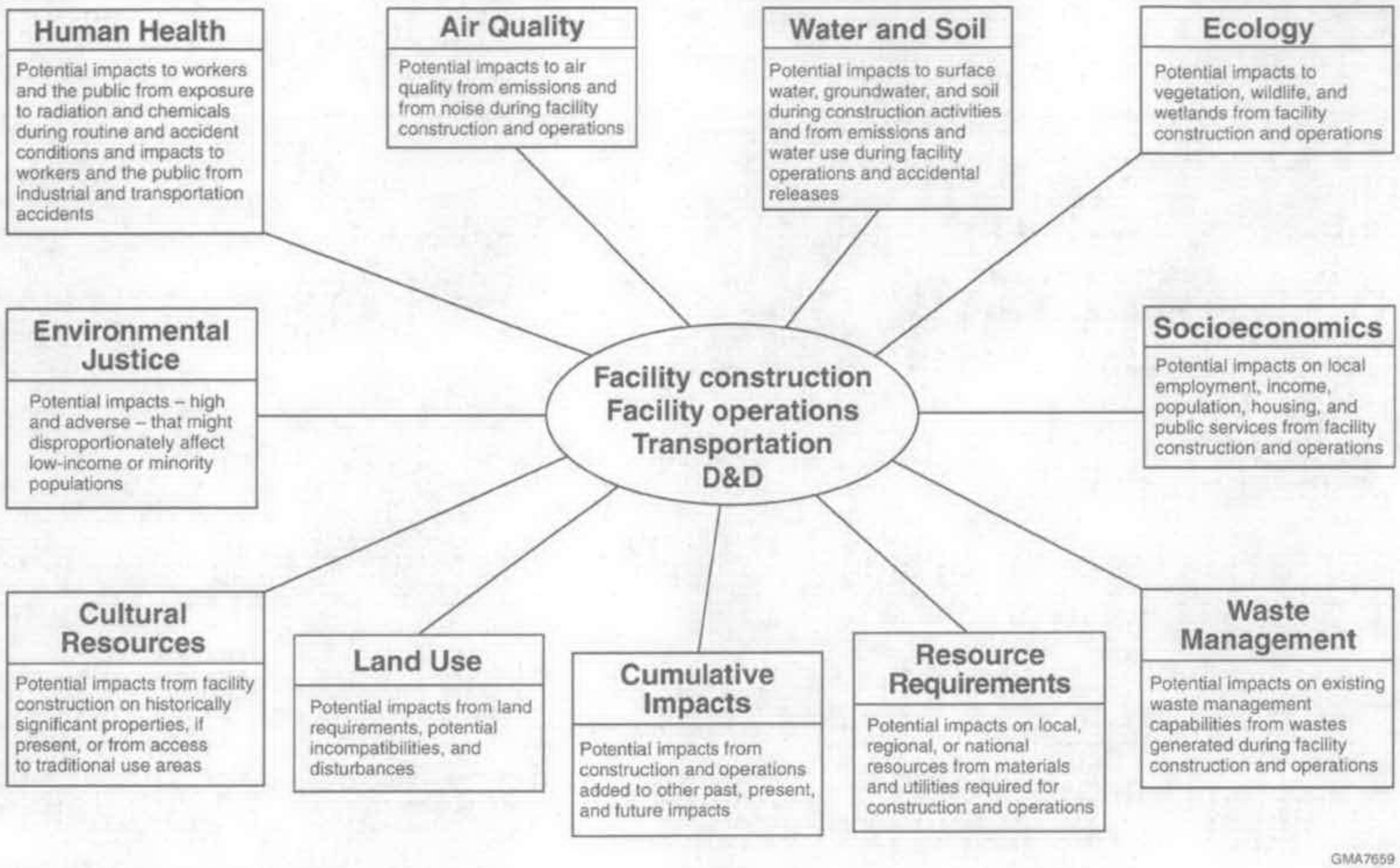

FIGURE S-7 Areas of Potential Impact Evaluated for Each Alternative

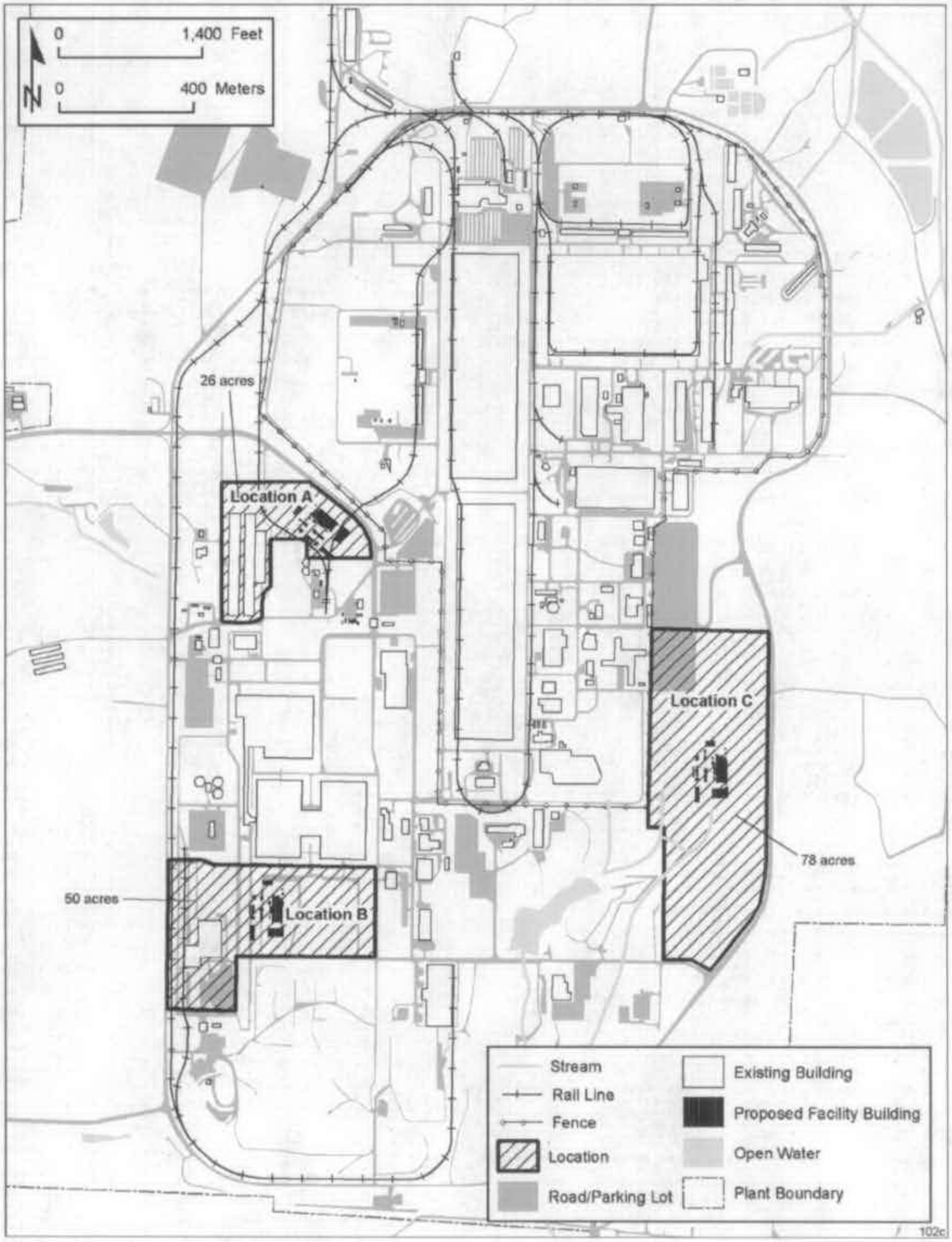

FIGURE 2.2-1 Three Alternative Conversion Facility Locations within the Portsmouth Site, with Location A Being the Preferred Alternative (A representative conversion facility footprint is shown within each location.)

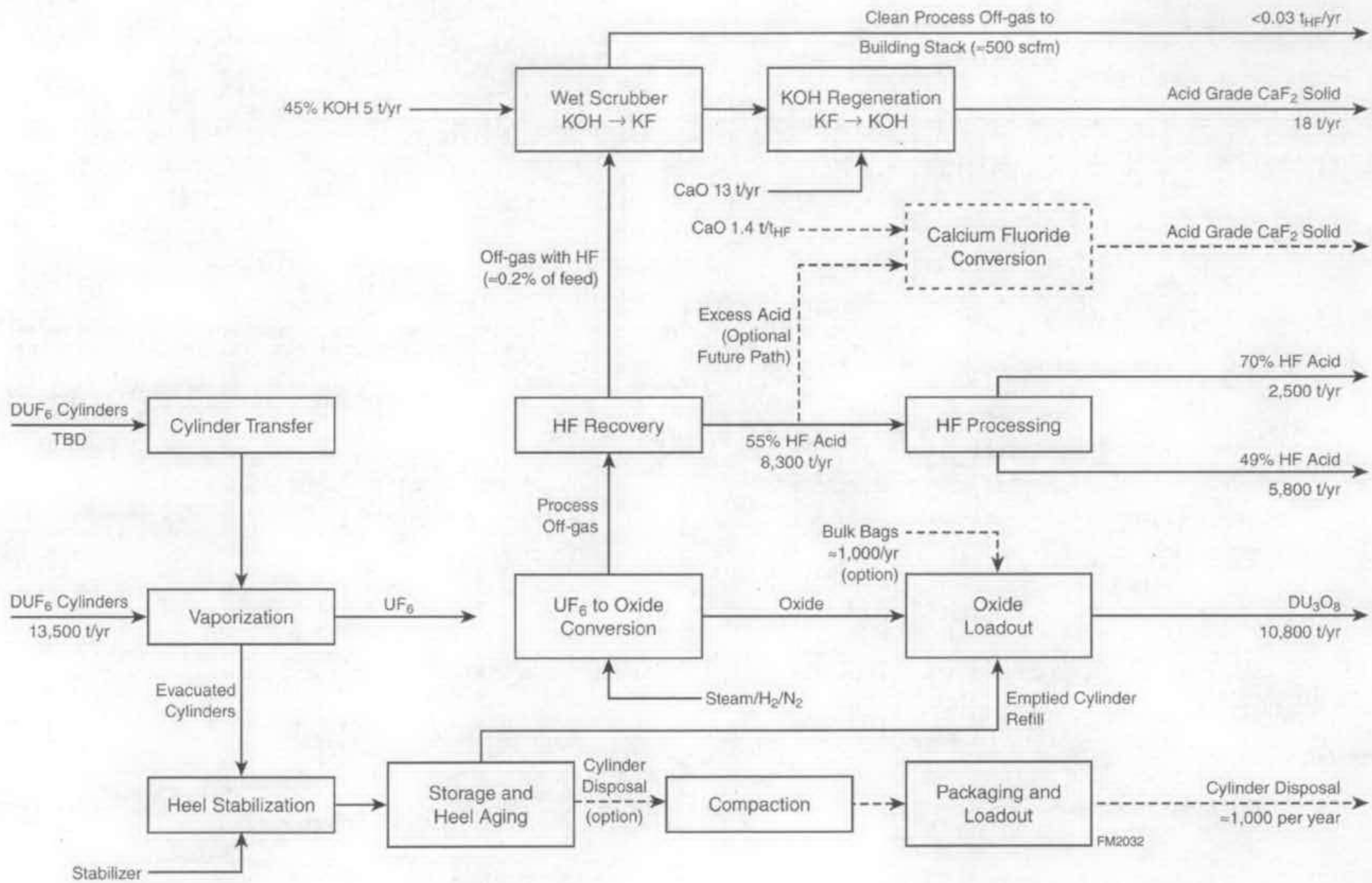

FIGURE 2.2-2 Conceptual Overall Material Flow Diagram for the Portsmouth Conversion Facility (Source: UDS 2003b)

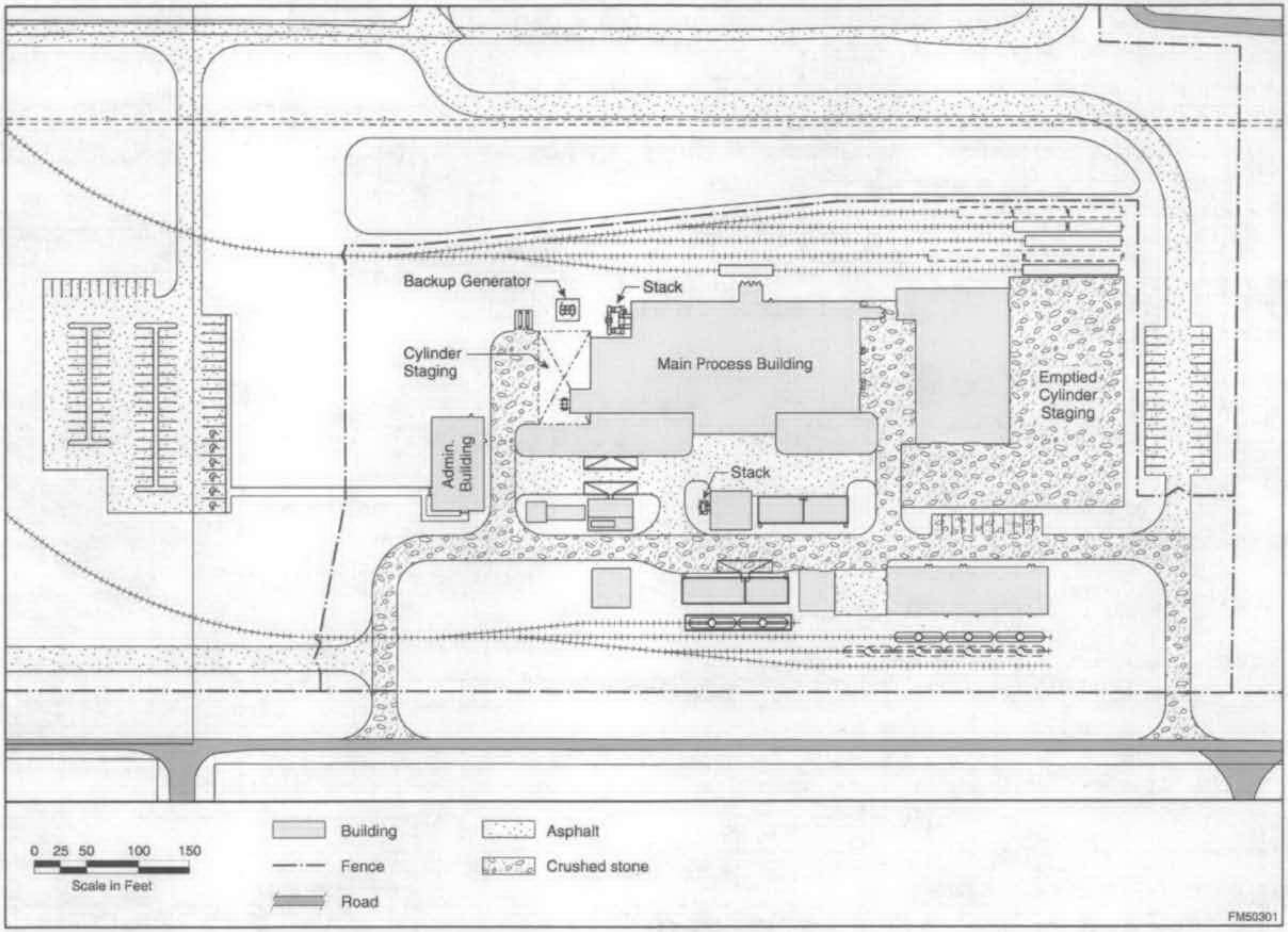

FIGURE 2.2-3 Conceptual Conversion Facility Site Layout for Portsmouth

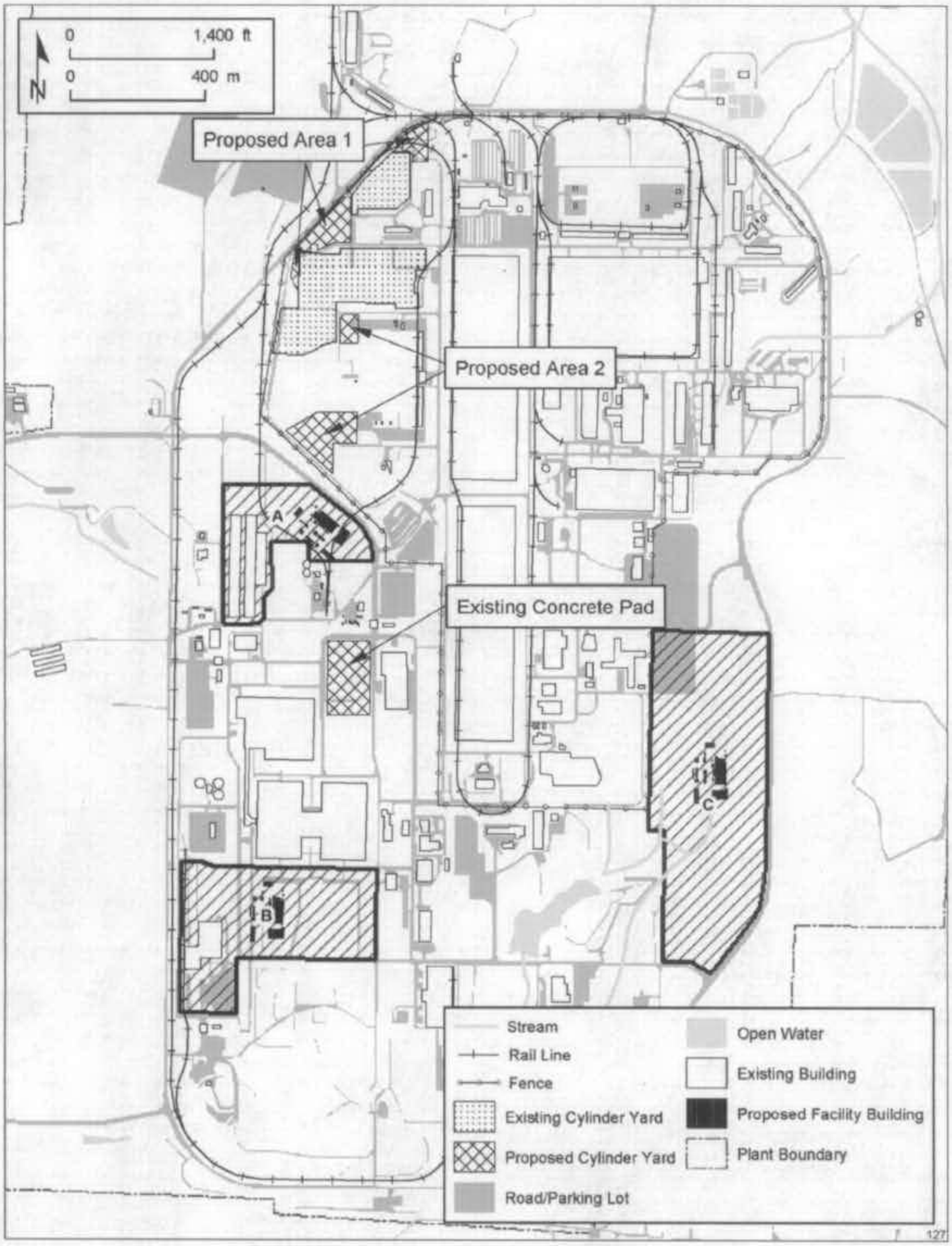

FIGURE 2.2-4 Potential Locations for Construction of a New Cylinder Storage Yard at Portsmouth

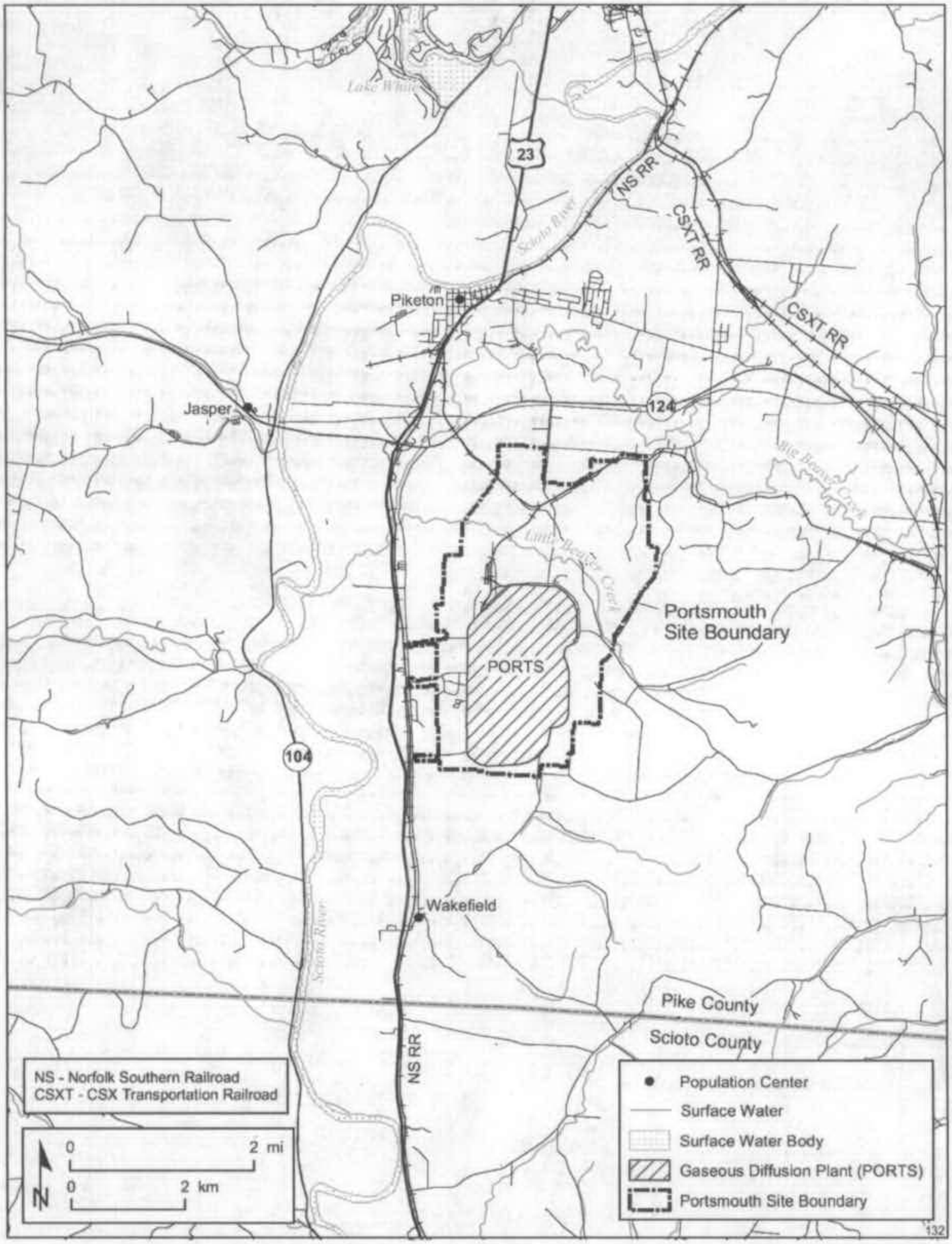

FIGURE 3.1-1 Regional Map of the Portsmouth Site Vicinity (Source: Adapted from LMES 1996a)

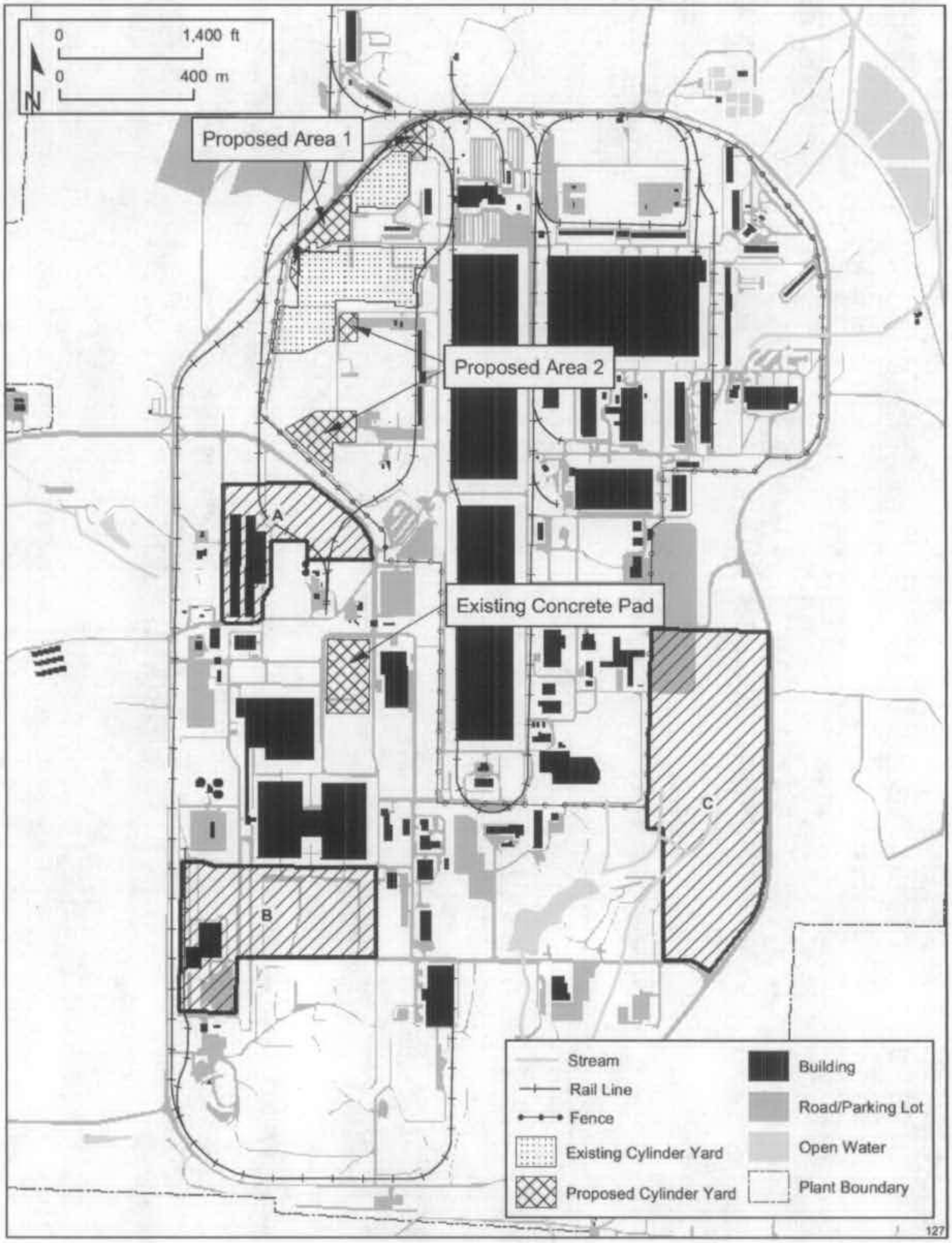

FIGURE 3.1-2 Locations of Cylinder Yards at the Portsmouth Site That Are Used to Store DOE-Managed Cylinders (Source: Adapted from DOE 1996a; MMES 1992a)

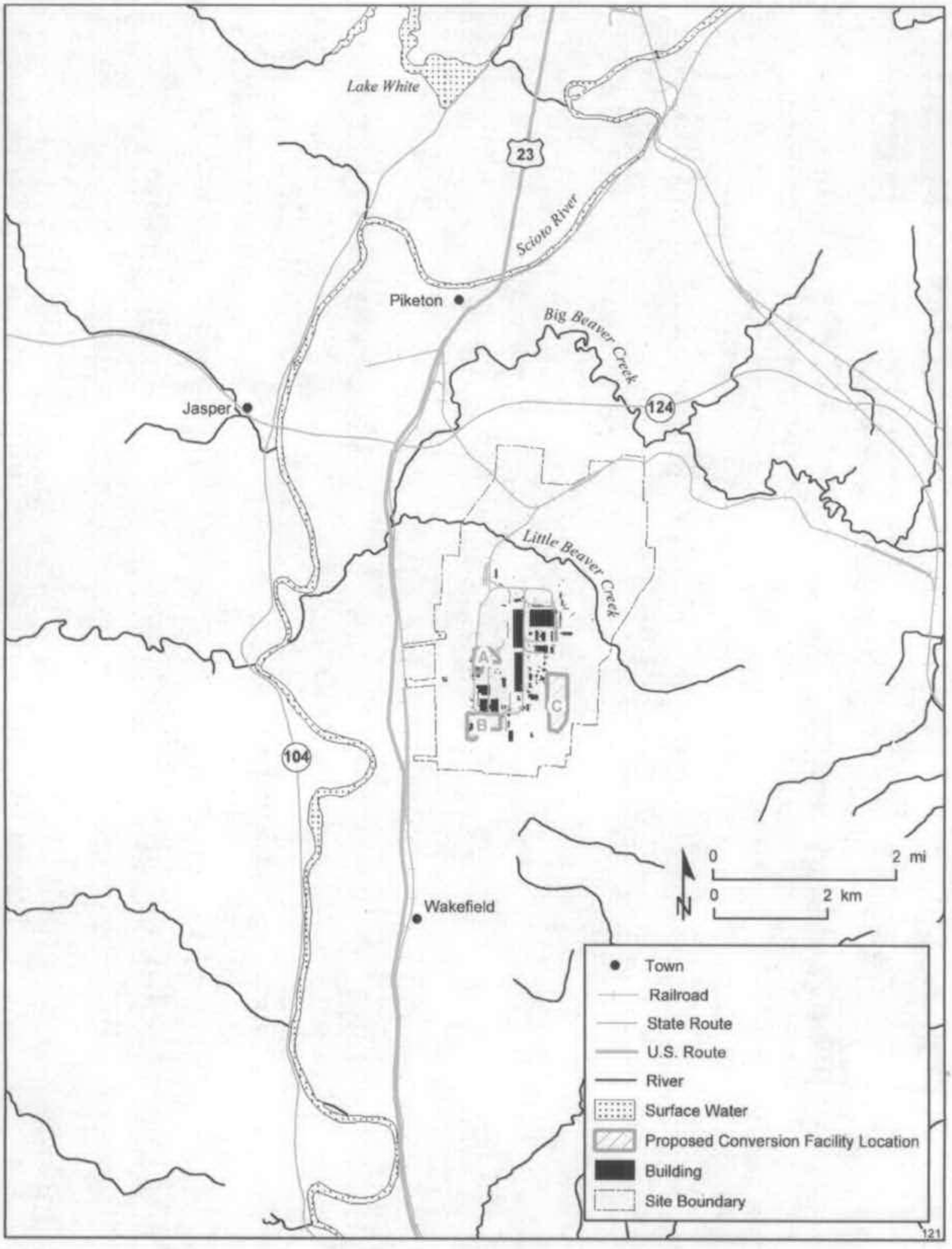

FIGURE 3.1-4 Portsmouth Site Drainage Features

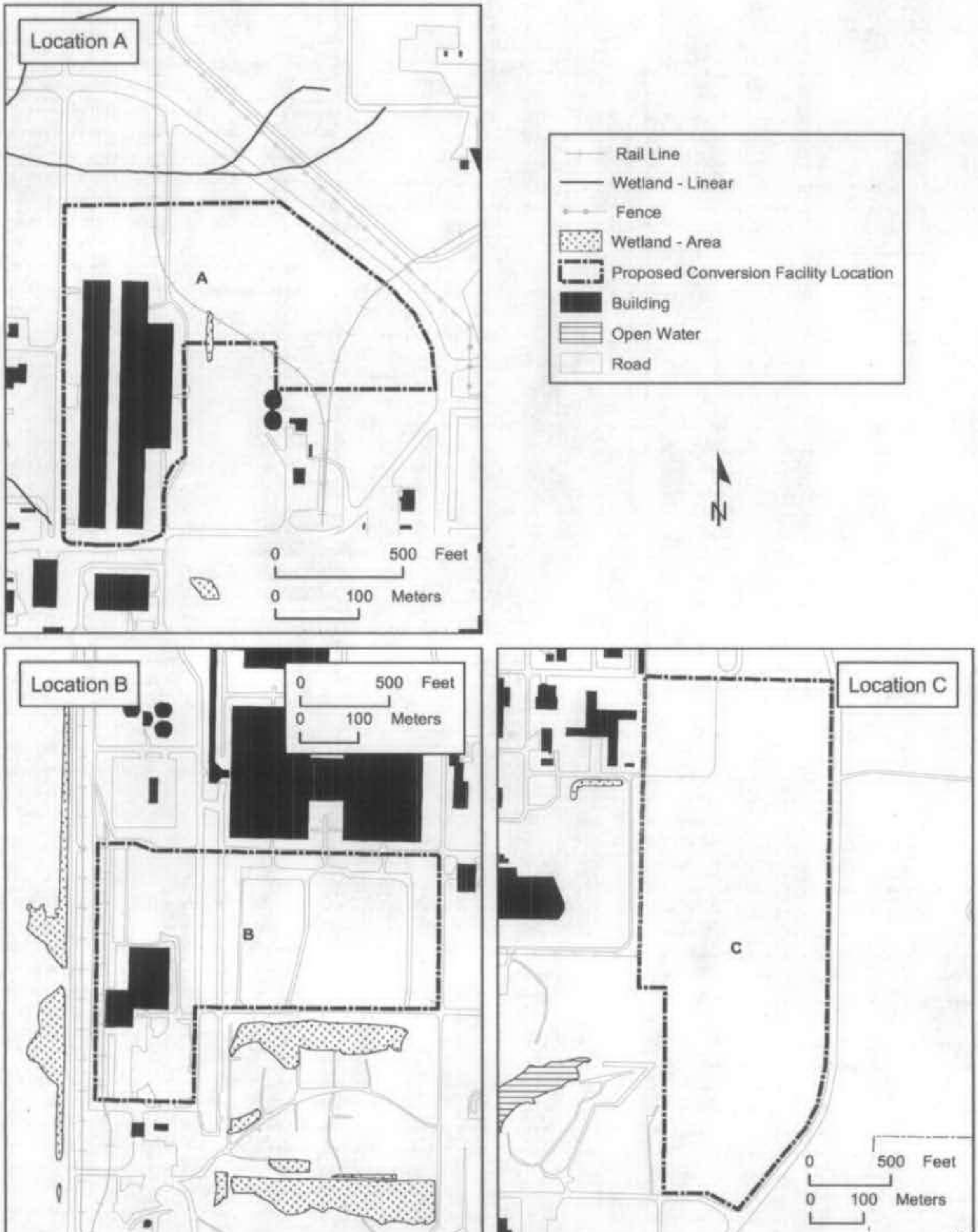

FIGURE 3.1-5 Wetlands in the Vicinity of the Three Candidate Locations for the Portsmouth Conversion Facility

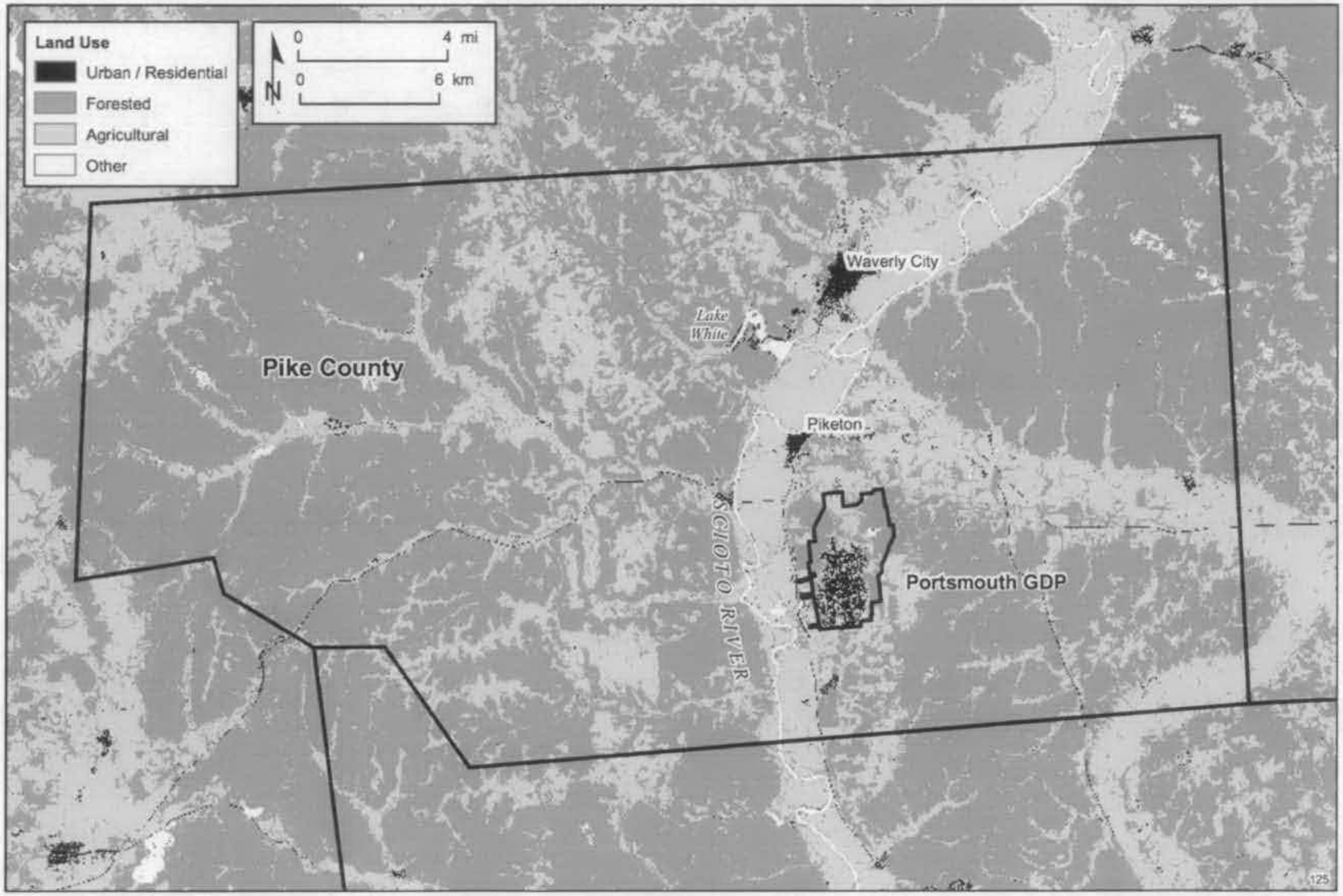

FIGURE 3.1-6 Land Cover in Pike County, Ohio (Data Source: USGS 2002)

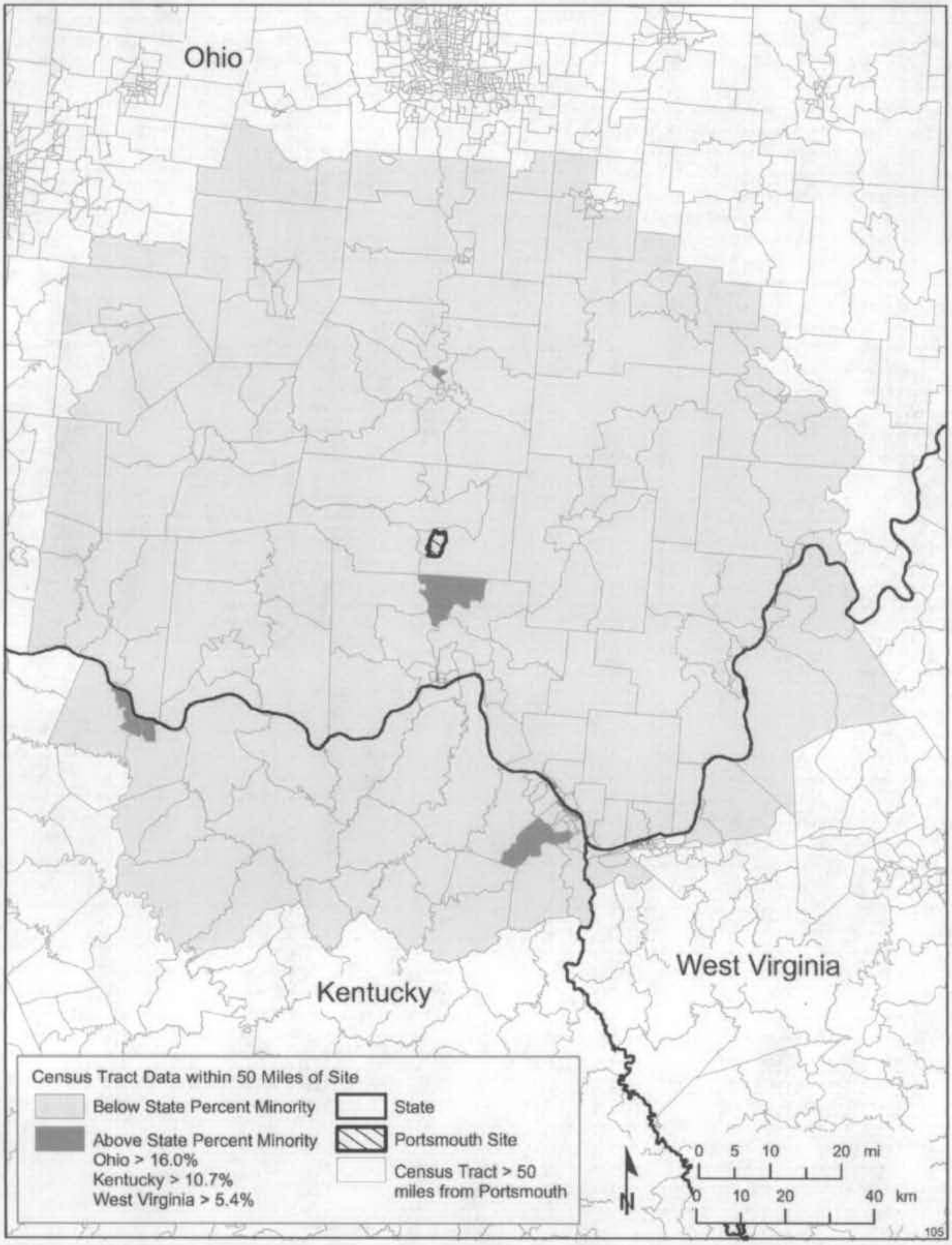

FIGURE 3.1-7 Census Tracts within 50 mi (80 km) of the Conversion Facility at the Portsmouth Site with Minority Populations in Excess of State-Specific Thresholds (Source: Based on data from U.S. Bureau of the Census 2002d)

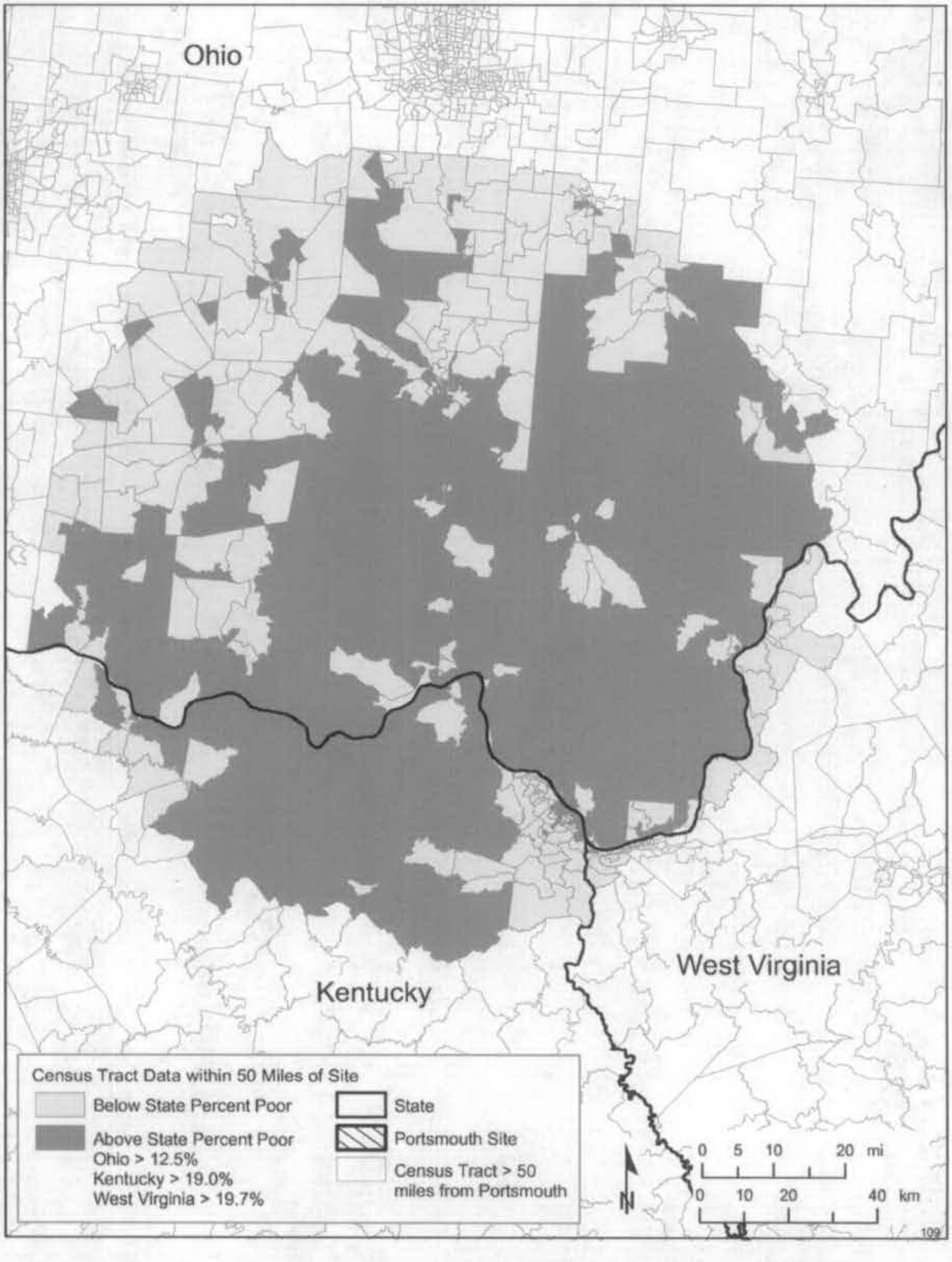

FIGURE 3.1-8 Census Tracts within 50 mi (80 km) of the Conversion Facility at the Portsmouth Site with Low-Income Populations in Excess of State-Specific Thresholds (Source: Based on data from U.S. Bureau of the Census 2002d)

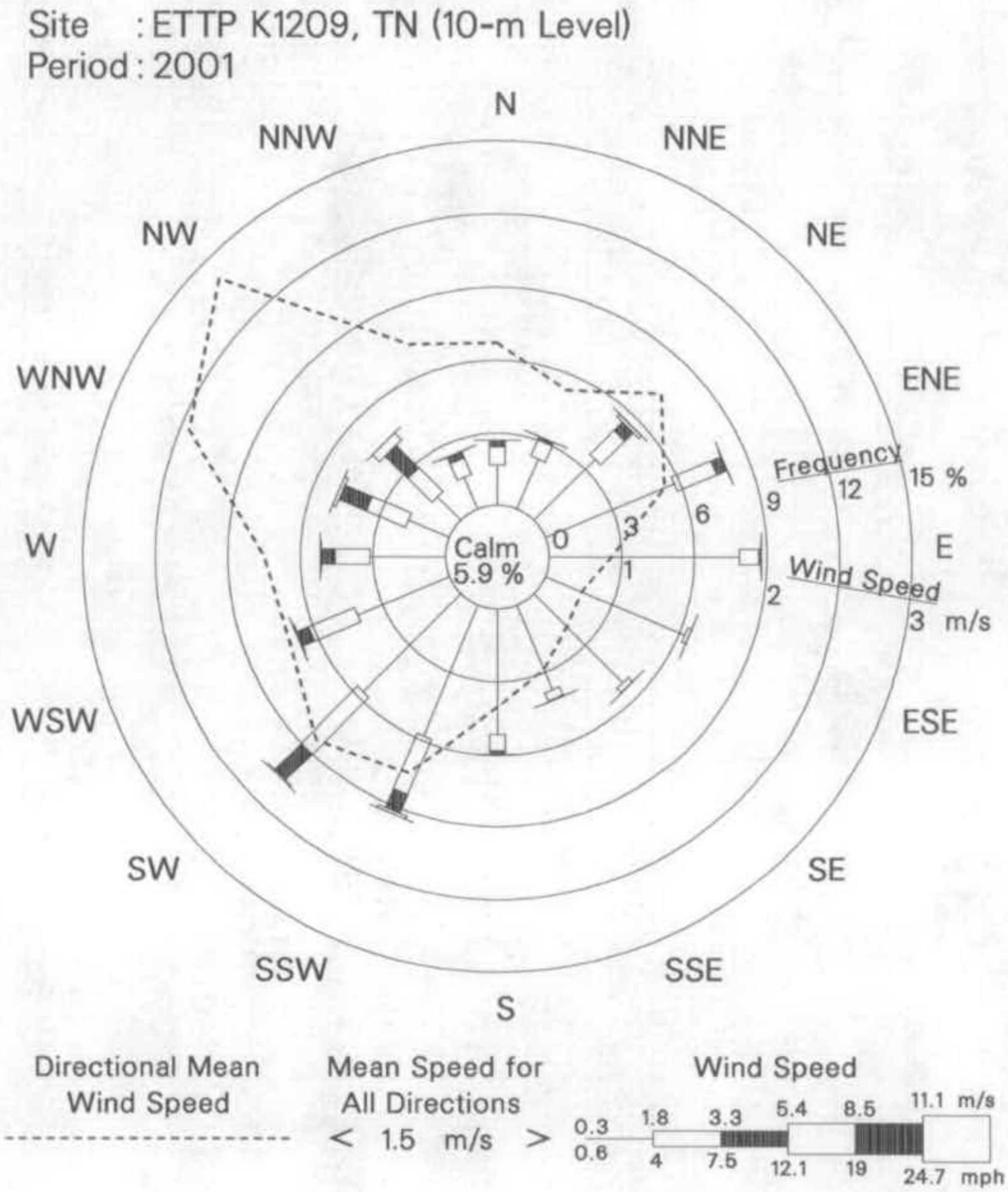

FIGURE 3.2-3 Wind Rose for the ETTP K1209 Meteorological Tower (10-m [33-ft] level), 2001 (Source: ORNL 2002)

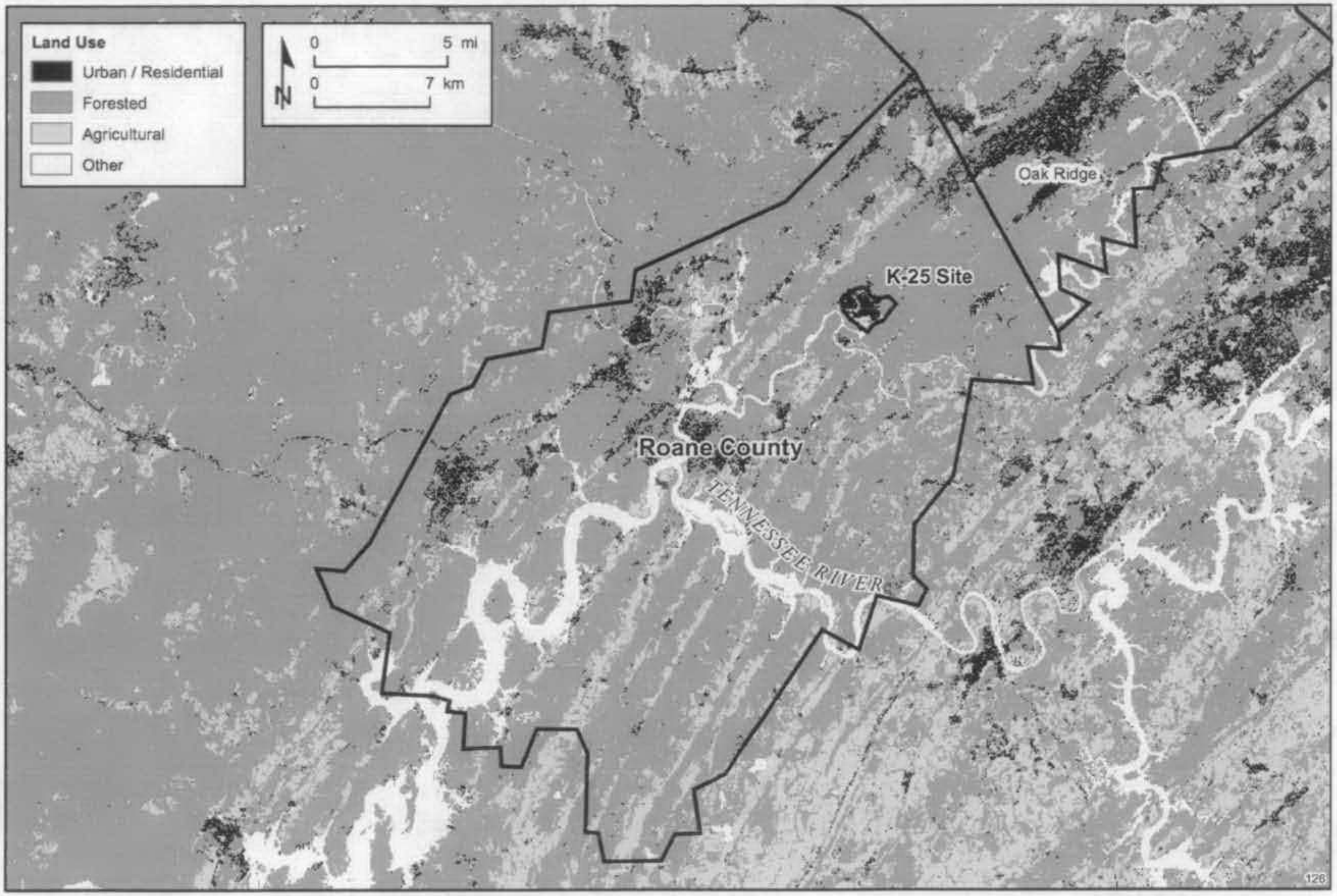

FIGURE 3.2-5 Land Cover in Roane County, Tennessee (Data Source: USGS 2002)

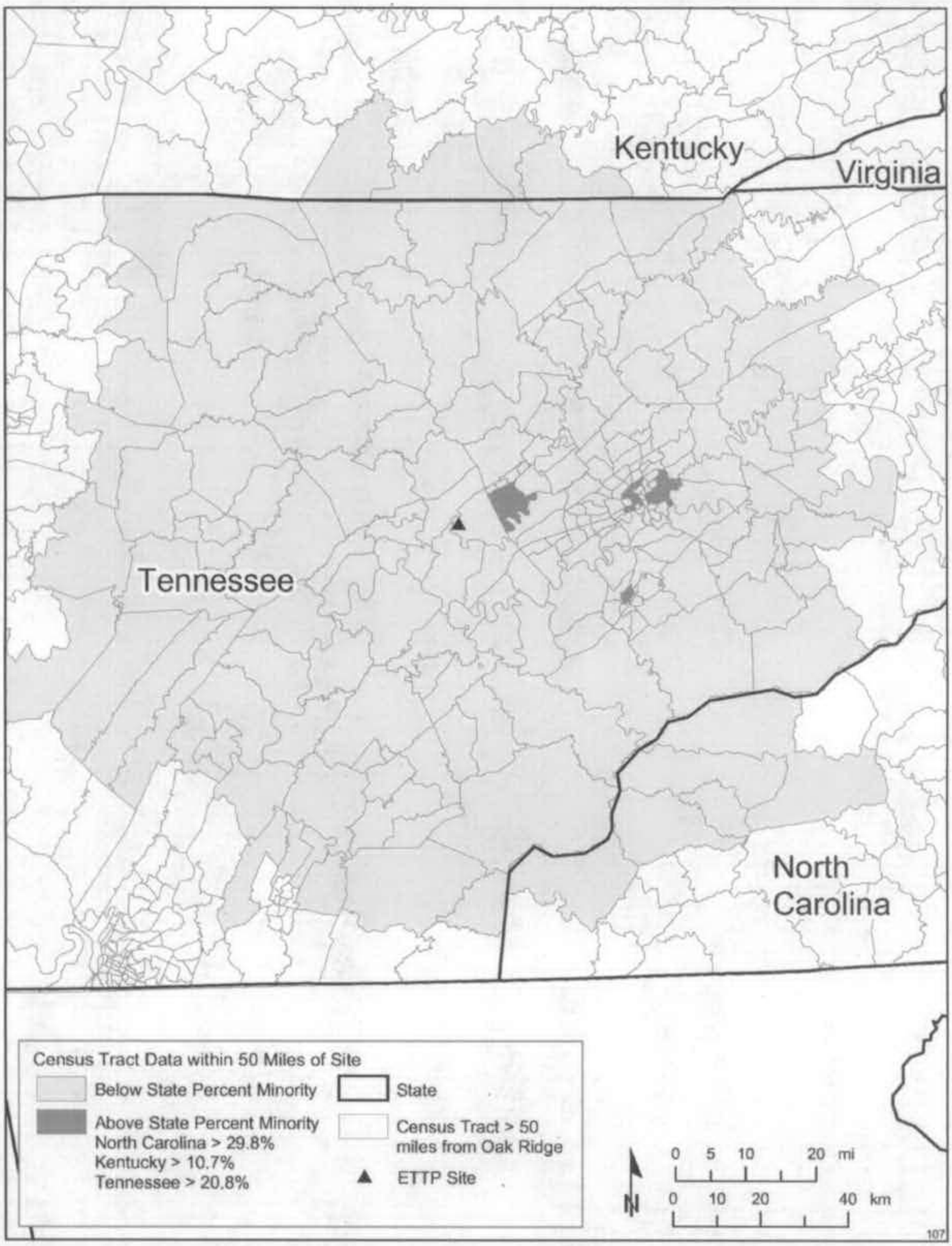

FIGURE 3.2-6 Census Tracts within 50 mi (80 km) of the Storage Facility at ETTP with Minority Populations in Excess of State-Specific Thresholds (Source: Based on data from U.S. Bureau of the Census 2002e)

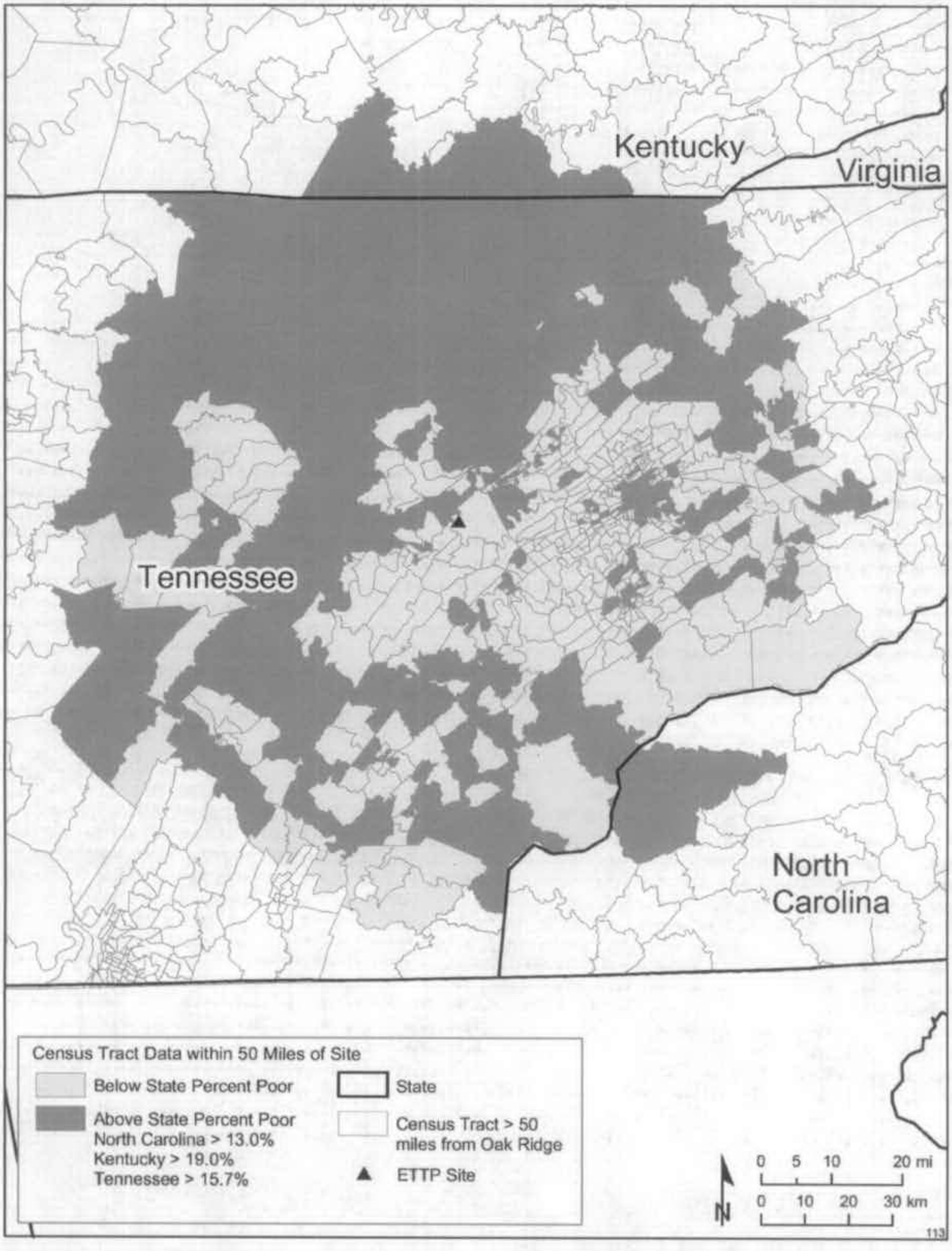

FIGURE 3.2-7 Census Tracts within 50 mi (80 km) of the Storage Facility at ETTP with Low-Income Populations in Excess of State-Specific Thresholds (Source: Based on data from U.S. Bureau of the Census 2002e)

TABLE S-2 Summary of Alternatives Considered for the Portsmouth Conversion Facility EIS

Alternative	Description	Options Considered
No Action	Continued storage of the DUF_6 cylinders indefinitely at the Portsmouth and ETTP sites, with continued cylinder surveillance and maintenance.	None.
Proposed Action	Construction and operation of a conversion facility at the Portsmouth site for conversion of the Portsmouth and ETTP DUF_6 inventories into depleted uranium oxide (primarily U_3O_8) and other conversion products. This EIS assesses the potential environmental impacts from the following proposed activities: • Construction, operation, maintenance, and D&D of the proposed DUF_6 conversion facility at the Portsmouth site; • Transportation of DUF_6 and non-DUF_6 cylinders from ETTP to Portsmouth; • Construction of a new cylinder storage yard (if required) for ETTP cylinders; • Transportation of uranium conversion products and waste materials to a disposal facility; • Transportation and sale of the HF conversion product; and • Neutralization of HF to CaF_2 and sale or disposal in the event that the HF product is not sold.	*ETTP Cylinders:* This EIS considers an option of shipping cylinders at ETTP to Paducah. *Transportation:* This EIS evaluates the shipment of cylinders and conversion products by both truck and rail. *Expanded Operations:* This EIS discusses the impacts associated with potential expansion of plant operations by extending the operational period and by increasing throughput (by efficiency improvements or by adding a fourth process line).
Alternative Location A (Preferred)	Construction of the conversion facility at Location A, an area that encompasses 26 acres (10 ha) in the west-central portion of the site.	
Alternative Location B	Construction of the conversion facility at Location B, an area that encompasses 50 acres (20 ha) in the southwest portion of the site.	
Alternative Location C	Construction of the conversion facility at Location C, an area that encompasses 78 acres (31 ha) in the southeast portion of the site.	

TABLE S-5 Summary of Major EIS Data and Assumptions

Parameter/Characteristic	Data/Assumption
General	
Portsmouth DUF_6 cylinder inventory	16,109 cylinders; 195,800 t (216,000 tons)
Portsmouth non-DUF_6 cylinder inventory	2,693 cylinders; 13,500 t (14,900 tons)
ETTP DUF_6 cylinder inventory	4,822 cylinders; 54,300 t (60,000 tons)
ETTP non-DUF_6 cylinder inventory	1,102 cylinders; 26 t (27 tons)
No Action Alternative	No conversion facility constructed; continued long-term storage of DUF_6 and non-DUF_6 in cylinders at Portsmouth and ETTP.
Assessment period	Through 2039, plus long-term impacts
Construction	None
Cylinder management	Continued surveillance and maintenance activities consistent with current plans and procedures.
Assumed total number of future cylinder breaches:	
Controlled-corrosion case	16 at Portsmouth; 7 at ETTP
Uncontrolled-corrosion case	74 at Portsmouth; 213 at ETTP
Action Alternatives	Build and operate a conversion facility at the Portsmouth site for conversion of the Portsmouth and ETTP DUF_6 inventories; construct a new cylinder storage yard at Portsmouth for ETTP cylinders.
Construction start	2004
Construction period	≈2 years
Start of operations	2006
Operational period	18 years (14 years if ETTP cylinders are converted at Paducah)
Facility footprint	10 acres (4 ha)
Facility throughput	13,500 t/yr (15,000 tons/yr) DUF_6
Conversion products	
Depleted U_3O_8	10,800 t/yr (11,800 tons/yr)
CaF_2	18 t/yr (20 tons/yr)
70% HF acid	2,500 t/yr (2,800 tons/yr)
49% HF acid	5,800 t/yr (6,300 tons/yr)
Steel (empty cylinders, if not used as disposal containers)	1,177 t/yr (1,300 tons/yr)

TABLE S-6 Summary Comparison of Potential Environmental Consequences of the Alternatives[a] (Impacts associated with expanded operations are shown in brackets where they would differ from those presented for the proposed design.)

Environmental Consequence	Proposed Action			No Action	
	Location A (Preferred)	Location B	Location C	at Portsmouth	at ETTP
	Human Health and Safety — Normal Facility Operations				
Radiation exposure					
Construction					
New cylinder yard workers	Potential external radiation exposures (above background); estimated individual worker dose of 30 mrem/yr for either Area 1 or Area 2.	Same as Location A	Same as Location A	NA[b]	NA
Conversion facility workers	<60 mrem/yr over a 2-year construction period (if new cylinder yard is located at Area 1).	Background	Background	NA	NA
Operations					
Involved workers					
Average dose to individual involved workers	Conversion facility: 75 mrem/yr [100 mrem/yr] Cylinder yards: 510–600 mrem/yr [680–800 mrem/yr]	Same as Location A	Same as Location A	600 mrem/yr	410 mrem/yr

TABLE S-6 (Cont.)

Environmental Consequence	Proposed Action: Location A (Preferred)	Proposed Action: Location B	Proposed Action: Location C	No Action: at Portsmouth	No Action: at ETTP
Collective dose to involved workers	Conversion facility: 10 person-rem/yr [10.7 person-rem/yr] Cylinder yards: 3 person-rem/yr [4 person-rem/yr]	Same as Location A	Same as Location A	11.5 person-rem/yr	5 person-rem/yr
Total health effects among involved workers for the life of the project (through 2039 for no action)	1 in 10 chance of 1 latent cancer fatality (LCF)	Same as Location A	Same as Location A	1 in 5 chance of 1 LCF	1 in 12 chance of 1 LCF
Noninvolved workers					
Maximum dose to noninvolved worker maximally exposed individual (MEI)	<5.5 × 10^{-6} mrem/yr [<7.3 × 10^{-6} mrem/yr]	Same as Location A	Same as Location A	0.15 mrem/yr	0.048 mrem/yr
Collective dose to noninvolved workers	<9.9 × 10^{-6} person-rem/yr [<1.3 × 10^{-5} person-rem/yr]	Same as Location A	Same as Location A	0.001 person-rem/yr	0.0005 person-rem/yr
Total health effects among noninvolved workers for the life of the project (through 2039 for no action)	<1 in 1 million chance of 1 LCF	Same as Location A	Same as Location A	<1 in 50,000 chance of 1 LCF	<1 in 100,000 chance of 1 LCF
General public					
Maximum dose to the general public MEI	<2.1 × 10^{-5} mrem/yr [<2.8 × 10^{-5} mrem/yr]	Same as Location A	Same as Location A	<0.1 mrem/yr (during storage) <0.4 mrem/yr (long-term)	<0.2 mrem/yr (during storage) <0.5 mrem/yr (long-term)

TABLE S-6 (Cont.)

Environmental Consequence	Proposed Action: Location A (Preferred)	Proposed Action: Location B	Proposed Action: Location C	No Action: at Portsmouth	No Action: at ETTP
Collective dose to general public within 50 mi (80 km)	6.2×10^{-5} person-rem/yr [8.2×10^{-5} person-rem/yr]	Same as Location A	Same as Location A	0.002 person-rem/yr	0.005 person-rem/yr
Total health effects among members of the public over the life of the project (through 2039 for no action)	<1 in 1 million chance of 1 LCF	Same as Location A	Same as Location A	<1 in 25,000 chance of 1 LCF	<1 in 10,000 chance of 1 LCF
Chemical exposure of concern[c] (concern = hazard index >1)					
Noninvolved worker MEI	Well below levels expected to cause health effects (hazard index <0.1).	Same as Location A	Same as Location A	Well below levels expected to cause health effects (hazard index <0.1).	Well below levels expected to cause health effects (hazard index <0.1).
General public MEI	Well below levels expected to cause health effects (hazard index <0.1).	Same as Location A	Same as Location A	Well below levels expected to cause health effects (hazard index <0.1).	Well below levels expected to cause health effects (hazard index <0.1).
Human Health and Safety — Facility Accidents[d]					
Physical hazards (involved and noninvolved workers)					
Construction: on-the-job fatalities and injuries	Conversion facility: 0 fatalities; 11 injuries Cylinder yards: 0 fatalities; 1 injury	Same as Location A	Same as Location A	NA	NA

TABLE S-6 (Cont.)

Environmental Consequence	Proposed Action: Location A (Preferred)	Proposed Action: Location B	Proposed Action: Location C	No Action: at Portsmouth	No Action: at ETTP
Operations: on-the-job fatalities and injuries	0 fatalities/yr 8 injuries/yr [40 fewer total injuries from reducing processing time by 5 years]	Same as Location A	Same as Location A	0 fatalities/yr; 1 injury/yr	0 fatalities/yr; 0.7 injury/yr
Accidents involving chemical or radiation releases, low frequency-high consequence accidents					
Bounding chemical accidents	Hydrogen fluoride (HF) tank rupture (high for adverse effects); anhydrous ammonia (NH_3) tank rupture (high for irreversible adverse effects).	Same as Location A	Same as Location A	Cylinder ruptures – fire (high for adverse effects); corroded cylinder spill, wet conditions (high for irreversible adverse effects).	Cylinder ruptures – fire (high for adverse effects); corroded cylinder spill, wet conditions (high for irreversible adverse effects).
Release amounts	25,680 lb (11,600 kg) of HF 29,500 lb (13,400 kg) of NH_3	Same as Location A	Same as Location A	24,000 lb (11,000 kg) of DUF_6 (fire); 96 lb (44 kg) of HF (spill, wet conditions)	24,000 lb (11,000 kg) of DUF_6 (fire); 96 lb (44 kg) of HF (spill, wet conditions)
Estimated frequency	<1 time in 1,000,000 years	Same as Location A	Same as Location A	≈1 time in 100,000 years (both accidents)	≈1 time in 100,000 years (both accidents)
Probability – life of the project (through 2039 for no action)	<1 chance in 56,000	Same as Location A	Same as Location A	≈1 in 2,500	≈1 in 2,500

TABLE S-6 (Cont.)

Environmental Consequence	Proposed Action: Location A (Preferred)	Proposed Action: Location B	Proposed Action: Location C	No Action: at Portsmouth	No Action: at ETTP
Consequences (per accident)[e]					
Chemical exposure – public					
Adverse effects	29–2,200 persons	30–2,000 persons	33–2,300 persons	4–680 persons	640 persons
Irreversible adverse effects	2–200 persons	2–210 persons	4–210 persons	0–1 person	0 persons
Fatalities	0–4 persons	0–4 persons	0–4 persons	0 persons	0 persons
Chemical exposure – noninvolved workers[f]					
Adverse effects	580–810 persons	880–1,400 persons	850–1,100 persons	160–1,000 persons	770 persons
Irreversible adverse effects	390–810 persons	370–1,400 persons	50–1,100 persons	0–110 persons	140 persons
Fatalities	0–20 persons	0–30 persons	0–20 persons	0–1 person	0-1 person
Accident risk (consequence × probability)					
General public	0 fatalities	Same as Location A	Same as Location A	0 fatalities	0 fatalities
Noninvolved workers[f]	0 fatalities	Same as Location A	Same as Location A	0 fatalities	0 fatalities
Bounding radiological accident	Earthquake accident damages U_3O_8 storage building containing 6 months' of product	Same as Location A	Same as Location A	Cylinder ruptures – fire	Cylinder ruptures – fire
Release	135 lb (61 kg) of depleted U_3O_8 [180 lb (82 kg) of depleted U_3O_8]	Same as Location A	Same as Location A	24,000 lb (11,000 kg) of UF_6	24,000 lb (11,000 kg) of UF_6
Estimated frequency	≈1 time in 100,000 years	Same as Location A	Same as Location A	≈1 time in 100,000 years	≈1 time in 100,000 years
Probability – life of the project (through 2039 for no action)	≈1 chance in 6,000	Same as Location A	Same as Location A	≈1 chance in 2,500	≈1 chance in 2,500

TABLE S-6 (Cont.)

Environmental Consequence	Proposed Action: Location A (Preferred)	Proposed Action: Location B	Proposed Action: Location C	No Action: at Portsmouth	No Action: at ETTP
Consequences (per accident)					
Radiation exposure – public					
Dose to MEI	1–30 rem [1-40 rem]	Same as Location A	Same as Location A	13 mrem	13 mrem
Risk of LCF	1 chance in 50			7 in 1 million	7 in 1 million
Total dose to population (within 50 mi [80 km])	7–30 person-rem [9–40 person-rem]			34 person-rem	73 person-rem
Total LCFs	1 chance in 50 of 1 LCF [1 chance in 40 of 1 LCF]	Same as Location A	Same as Location A	1 chance in 50 of 1 LCF	1 chance in 30 of 1 LCF
Radiation exposure – noninvolved workers[f]					
Dose to MEI	1–30 rem [1-40 rem]	Same as Location A	Same as Location A	20 mrem	20 mrem
Risk of LCF	1 chance in 50	Same as Location A	Same as Location A	8 in 1 million	8 in 1 million
Total dose to workers	0.2–400 person-rem [0.3–530 person-rem]	0.2–530 person-rem [0.3–710 person-rem]	0.2–430 person-rem [0.3–570 person-rem]	16 person-rem	16 person-rem
Total LCFs	1 chance in 5 of 1 LCF [1 chance in 4 of 1 LCF]	1 chance in 5 of 1 LCF [1 chance in 4 of 1 LCF]	1 chance in 5 of 1 LCF [1 chance in 4 of 1 LCF]	1 chance in 100 of 1 LCF	1 chance in 100 of 1 LCF
Accident risk (consequence × probability)					
General public	0 LCFs	Same as Location A	Same as Location A	0 LCFs	0 LCFs
Noninvolved workers[f]	0 LCFs	Same as Location A	Same as Location A	0 LCFs	0 LCFs

TABLE S-6 (Cont.)

Environmental Consequence	Proposed Action			No Action	
	Location A (Preferred)	Location B	Location C	at Portsmouth	at ETTP
			Human Health and Safety — Transportation		
Transportation impacts during normal operations					
Total fatalities from exposure to vehicle exhaust emissions					
Maximum use of truck	10 (20 if HF is neutralized to calcium fluoride [CaF_2] for disposal)	Same as Location A	Same as Location A	Negligible impacts due to small number of shipments (1 per year) and low concentration of expected contamination.	Negligible impacts due to small number of shipments (1 per year) and low concentration of expected contamination.
Maximum use of rail	<1 (1 including CaF_2)	Same as Location A	Same as Location A	Negligible	Negligible
Total fatalities from exposure to external radiation					
Maximum use of truck	<1	Same as Location A	Same as Location A	Negligible	Negligible
Maximum use of rail	<1	Same as Location A	Same as Location A	Negligible	Negligible
Maximum radiation exposure to a person along a route (MEI)	Negligible (<0.1 mrem)	Same as Location A	Same as Location A	Negligible	Negligible
Traffic accident fatalities (life of project); (physical hazards, unrelated to cargo)					
Maximum use of trucks	1 (2 if HF is neutralized to CaF_2 for disposal)	Same as Location A	Same as Location A	Negligible	Negligible
Maximum use of rail	1 (including CaF_2)	Same as Location A	Same as Location A	Negligible	Negligible

TABLE S-6 (Cont.)

Environmental Consequence	Proposed Action: Location A (Preferred)	Location B	Location C	No Action: at Portsmouth	at ETTP
Traffic accidents involving radiation or chemical releases					
Low frequency-high consequence cylinder accidents					
Bounding accident scenario	Urban rail accident involving DUF_6 cylinders	Same as Location A	Same as Location A	NA	NA
Release	Uranium, HF	Same as Location A	Same as Location A	NA	NA
Probability – life of the project	About 1 chance in 140,000	Same as Location A	Same as Location A	NA	NA
Consequences (per accident)					
Chemical exposure – all workers and members of general public					
Irreversible adverse effects	4	Same as Location A	Same as Location A	NA	NA
Fatalities	0	Same as Location A	Same as Location A	NA	NA
Radiation exposure – all workers and members of general public					
Total LCFs	60	Same as Location A	Same as Location A	NA	NA
Accident risk (consequence × probability) workers and general public	0 fatalities	Same as Location A	Same as Location A	NA	NA
Low frequency-high consequence accidents with all other materials				NA	NA
Bounding accident scenario	Urban rail accident involving anhydrous NH_3	Same as Location A	Same as Location A	NA	NA

TABLE S-6 (Cont.)

Environmental Consequence	Proposed Action: Location A (Preferred)	Location B	Location C	No Action: at Portsmouth	No Action: at ETTP
Release	Anhydrous NH_3	Same as Location A	Same as Location A	NA	NA
Probability – life of the project	About 1 chance in 400,000	Same as Location A	Same as Location A	NA	NA
Consequences (per accident)					
Chemical exposure – all workers and members of general public					NA
Irreversible adverse effects	5,000	Same as Location A	Same as Location A	NA	NA
Fatalities	100	Same as Location A	Same as Location A	NA	NA
Accident risk (consequence × probability)					NA
Irreversible adverse effects	0	Same as Location A	Same as Location A	NA	NA
Fatalities	0	Same as Location A	Same as Location A	NA	NA
Air Quality and Noise					
Pollutant emissions during new cylinder yard construction	Total (modeled plus background) concentrations for particulate matter (PM) with an aerodynamic diameter less than or equal to 2.5 μm ($PM_{2.5}$) would be close to or above standards at the construction site boundary for both candidate areas; construction-related concentrations would be negligible at the nearest residence.	Same as Location A	Same as Location A	NA	NA

TABLE S-6 (Cont.)

	Proposed Action			No Action	
Environmental Consequence	Location A (Preferred)	Location B	Location C	at Portsmouth	at ETTP
Pollutant emissions during conversion facility construction	Total concentrations for PM (PM_{10} and $PM_{2.5}$) would be close to or above standards at the construction site boundary because of high background concentrations; construction-related concentrations would be negligible at the nearest residence. Other criteria pollutants are within standards.	Same as Location A	Same as Location A	NA	NA
Pollutant emissions during conversion facility operations	Total annual-average $PM_{2.5}$ concentration would be above the standard at the site boundary because of high background concentrations; the operations-related concentration would be less than 0.2% of the standard. Other criteria pollutants would be well within standards.	Same as Location A	Same as Location A	Under the controlled cylinder corrosion scenario, the maximum 24-hour HF concentration would be less than 4% of the Kentucky (used for comparison) secondary standard; criteria pollutants would be well within standards.	Under the controlled cylinder corrosion scenario, the maximum 24-hour HF concentration would be less than 23% of the Tennessee primary standard; criteria pollutants would be well within standards.

TABLE S-6 (Cont.)

Environmental Consequence	Proposed Action: Location A (Preferred)	Proposed Action: Location B	Proposed Action: Location C	No Action at Portsmouth	No Action at ETTP
	No concentration increment would exceed applicable prevention of significant deterioration (PSD) increment at the site boundary (Class II area), and all increments would be well below the PSD increment for the nearest Class I area.	Same as Location A	Same as Location A	Under the uncontrolled cylinder corrosion scenario, the maximum 24-hour HF concentration at the site boundary would be up to 28% of the Kentucky (used for comparison) secondary standard.	Under the uncontrolled cylinder corrosion scenario, the maximum HF concentration at the site boundary would be about equal to the Tennessee primary standard (2.9 $\mu g/m^3$) around the year 2020.
Estimated noise levels at the nearest residence	Below the U.S. Environmental Protection Agency (EPA) guideline of 55 dB(A) as day-night average sound level (DNL) during construction and operation.	Same as Location A	Same as Location A	Below the EPA guideline of 55 dB(A) as DNL during operation.	Below the EPA guideline of 55 dB(A) as DNL during operation.
Water and Soil					
Surface water Construction	Negligible impacts from changes to runoff, from floodplains, or from water use and discharge.	Same as Location A	Same as Location A	NA	NA

TABLE S-6 (Cont.)

Environmental Consequence	Proposed Action: Location A (Preferred)	Location B	Location C	No Action: at Portsmouth	at ETTP
Operations	Negligible impacts from water use and discharge.	Same as Location A	Same as Location A	Negligible impacts from water use and discharge.	Negligible impacts from water use and discharge
Groundwater					
Construction	No direct impacts to groundwater recharge, depth, or flow direction; impacts to groundwater quality unlikely.	Same as Location A	Same as Location A	NA	NA
Operations	No direct impacts to groundwater recharge, depth, or flow direction; impacts to groundwater quality unlikely.	Same as Location A	Same as Location A	Under the controlled corrosion case, maximum uranium groundwater concentration (occurring in around 2070) of 5 µg/L, below the guideline of 20 µg/L.[g] Under the uncontrolled corrosion case, cylinder breaches occurring before 2050 could result in groundwater concentrations exceeding the guideline sometime after 2100.	Under the controlled corrosion case, maximum uranium groundwater concentration (occurring in around 2070) of 7 µg/L, below the guideline of 20 µg/L.[g] Under the uncontrolled corrosion case, cylinder breaches occurring before 2025 could result in groundwater concentrations exceeding the guideline sometime after 2100.

TABLE S-6 (Cont.)

Environmental Consequence	Proposed Action: Location A (Preferred)	Proposed Action: Location B	Proposed Action: Location C	No Action: at Portsmouth	No Action: at ETTP
Soils					
Construction	Local and temporary increase in erosion; impacts to soil quality unlikely.	Same as Location A	Same as Location A	NA	NA
Operations	No direct impacts to soil.	Same as Location A	Same as Location A	Negligible impacts to soils.	Negligible impacts to soils.
Socioeconomics					
New cylinder yard construction	Direct employment of 60 people; 150 total jobs in region of influence (ROI); total personal income of $5.6 million; no significant impacts on public services. Less than 1-year duration of impacts.	Same as Location A	Same as Location A	NA	NA

TABLE S-6 (Cont.)

Environmental Consequence	Proposed Action: Location A (Preferred)	Proposed Action: Location B	Proposed Action: Location C	No Action: at Portsmouth	No Action: at ETTP
Conversion facility construction	Direct employment of 190 people in peak year; 280 total jobs in ROI; total personal income of $9 million in peak year; no significant impacts on public services. Two-year duration of impacts.	Same as Location A	Same as Location A	NA	NA
Operations	Direct employment of 160 people; 320 total jobs in ROI; total personal income of $13 million per year of operations; no significant impacts on public services.	Same as Location A	Same as Location A	Direct employment of 20 people; 40 total jobs in ROI; personal income of $1.0 million per year through 2039; no significant impacts on public services.	Direct employment of 30 people; 90 total jobs in ROI; personal income of $4.2 million per year through 2039; no significant impacts on public services.

TABLE S-6 (Cont.)

	Proposed Action			No Action	
Environmental Consequence	Location A (Preferred)	Location B	Location C	at Portsmouth	at ETTP
		Ecology			
Ecological resources (habitat loss, vegetation, wildlife)	Total area disturbed during new cylinder yard construction: 5.5 acres (2.2 ha) – Area 1; 6.3 acres (2.5 ha) – Area 2. Total area disturbed during conversion facility construction: 65 acres (26 ha). Vegetation and wildlife communities impacted and potential loss of habitat; impacts could be minimized by facility placement.	Same as Location A	Same as Location A	Negligible impact to ecological resources; all activities would occur in previously developed areas.	Negligible impact to ecological resources; all activities would occur in previously developed areas.
Concentrations of chemical or radioactive materials	Well below harmful levels; negligible impacts on vegetation and wildlife.	Same as Location A	Same as Location A	Potential for adverse impacts to aquatic biota associated with cylinder yard runoff during painting activities.	Potential for adverse impacts to aquatic biota associated with cylinder yard runoff during painting activities.
Wetlands	Potential direct and indirect impacts to wetlands from facility construction; impacts could be minimized by facility placement.	No direct impacts to wetlands. Possible indirect impacts to nearby wetlands.	Similar to Location B	Negligible impacts	Negligible impacts

TABLE S-6 (Cont.)

Environmental Consequence	Proposed Action: Location A (Preferred)	Proposed Action: Location B	Proposed Action: Location C	No Action: at Portsmouth	No Action: at ETTP
Threatened or endangered species	No direct impacts from construction or operations; destruction of trees with exfoliating bark could indirectly impact the Indiana bat by destroying roosting habitat.	No direct or indirect impacts from construction or operations.	Similar to Location A	Negligible impacts	Negligible impacts
			Waste Management		
Construction	Minimal impacts to site waste management capabilities from construction-generated waste.	Same as Location A	Same as Location A	NA	NA
Operations	Negligible impacts to site management capabilities from low-level radioactive waste (LLW) and hazardous waste generation.	Same as Location A	Same as Location A	No impacts from LLW or low-level radioactive mixed waste (LLMW) generation; both would generate less than 1% of annual site totals for each.	No impacts from LLW or LLMW generation; both would generate less than 1% of annual site totals for each.

TABLE S-6 (Cont.)

Environmental Consequence	Proposed Action: Location A (Preferred)	Proposed Action: Location B	Proposed Action: Location C	No Action: at Portsmouth	No Action: at ETTP
Operations (Cont.)	The U_3O_8 produced would generate about 4,700 yd^3 (3,570 m^3)/yr [6,250 yd^3 (4,750 m^3)/yr] of LLW. This is 5% [7%] of Portsmouth's annual projected volume; low impact on site LLW management. If HF is neutralized to CaF_2, generation of about 3,745 yd^3 (2,860 m^3)/yr [4,980 yd^3 (3,800 m^3)/yr] of CaF_2. Generation of TRU waste is unlikely under current proposals.				

TABLE S-6 (Cont.)

Environmental Consequence	Proposed Action: Location A (Preferred)	Proposed Action: Location B	Proposed Action: Location C	No Action at Portsmouth	No Action at ETTP
			Resource Requirements[h]		
Construction and operations	No effects on local, regional, or national availability of materials required for construction or operations are expected.	Same as Location A	Same as Location A	No effects on local, regional, or national availability of materials are expected.	No effects on local, regional, or national availability of materials are expected.
			Land Use		
Construction and operations	Up to 65 acres (26 ha) would be disturbed for construction of the conversion facility, with 10 acres (4 ha) permanently altered. Up to an additional 6.3 acres (2.5 ha) would be required for construction of a new cylinder yard. The permanently altered areas represent about 1% of available land already developed for industrial purposes, resulting in negligible impacts to land use.	Same as Location A	Same as Location A	No impacts	No impacts

TABLE S-6 (Cont.)

Environmental Consequence	Proposed Action			No Action	
	Location A (Preferred)	Location B	Location C	at Portsmouth	at ETTP
Cultural Resources					
Construction and operations	Impacts to cultural resources are possible; archaeological and architectural surveys have not been finalized and must be completed prior to initiation of the proposed action.	Same as Location A	Same as Location A	Impacts would be unlikely because storage yards are located in previously disturbed areas already dedicated to cylinder storage.	Impacts would be unlikely because storage yards are located in previously disturbed areas already dedicated to cylinder storage.
Environmental Justice					
Construction and operations	No disproportionately high and adverse impacts to minority or low-income populations in the general public during normal operations or from accidents.	Same as Location A	Same as Location A	No disproportionately high and adverse impacts to minority or low-income populations in the general public during normal operations or from accidents.	No disproportionately high and adverse impacts to minority or low-income populations in the general public during normal operations or from accidents.
Conversion of ETTP Cylinders at Portsmouth					
Cylinder preparation					
Location of cylinder preparation activities	ETTP: approximately 5,900 ETTP cylinders prepared for shipment to Portsmouth.	Same as Location A	Same as Location A	NA	NA

TABLE S-6 (Cont.)

	Proposed Action			No Action	
Environmental Consequence	Location A (Preferred)	Location B	Location C	at Portsmouth	at ETTP
Impacts from using cylinder overpacks	No facility construction required; operational impacts limited to external radiation exposure of involved workers; total collective dose to the worker population of 69 to 85 person-rem at ETTP, with no LCFs expected.	Same as Location A	Same as Location A	NA	NA
Impacts from using cylinder transfer facility	Construction of a transfer facility would be required at ETTP. Operational impacts would generally be small and limited primarily to external radiation exposure of involved workers; total collective dose to the worker population of 440 to 480 person-rem at ETTP, with no LCFs expected.	Same as Location A	Same as Location A	NA	NA

TABLE S-6 (Cont.)

	Proposed Action			No Action	
Environmental Consequence	Location A (Preferred)	Location B	Location C	at Portsmouth	at ETTP
Operations if ETTP cylinders are transported to Paducah (option)	If ETTP cylinders were transported to Paducah, the operational period of the Portsmouth conversion plant would be reduced by about 4 years. Annual impacts would be the same, as discussed for each technical discipline. No significant decrease in overall impacts.	Same as Location A	Same as Location A	NA	NA
		Decontamination and Decommissioning			
Activities involved	Disassembly and removal of all radioactive and hazardous components, equipment, and structures, with the objective of completely dismantling the various buildings and achieving greenfield (unrestricted use) conditions.	Same as Location A	Same as Location A	NA	NA

TABLE S-6 (Cont.)

Environmental Consequence	Proposed Action			No Action	
	Location A (Preferred)	Location B	Location C	at Portsmouth	at ETTP
Human health and safety impacts	Decontamination and decommissioning (D&D) impacts primarily limited to external radiation exposure of involved workers; expected exposures would be a small fraction of operational doses; no LCFs expected. No fatalities from occupational accidents expected; up to 5 injuries.	Same as Location A	Same as Location A	NA	NA
Other impacts	Generation of LLW, LLMW, and hazardous waste; approximately 90% of D&D materials generated are expected to be clean.	Same as Location A	Same as Location A	NA	NA
Impacts Associated with Conversion Product Sale					
Products potentially marketed	HF and/or CaF_2	Same as Location A	Same as Location A	NA	NA
Annual Portsmouth production	55% HF solution: 8,200 t/yr [9,000 tons/yr]	Same as Location A	Same as Location A	NA	NA
	CaF_2: 18 t/yr [20 tons/yr]	Same as Location A	Same as Location A	NA	NA

TABLE S-6 (Cont.)

	Proposed Action			No Action	
Environmental Consequence	Location A (Preferred)	Location B	Location C	at Portsmouth	at ETTP
CaF_2 produced if HF is neutralized	8,800 t/yr [9,700 tons/yr]	Same as Location A	Same as Location A	NA	NA
Maximum estimated radiation dose to a worker from HF or CaF_2 use	<1 mrem/yr	Same as Location A	Same as Location A	NA	NA
Potential socioeconomic impacts from use	Negligible socioeconomic impacts	Same as Location A	Same as Location A	NA	NA

[a] Potential environmental impacts are summarized and compared in this table for the no action alternative and the action alternatives. For the action alternatives, impacts are presented for the three alternative locations within the site; annual impacts are based on the assumption of an 18-year operational period. For the no action alternative, annual impacts are based on the assumption of a 40-year operational period.

[b] NA = not applicable.

[c] Chemical exposures for involved workers during normal operations were not estimated; the workplace environment would be monitored to ensure that airborne chemical concentrations were below applicable exposure limits.

[d] On the basis of calculations performed for this EIS, the accidents that are listed in this table have been found to have the highest consequences of all the accidents analyzed. In general, accidents that have lower probabilities have higher consequences.

[e] The ranges in accident impacts reflect differences in the possible atmospheric conditions at the time of the accident.

[f] In addition to noninvolved worker impacts, chemical and radiological exposures for involved workers under accident conditions (workers within 100 m [328 ft] of a release) would depend in part on specific circumstances of the accident. Involved EPA worker fatalities and injuries resulting from the accident initiator or the accident itself are possible.

[g] The guideline concentration used for comparison with estimated surface water and groundwater uranium concentrations is the former proposed EPA maximum concentration limit (MCL) of 20 μg/L; a revised value of 30 μg/L became effective in December 2003. These values are applicable for water "at the tap" of the user and are not directly applicable for surface water or groundwater (no such standard exists). The guideline concentration used for comparison with estimated soil uranium concentrations is a health-based guideline value for residential settings of 230 μg/g.

[h] Resources evaluated include construction materials (e.g., concrete, steel, special coatings), fuel, electricity, process chemicals, and containers (e.g., drums and cylinders).

TABLE 2.4-1 Summary Comparison of Potential Environmental Consequences of the Alternatives[a] (Impacts associated with expanded operations are shown in brackets where they would differ from those presented for the proposed design.)

Environmental Consequence	Proposed Action: Location A (Preferred)	Proposed Action: Location B	Proposed Action: Location C	No Action: at Portsmouth	No Action: at ETTP
	Human Health and Safety — Normal Facility Operations				
Radiation exposure					
Construction					
New cylinder yard workers	Potential external radiation exposures (above background); estimated individual worker dose of 30 mrem/yr for either Area 1 or Area 2.	Same as Location A	Same as Location A	NA[b]	NA
Conversion facility workers	<60 mrem/yr over a 2-year construction period (if new cylinder yard is located at Area 1).	Background	Background	NA	NA
Operations					
Involved workers					
Average dose to individual involved workers	Conversion facility: 75 mrem/yr [100 mrem/yr] Cylinder yards: 510–600 mrem/yr [680–800 mrem/yr]	Same as Location A	Same as Location A	600 mrem/yr	410 mrem/yr

TABLE 2.4-1 (Cont.)

Environmental Consequence	Proposed Action: Location A (Preferred)	Proposed Action: Location B	Proposed Action: Location C	No Action: at Portsmouth	No Action: at ETTP
Collective dose to involved workers	Conversion facility: 10 person-rem/yr [10.7 person-rem/yr] Cylinder yards: 3 person-rem/yr [4 person-rem/yr]	Same as Location A	Same as Location A	11.5 person-rem/yr	5 person-rem/yr
Total health effects among involved workers for the life of the project (through 2039 for no action)	1 in 10 chance of 1 latent cancer fatality (LCF)	Same as Location A	Same as Location A	1 in 5 chance of 1 LCF	1 in 12 chance of 1 LCF
Noninvolved workers					
Maximum dose to noninvolved worker maximally exposed individual (MEI)	$<5.5 \times 10^{-6}$ mrem/yr [$<7.3 \times 10^{-6}$ mrem/yr]	Same as Location A	Same as Location A	0.15 mrem/yr	0.048 mrem/yr
Collective dose to noninvolved workers	$<9.9 \times 10^{-6}$ person-rem/yr [$<1.3 \times 10^{-5}$ person-rem/yr]	Same as Location A	Same as Location A	0.001 person-rem/yr	0.0005 person-rem/yr
Total health effects among noninvolved workers for the life of the project (through 2039 for no action)	<1 in 1 million chance of 1 LCF	Same as Location A	Same as Location A	<1 in 50,000 chance of 1 LCF	<1 in 100,000 chance of 1 LCF
General public					
Maximum dose to the general public MEI	$<2.1 \times 10^{-5}$ mrem/yr [$<2.8 \times 10^{-5}$ mrem/yr]	Same as Location A	Same as Location A	<0.1 mrem/yr (during storage) <0.4 mrem/yr (long-term)	<0.2 mrem/yr (during storage) <0.5 mrem/yr (long-term)

TABLE 2.4-1 (Cont.)

Environmental Consequence	Proposed Action			No Action	
	Location A (Preferred)	Location B	Location C	at Portsmouth	at ETTP
Collective dose to general public within 50 mi (80 km)	6.2×10^{-5} person-rem/yr [8.2×10^{-5} person-rem/yr]	Same as Location A	Same as Location A	0.002 person-rem/yr	0.005 person-rem/yr
Total health effects among members of the public over the life of the project (through 2039 for no action)	<1 in 1 million chance of 1 LCF	Same as Location A	Same as Location A	<1 in 25,000 chance of 1 LCF	<1 in 10,000 chance of 1 LCF
Chemical exposure of concern[c] (concern = hazard index >1)					
Noninvolved worker MEI	Well below levels expected to cause health effects (hazard index <0.1).	Same as Location A	Same as Location A	Well below levels expected to cause health effects (hazard index <0.1).	Well below levels expected to cause health effects (hazard index <0.1).
General public MEI	Well below levels expected to cause health effects (hazard index <0.1).	Same as Location A	Same as Location A	Well below levels expected to cause health effects (hazard index <0.1).	Well below levels expected to cause health effects (hazard index <0.1).
Human Health and Safety — Facility Accidents[d]					
Physical hazards (involved and noninvolved workers)					
Construction: on-the-job fatalities and injuries	Conversion facility: 0 fatalities; 11 injuries Cylinder yards: 0 fatalities; 1 injury	Same as Location A	Same as Location A	NA	NA

TABLE 2.4-1 (Cont.)

Environmental Consequence	Proposed Action: Location A (Preferred)	Proposed Action: Location B	Proposed Action: Location C	No Action: at Portsmouth	No Action: at ETTP
Operations: on-the-job fatalities and injuries	0 fatalities/yr 8 injuries/yr [40 fewer total injuries from reducing processing time by 5 years]	Same as Location A	Same as Location A	0 fatalities/yr; 1 injury/yr	0 fatalities/yr; 0.7 injury/yr
Accidents involving chemical or radiation releases, low frequency-high consequence accidents					
Bounding chemical accidents	Hydrogen fluoride (HF) tank rupture (high for adverse effects); anhydrous ammonia (NH_3) tank rupture (high for irreversible adverse effects).	Same as Location A	Same as Location A	Cylinder ruptures – fire (high for adverse effects); corroded cylinder spill, wet conditions (high for irreversible adverse effects).	Cylinder ruptures – fire (high for adverse effects); corroded cylinder spill, wet conditions (high for irreversible adverse effects).
Release amounts	25,680 lb (11,600 kg) of HF 29,500 lb (13,400 kg) of NH_3	Same as Location A	Same as Location A	24,000 lb (11,000 kg) of DUF_6 (fire); 96 lb (44 kg) of HF (spill, wet conditions)	24,000 lb (11,000 kg) of DUF_6 (fire); 96 lb (44 kg) of HF (spill, wet conditions)
Estimated frequency	<1 time in 1,000,000 years	Same as Location A	Same as Location A	≈1 time in 100,000 years (both accidents)	≈1 time in 100,000 years (both accidents)
Probability – life of the project (through 2039 for no action)	<1 chance in 56,000	Same as Location A	Same as Location A	≈1 in 2,500	≈1 in 2,500

TABLE 2.4-1 (Cont.)

Environmental Consequence	Proposed Action: Location A (Preferred)	Proposed Action: Location B	Proposed Action: Location C	No Action: at Portsmouth	No Action: at ETTP
Consequences (per accident)[e]					
Chemical exposure – public					
Adverse effects	29–2,200 persons	30–2,000 persons	33–2,300 persons	4–680 persons	640 persons
Irreversible adverse effects	2–200 persons	2–210 persons	4–210 persons	0–1 person	0 persons
Fatalities	0–4 persons	0–4 persons	0–4 persons	0 persons	0 persons
Chemical exposure – noninvolved workers[f]					
Adverse effects	580–810 persons	880–1,400 persons	850–1,100 persons	160–1,000 persons	770 persons
Irreversible adverse effects	390–810 persons	370–1,400 persons	50–1,100 persons	0–110 persons	140 persons
Fatalities	0–20 persons	0–30 persons	0–20 persons	0–1 person	0-1 person
Accident risk (consequence × probability)					
General public	0 fatalities	Same as Location A	Same as Location A	0 fatalities	0 fatalities
Noninvolved workers[f]	0 fatalities	Same as Location A	Same as Location A	0 fatalities	0 fatalities
Bounding radiological accident	Earthquake accident damages U_3O_8 storage building containing 6 months' of product	Same as Location A	Same as Location A	Cylinder ruptures – fire	Cylinder ruptures – fire
Release	135 lb (61 kg) of depleted U_3O_8 [180 lb (82 kg) of depleted U_3O_8]	Same as Location A	Same as Location A	24,000 lb (11,000 kg) of UF_6	24,000 lb (11,000 kg) of UF_6
Estimated frequency	≈1 time in 100,000 years	Same as Location A	Same as Location A	≈1 time in 100,000 years	≈1 time in 100,000 years
Probability – life of the project (through 2039 for no action)	≈1 chance in 6,000	Same as Location A	Same as Location A	≈1 chance in 2,500	≈1 chance in 2,500

TABLE 2.4-1 (Cont.)

	Proposed Action			No Action	
Environmental Consequence	Location A (Preferred)	Location B	Location C	at Portsmouth	at ETTP
Consequences (per accident)					
Radiation exposure – public					
Dose to MEI	1–30 rem [1-40 rem]	Same as Location A	Same as Location A	13 mrem	13 mrem
Risk of LCF	1 chance in 50			7 in 1 million	7 in 1 million
Total dose to population (within 50 mi [80 km])	7–30 person-rem [9–40 person-rem]			34 person-rem	73 person-rem
Total LCFs	1 chance in 50 of 1 LCF [1 chance in 40 of 1 LCF]	Same as Location A	Same as Location A	1 chance in 50 of 1 LCF	1 chance in 30 of 1 LCF
Radiation exposure – noninvolved workers[f]					
Dose to MEI	1–30 rem [1-40 rem]	Same as Location A	Same as Location A	20 mrem	20 mrem
Risk of LCF	1 chance in 50	Same as Location A	Same as Location A	8 in 1 million	8 in 1 million
Total dose to workers	0.2–400 person-rem [0.3–530 person-rem]	0.2–530 person-rem [0.3–710 person-rem]	0.2–430 person-rem [0.3–570 person-rem]	16 person-rem	16 person-rem
Total LCFs	1 chance in 5 of 1 LCF [1 chance in 4 of 1 LCF]	1 chance in 5 of 1 LCF [1 chance in 4 of 1 LCF]	1 chance in 5 of 1 LCF [1 chance in 4 of 1 LCF]	1 chance in 100 of 1 LCF	1 chance in 100 of 1 LCF
Accident risk (consequence × probability)					
General public	0 LCFs	Same as Location A	Same as Location A	0 LCFs	0 LCFs
Noninvolved workers[f]	0 LCFs	Same as Location A	Same as Location A	0 LCFs	0 LCFs

TABLE 2.4-1 (Cont.)

Environmental Consequence	Proposed Action: Location A (Preferred)	Proposed Action: Location B	Proposed Action: Location C	No Action at Portsmouth	No Action at ETTP
		Human Health and Safety — Transportation			
Transportation impacts during normal operations					
Total fatalities from exposure to vehicle exhaust emissions					
Maximum use of truck	10 (20if HF is neutralized to calcium fluoride [CaF_2] for disposal)	Same as Location A	Same as Location A	Negligible impacts due to small number of shipments (1 per year) and low concentration of expected contamination.	Negligible impacts due to small number of shipments (1 per year) and low concentration of expected contamination.
Maximum use of rail	<1 (1 including CaF_2)	Same as Location A	Same as Location A	Negligible	Negligible
Total fatalities from exposure to external radiation					
Maximum use of truck	<1	Same as Location A	Same as Location A	Negligible	Negligible
Maximum use of rail	<1	Same as Location A	Same as Location A	Negligible	Negligible
Maximum radiation exposure to a person along a route (MEI)	Negligible (<0.1 mrem)	Same as Location A	Same as Location A	Negligible	Negligible
Traffic accident fatalities (life of project); (physical hazards, unrelated to cargo)					
Maximum use of trucks	1 (2 if HF is neutralized to CaF_2 for disposal)	Same as Location A	Same as Location A	Negligible	Negligible
Maximum use of rail	1 (including CaF_2)	Same as Location A	Same as Location A	Negligible	Negligible

TABLE 2.4-1 (Cont.)

	Proposed Action			No Action	
Environmental Consequence	Location A (Preferred)	Location B	Location C	at Portsmouth	at ETTP
Traffic accidents involving radiation or chemical releases					
Low frequency-high consequence cylinder accidents					
Bounding accident scenario	Urban rail accident involving DUF_6 cylinders	Same as Location A	Same as Location A	NA	NA
Release	Uranium, HF	Same as Location A	Same as Location A	NA	NA
Probability – life of the project	About 1 chance in 140,000	Same as Location A	Same as Location A	NA	NA
Consequences (per accident)					
Chemical exposure – all workers and members of general public					
Irreversible adverse effects	4	Same as Location A	Same as Location A	NA	NA
Fatalities	0	Same as Location A	Same as Location A	NA	NA
Radiation exposure – all workers and members of general public					
Total LCFs	60	Same as Location A	Same as Location A	NA	NA
Accident risk (consequence × probability) workers and general public	0 fatalities	Same as Location A	Same as Location A	NA	NA
Low frequency-high consequence accidents with all other materials				NA	NA
Bounding accident scenario	Urban rail accident involving anhydrous NH_3	Same as Location A	Same as Location A	NA	NA

TABLE 2.4-1 (Cont.)

Environmental Consequence	Proposed Action: Location A (Preferred)	Proposed Action: Location B	Proposed Action: Location C	No Action at Portsmouth	No Action at ETTP
Release	Anhydrous NH_3	Same as Location A	Same as Location A	NA	NA
Probability – life of the project	About 1 chance in 400,000	Same as Location A	Same as Location A	NA	NA
Consequences (per accident)					
Chemical exposure – all workers and members of general public					NA
Irreversible adverse effects	5,000	Same as Location A	Same as Location A	NA	NA
Fatalities	100	Same as Location A	Same as Location A	NA	NA
Accident risk (consequence × probability)					NA
Irreversible adverse effects	0	Same as Location A	Same as Location A	NA	NA
Fatalities	0	Same as Location A	Same as Location A	NA	NA
Air Quality and Noise					
Pollutant emissions during new cylinder yard construction	Total (modeled plus background) concentrations for particulate matter (PM) with an aerodynamic diameter less than or equal to 2.5 µm ($PM_{2.5}$) would be close to or above standards at the construction site boundary for both candidate areas; construction-related concentrations would be negligible at the nearest residence.	Same as Location A	Same as Location A	NA	NA

TABLE 2.4-1 (Cont.)

	Proposed Action			No Action	
Environmental Consequence	Location A (Preferred)	Location B	Location C	at Portsmouth	at ETTP
Pollutant emissions during conversion facility construction	Total concentrations for PM (PM_{10} and $PM_{2.5}$) would be close to or above standards at the construction site boundary because of high background concentrations; construction-related concentrations would be negligible at the nearest residence. Other criteria pollutants are within standards.	Same as Location A	Same as Location A	NA	NA
Pollutant emissions during conversion facility operations	Total annual-average $PM_{2.5}$ concentration would be above the standard at the site boundary because of high background concentrations; the operations-related concentration would be less than 0.2% of the standard. Other criteria pollutants would be well within standards.	Same as Location A	Same as Location A	Under the controlled cylinder corrosion scenario, the maximum 24-hour HF concentration would be less than 4% of the Kentucky (used for comparison) secondary standard; criteria pollutants would be well within standards.	Under the controlled cylinder corrosion scenario, the maximum 24-hour HF concentration would be less than 23% of the Tennessee primary standard; criteria pollutants would be well within standards.

TABLE 2.4-1 (Cont.)

Environmental Consequence	Proposed Action: Location A (Preferred)	Proposed Action: Location B	Proposed Action: Location C	No Action: at Portsmouth	No Action: at ETTP
	No concentration increment would exceed applicable prevention of significant deterioration (PSD) increment at the site boundary (Class II area), and all increments would be well below the PSD increment for the nearest Class I area.	Same as Location A	Same as Location A	Under the uncontrolled cylinder corrosion scenario, the maximum 24-hour HF concentration at the site boundary would be up to 28% of the Kentucky (used for comparison) secondary standard.	Under the uncontrolled cylinder corrosion scenario, the maximum HF concentration at the site boundary would be about equal to the Tennessee primary standard (2.9 $\mu g/m^3$) around the year 2020.
Estimated noise levels at the nearest residence	Below the U.S. Environmental Protection Agency (EPA) guideline of 55 dB(A) as day-night average sound level (DNL) during construction and operation.	Same as Location A	Same as Location A	Below the EPA guideline of 55 dB(A) as DNL during operation.	Below the EPA guideline of 55 dB(A) as DNL during operation.
			Water and Soil		
Surface water					
Construction	Negligible impacts from changes to runoff, from floodplains, or from water use and discharge.	Same as Location A	Same as Location A	NA	NA

TABLE 2.4-1 (Cont.)

	Proposed Action			No Action	
Environmental Consequence	Location A (Preferred)	Location B	Location C	at Portsmouth	at ETTP
Operations	Negligible impacts from water use and discharge.	Same as Location A	Same as Location A	Negligible impacts from water use and discharge.	Negligible impacts from water use and discharge
Groundwater					
Construction	No direct impacts to groundwater recharge, depth, or flow direction; impacts to groundwater quality unlikely.	Same as Location A	Same as Location A	NA	NA
Operations	No direct impacts to groundwater recharge, depth, or flow direction; impacts to groundwater quality unlikely.	Same as Location A	Same as Location A	Under the controlled corrosion case, maximum uranium groundwater concentration (occurring in around 2070) of 5 μg/L, below the guideline of 20 μg/L.[g] Under the uncontrolled corrosion case, cylinder breaches occurring before 2050 could result in groundwater concentrations exceeding the guideline sometime after 2100.	Under the controlled corrosion case, maximum uranium groundwater concentration (occurring in around 2070) of 7 μg/L, below the guideline of 20 μg/L.[g] Under the uncontrolled corrosion case, cylinder breaches occurring before 2025 could result in groundwater concentrations exceeding the guideline sometime after 2100.

TABLE 2.4-1 (Cont.)

	Proposed Action			No Action	
Environmental Consequence	Location A (Preferred)	Location B	Location C	at Portsmouth	at ETTP
Soils					
Construction	Local and temporary increase in erosion; impacts to soil quality unlikely.	Same as Location A	Same as Location A	NA	NA
Operations	No direct impacts to soil.	Same as Location A	Same as Location A	Negligible impacts to soils.	Negligible impacts to soils.
		Socioeconomics			
New cylinder yard construction	Direct employment of 60 people; 150 total jobs in region of influence (ROI); total personal income of $5.6 million; no significant impacts on public services. Less than 1-year duration of impacts.	Same as Location A	Same as Location A	NA	NA

TABLE 2.4-1 (Cont.)

Environmental Consequence	Proposed Action: Location A (Preferred)	Proposed Action: Location B	Proposed Action: Location C	No Action: at Portsmouth	No Action: at ETTP
Conversion facility construction	Direct employment of 190 people in peak year; 280total jobs in ROI; total personal income of $9 million in peak year; no significant impacts on public services. Two-year duration of impacts.	Same as Location A	Same as Location A	NA	NA
Operations	Direct employment of 160 people; 320 total jobs in ROI; total personal income of $13 million per year of operations; no significant impacts on public services.	Same as Location A	Same as Location A	Direct employment of 20 people; 40 total jobs in ROI; personal income of $1.0 million per year through 2039; no significant impacts on public services.	Direct employment of 30 people; 90 total jobs in ROI; personal income of $4.2 million per year through 2039; no significant impacts on public services.

TABLE 2.4-1 (Cont.)

Environmental Consequence	Proposed Action			No Action	
	Location A (Preferred)	Location B	Location C	at Portsmouth	at ETTP
		Ecology			
Ecological resources (habitat loss, vegetation, wildlife)	Total area disturbed during new cylinder yard construction: 5.5 acres (2.2 ha) – Area 1; 6.3 acres (2.5 ha) – Area 2. Total area disturbed during conversion facility construction: 65 acres (26 ha). Vegetation and wildlife communities impacted and potential loss of habitat; impacts could be minimized by facility placement.	Same as Location A	Same as Location A	Negligible impact to ecological resources; all activities would occur in previously developed areas.	Negligible impact to ecological resources; all activities would occur in previously developed areas.
Concentrations of chemical or radioactive materials	Well below harmful levels; negligible impacts on vegetation and wildlife.	Same as Location A	Same as Location A	Potential for adverse impacts to aquatic biota associated with cylinder yard runoff during painting activities.	Potential for adverse impacts to aquatic biota associated with cylinder yard runoff during painting activities.
Wetlands	Potential direct and indirect impacts to wetlands from facility construction; impacts could be minimized by facility placement.	No direct impacts to wetlands. Possible indirect impacts to nearby wetlands.	Similar to Location B	Negligible impacts	Negligible impacts

TABLE 2.4-1 (Cont.)

Environmental Consequence	Proposed Action			No Action	
	Location A (Preferred)	Location B	Location C	at Portsmouth	at ETTP
Threatened or endangered species	No direct impacts from construction or operations; destruction of trees with exfoliating bark could indirectly impact the Indiana bat by destroying roosting habitat.	No direct or indirect impacts from construction or operations.	Similar to Location A	Negligible impacts	Negligible impacts
Waste Management					
Construction	Minimal impacts to site waste management capabilities from construction-generated waste.	Same as Location A	Same as Location A	NA	NA
Operations	Negligible impacts to site management capabilities from low-level radioactive waste (LLW) and hazardous waste generation.	Same as Location A	Same as Location A	No impacts from LLW or low-level radioactive mixed waste (LLMW) generation; both would generate less than 1% of annual site totals for each.	No impacts from LLW or LLMW generation; both would generate less than 1% of annual site totals for each.

TABLE 2.4-1 (Cont.)

	Proposed Action			No Action	
Environmental Consequence	Location A (Preferred)	Location B	Location C	at Portsmouth	at ETTP
Operations (Cont.)	The triuranium octaoxide (U_3O_8) produced would generate about 4,700 yd^3 (3,570 m^3)/yr [6,250 yd^3 (4,750 m^3)/yr] of LLW. This is 5% [7%] of Portsmouth's annual projected volume; low impact on site LLW management. If HF is neutralized to CaF_2, generation of about 3,745 yd^3 (2,860 m^3)/yr [4,980 yd^3 (3,800 m^3)/yr] of CaF_2. Generation of TRU waste is unlikely under current proposals.				

TABLE 2.4-1 (Cont.)

Environmental Consequence	Proposed Action: Location A (Preferred)	Proposed Action: Location B	Proposed Action: Location C	No Action: at Portsmouth	No Action: at ETTP
		Resource Requirements[h]			
Construction and operations	No effects on local, regional, or national availability of materials required for construction or operations are expected.	Same as Location A	Same as Location A	No effects on local, regional, or national availability of materials are expected.	No effects on local, regional, or national availability of materials are expected.
		Land Use			
Construction and operations	Up to 65 acres (26 ha) would be disturbed for construction of the conversion facility, with 10 acres (4 ha) permanently altered. Up to an additional 6.3 acres (2.5 ha) would be required for construction of a new cylinder yard. The permanently altered areas represent about 1% of available land already developed for industrial purposes, resulting in negligible impacts to land use.	Same as Location A	Same as Location A	No impacts	No impacts

TABLE 2.4-1 (Cont.)

Environmental Consequence	Proposed Action: Location A (Preferred)	Proposed Action: Location B	Proposed Action: Location C	No Action: at Portsmouth	No Action: at ETTP
			Cultural Resources		
Construction and operations	Impacts to cultural resources are possible; archaeological and architectural surveys have not been finalized and must be completed prior to initiation of the proposed action.	Same as Location A	Same as Location A	Impacts would be unlikely because storage yards are located in previously disturbed areas already dedicated to cylinder storage.	Impacts would be unlikely because storage yards are located in previously disturbed areas already dedicated to cylinder storage.
			Environmental Justice		
Construction and operations	No disproportionately high and adverse impacts to minority or low-income populations in the general public during normal operations or from accidents.	Same as Location A	Same as Location A	No disproportionately high and adverse impacts to minority or low-income populations in the general public during normal operations or from accidents.	No disproportionately high and adverse impacts to minority or low-income populations in the general public during normal operations or from accidents.
			Conversion of ETTP Cylinders at Portsmouth		
Cylinder preparation					
Location of cylinder preparation activities	ETTP: approximately 5,900 ETTP cylinders prepared for shipment to Portsmouth.	Same as Location A	Same as Location A	NA	NA

TABLE 2.4-1 (Cont.)

Environmental Consequence	Proposed Action: Location A (Preferred)	Proposed Action: Location B	Proposed Action: Location C	No Action: at Portsmouth	No Action: at ETTP
Impacts from using cylinder overpacks	No facility construction required; operational impacts limited to external radiation exposure of involved workers; total collective dose to the worker population of 69 to 85 person-rem at ETTP, with no LCFs expected.	Same as Location A	Same as Location A	NA	NA
Impacts from using cylinder transfer facility	Construction of a transfer facility would be required at ETTP. Operational impacts would generally be small and limited primarily to external radiation exposure of involved workers; total collective dose to the worker population of 440 to 480 person-rem at ETTP, with no LCFs expected.	Same as Location A	Same as Location A	NA	NA

TABLE 2.4-1 (Cont.)

	Proposed Action			No Action	
Environmental Consequence	Location A (Preferred)	Location B	Location C	at Portsmouth	at ETTP
Operations if ETTP cylinders are transported to Paducah (option)	If ETTP cylinders were transported to Paducah, the operational period of the Portsmouth conversion plant would be reduced by about 4 years. Annual impacts would be the same, as discussed for each technical discipline. No significant decrease in overall impacts.	Same as Location A	Same as Location A	NA	NA
Decontamination and Decommissioning					
Activities involved	Disassembly and removal of all radioactive and hazardous components, equipment, and structures, with the objective of completely dismantling the various buildings and achieving greenfield (unrestricted use) conditions.	Same as Location A	Same as Location A	NA	NA

TABLE 2.4-1 (Cont.)

Environmental Consequence	Proposed Action: Location A (Preferred)	Proposed Action: Location B	Proposed Action: Location C	No Action: at Portsmouth	No Action: at ETTP
Human health and safety impacts	Decontamination and decommissioning (D&D) impacts primarily limited to external radiation exposure of involved workers; expected exposures would be a small fraction of operational doses; no LCFs expected. No fatalities from occupational accidents expected; up to 5 injuries.	Same as Location A	Same as Location A	NA	NA
Other impacts	Generation of LLW, LLMW, and hazardous waste; approximately 90% of D&D materials generated are expected to be clean.	Same as Location A	Same as Location A	NA	NA
Impacts Associated with Conversion Product Sale					
Products potentially marketed	HF and/or CaF_2	Same as Location A	Same as Location A	NA	NA
Annual Portsmouth production	55% HF solution: 8,200 t/yr [9,000 tons/yr]	Same as Location A	Same as Location A	NA	NA
	CaF_2: 18 t/yr [20 tons/yr]	Same as Location A	Same as Location A	NA	NA

TABLE 2.4-1 (Cont.)

	Proposed Action			No Action	
Environmental Consequence	Location A (Preferred)	Location B	Location C	at Portsmouth	at ETTP
CaF_2 produced if HF is neutralized	8,800 t/yr [9,700 tons/yr]	Same as Location A	Same as Location A	NA	NA
Maximum estimated radiation dose to a worker from HF or CaF_2 use	<1 mrem/yr	Same as Location A	Same as Location A	NA	NA
Potential socioeconomic impacts from use	Negligible socioeconomic impacts	Same as Location A	Same as Location A	NA	NA

[a] Potential environmental impacts are summarized and compared in this table for the no action alternative and the action alternatives. For the action alternatives, impacts are presented for the three alternative locations within the site; annual impacts are based on the assumption of an 18-year operational period. For the no action alternative, annual impacts are based on the assumption of a 40-year operational period.

[b] NA = not applicable.

[c] Chemical exposures for involved workers during normal operations were not estimated; the workplace environment would be monitored to ensure that airborne chemical concentrations were below applicable exposure limits.

[d] On the basis of calculations performed for this EIS, the accidents that are listed in this table have been found to have the highest consequences of all the accidents analyzed. In general, accidents that have lower probabilities have higher consequences.

[e] The ranges in accident impacts reflect differences in the possible atmospheric conditions at the time of the accident.

[f] In addition to noninvolved worker impacts, chemical and radiological exposures for involved workers under accident conditions (workers within 100 m [328 ft] of a release) would depend in part on specific circumstances of the accident. Involved EPA worker fatalities and injuries resulting from the accident initiator or the accident itself are possible.

[g] The guideline concentration used for comparison with estimated surface water and groundwater uranium concentrations is the former proposed EPA maximum concentration limit (MCL) of 20 µg/L; a revised value of 30 µg/L became effective in December 2003. These values are applicable for water "at the tap" of the user and are not directly applicable for surface water or groundwater (no such standard exists). The guideline concentration used for comparison with estimated soil uranium concentrations is a health-based guideline value for residential settings of 230 µg/g.

[h] Resources evaluated include construction materials (e.g., concrete, steel, special coatings), fuel, electricity, process chemicals, and containers (e.g., drums and cylinders).

TABLE 3.1-3 National Ambient Air Quality Standards, Ohio State Ambient Air Quality Standards, Maximum Allowable Increments for Prevention of Significant Deterioration, and Highest Background Levels Representative of the Portsmouth Gaseous Diffusion Plant

		NAAQS/SAAQS[b]		PSD Increment[d] (µg/m³)		Highest Background Level	
Pollutant[a]	Averaging Time	Value	Type[c]	Class I	Class II	Concentration[e]	Location (Year)
SO_2	3 hours	0.50 ppm (1,300 µg/m³)	S	25	512	0.118 ppm (24%)	Portsmouth (1999)
	24 hours	0.14 ppm (365 µg/m³)	P	5	91	0.042 ppm (30%)	Portsmouth (1999)
	Annual	0.03 ppm (80 µg/m³)	P	2	20	0.007 ppm (23%)	Portsmouth (2001)
NO_2	Annual	0.053 ppm (100 µg/m³)	P, S	2.5	25	0.029 ppm (55%)	Cincinnati (1999)
CO	1 hour	35 ppm (40 mg/m³)	P	–[f]	–	11.7 ppm (33%)	Columbus (1999)
	8 hours	9 ppm (10 mg/m³)	P	–	–	4.3 ppm (48%)	Columbus (1998)
O_3	1 hour	0.12 ppm (235 µg/m³)	P, S	–	–	0.136 ppm (113%)[g]	Lawrence County (1998)
	8 hours	0.08 ppm (157 µg/m³)	P, S	–	–	0.101 ppm (126%)[h]	Lawrence County (1998)
PM_{10}	24 hours	150 µg/m³	P, S	8	30	64 µg/m³ (43%)[g]	Portsmouth (1999)
	Annual	50 µg/m³	P, S	4	17	32 µg/m³ (64%)	Portsmouth (1999)
$PM_{2.5}$	24 hours	65 µg/m³	P, S	–	–	57.5 µg/m³ (88%)[g]	Portsmouth (2001)
	Annual	15 µg/m³	P, S	–	–	24.1 µg/m³ (161%)	Portsmouth (1999)
Pb	Calendar quarter	1.5 µg/m³	P, S	–	–	0.05 µg/m³ (3%)	Columbus (1999)

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TABLE 3.1-3 (Cont.)

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[a] CO = carbon monoxide; NO_2 = nitrogen dioxide; O_3 = ozone; Pb = lead; $PM_{2.5}$ = particulate matter ≤2.5 µm; PM_{10} = particulate matter ≤10 µm; and SO_2 = sulfur dioxide.

[b] The SO_2 (3-hour and 24-hour) and CO standards are attained when the stated value is not exceeded more than once per year. The SO_2 (annual), NO_2, and Pb standards are attained when the stated value is not exceeded. The O_3 (1-hour) standard is attained when the stated value is not exceeded more than three times in 3 years. The O_3 (8-hour) standard is attained when the 3-year average of the annual fourth-highest daily maximum 8-hour average concentration does not exceed the stated value. The PM_{10} (annual) and $PM_{2.5}$ (annual) standards are attained when the 3-year average of the annual arithmetic means does not exceed the stated value. The PM_{10} (24-hour) standard is attained when the 3-year average of the 99th percentile values does not exceed the stated value. The $PM_{2.5}$ (24-hour) standard is attained when the 3-year average of the annual 98th percentile values does not exceed the stated value.

[c] P = primary standard whose limits were set to protect public health; S = secondary standard whose limits were set to protect public welfare.

[d] Class I areas are specifically designated areas in which degradation of air quality is severely restricted under the Clean Air Act; Class II areas have a somewhat less stringent set of allowable emissions.

[e] Values in parentheses are monitored concentrations as a percentage of NAAQS or SAAQS.

[f] A dash indicates that no standard exists.

[g] Second-highest value.

[h] Fourth-highest value.

Sources: 40 CFR 50; OEPA (2002); 40 CFR 52.21; EPA (2003b).

TABLE 3.1-5 Estimated Radiation Doses to Members of the General Public and Cylinder Yard Workers at the Portsmouth Gaseous Diffusion Plant

Receptor	Radiation Source	Dose to Individual (mrem/yr)
Member of the general public (MEI)[a]	Routine site operations	
	Airborne radionuclides	0.060[b]
	Waterborne radionuclides	0.039[c]
	Direct gamma radiation	0.98[d]
	Ingestion	0.88[e]
Cylinder yard worker	External radiation	64[f]
On-site monitored employee	External radiation	1.85[g]
Member of the public or worker	Natural background radiation around the Portsmouth site	78[h]
DOE worker limit		2,000[i]

[a] The MEI is assumed to reside at an off-site location or undertake specific activities that would yield the largest dose. An average person would receive a radiation dose much less than the values shown in this table.

[b] Radiation doses from airborne releases were estimated on the basis of air concentrations calculated by an air dispersion model. For the total dose of 0.060 mrem/yr, 0.014 mrem/yr was contributed by DOE sources, and 0.046 mrem/yr was contributed by USEC sources. The radiation dose calculated from the maximum measured ambient air concentrations was approximately 0.3% of the estimated value (DOE 2002b,c).

[c] The MEI is assumed to drink water and ingest fish caught from the Scioto River. The MEI is also assumed to swim and boat in the river and use the shoreline for recreational activities (DOE 2002c). This is a very conservative assumption because actually, the Scioto River is not used for drinking water downstream of the Portsmouth facility.

[d] Radiation exposure is assumed to be incurred by a person driving slowly on Perimeter Road and passing close to the edge of the cylinder yards 2 times a day for 185 days per year. The radiation dose was estimated by using the direct radiation monitoring data taken at the cylinder yards. Radiation levels at the accessible point would be much lower (DOE 2002b). Because Perimeter Road was closed to the public after September 11, 2001, 185 days was used in the calculation rather than the previously used 260 days.

[e] Radiation doses would result from ingestion of sediment, soil, locally produced vegetation and crops, deer, and fish. They were calculated by using detected concentrations of radionuclides in different media at different locations (DOE 2002c).

[f] Average dose from monitoring data in year 2001 (DOE 2002b).

[g] Average dose from monitoring data (DOE 2002b). If cylinder yard workers were excluded, the average for the rest of the employees would be 0.84 mrem/yr.

[h] Average dose from natural background radiation; 50 mrem/yr cosmic radiation and 28 mrem/yr terrestrial radiation (DOE 2002c).

[i] DOE administrative procedures limit DOE workers to 2,000 mrem/yr (DOE 1992), whereas the regulatory dose limit for radiation workers is 5,000 mrem/yr (10 CFR Part 835).

TABLE 3.1-6 Estimated Hazard Quotients for Members of the General Public near the Portsmouth Site under Existing Environmental Conditions[a]

Environmental Medium	Parameter	Assumed Exposure Concentration	Estimated Chronic Intake (mg/kg-d)	Reference Level[b] (mg/kg-d)	Hazard Quotient[c]
Air[d]	Uranium	0.0013 μg/m^3	3.7×10^{-7}	0.0003	0.0012
	HF	0.094 μg/m^3	2.7×10^{-5}	0.02	0.0013
Soil[e]	Uranium	6.8 mg/kg	9.1×10^{-5}	0.003	0.030
Surface water[f]	Uranium	5.7 μg/L	3.1×10^{-6}	0.003	0.0010
	Fluoride	400 μg/L	2.2×10^{-4}	0.06	0.0037
Sediment[f]	Uranium	5.6 mg/kg	1.5×10^{-6}	0.003	0.0005
Groundwater[g]	Uranium	27.5 μg/L	7.9×10^{-4}	0.003	0.26

a The receptor is assumed to be a long-term resident near the site boundary or another off-site monitoring location that would have the highest concentration of the contaminant being addressed; reasonable maximum exposure conditions were assumed. Only the exposure pathway contributing the most to intake levels was considered (i.e., inhalation for air and ingestion for soil, sediment, surface water, and groundwater). Residential exposure scenarios were assumed for air, soil, and groundwater analyses; recreational exposure scenarios were assumed for surface water and sediment analyses.

b The reference level is an estimate of the daily human exposure level that is likely to be without an appreciable risk of deleterious effects. The reference levels used in this assessment are defined in Appendix F.

c The hazard quotient is the ratio of the intake of the human receptor to the reference level. A hazard quotient of less than 1 indicates that adverse health effects resulting from exposure to that chemical alone are unlikely.

d Maximum concentrations from among property-line and farther off-site sampling locations were used for assessment of general public exposures. Fluoride was reported, which was used as a surrogate for HF. Air exposure concentrations are the maximum annual average reported for all property-line and off-site monitoring locations (DOE 2002c,d). Sample numbers: 12 per location for uranium; 52 per location for fluoride.

e The soil exposure concentration is the maximum value from 31 property-line and off-site sampling locations (DOE 2002d). Sample numbers: 2 per location.

f Surface water and sediment exposure concentrations are the maximum annual averages reported for all NPDES outfall locations and other off-site monitoring locations, including cylinder yard runoff locations (DOE 2002c,d).

g Groundwater exposure concentration is the upper-end concentration reported for all on-site monitoring wells in 2000 (DOE 2001e). These wells are not used for drinking water. Several additional substances exceeded drinking water standards or guidelines in 2000; only uranium is listed here because it is of particular interest for this EIS. Specific concentrations were not available but were stated to be similar to 2000 concentrations (DOE 2002d). Fluoride concentrations were not available.

TABLE 3.2-3 National Ambient Air Quality Standards, Tennessee State Ambient Air Quality Standards, Maximum Allowable Increments for Prevention of Significant Deterioration, and Highest Background Levels Representative of the ETTP Site

		NAAQS/SAAQS[b]		PSD Increments[d] ($\mu g/m^3$)		Highest Background Level	
Pollutant[a]	Averaging Time	Value	Type[c]	Class I	Class II	Concentration[e]	Location (Year)
SO_2	3 hours	0.50 ppm (1,300 $\mu g/m^3$)	S	25	512	0.109 ppm (22%)	Rockwood (1998)
	24 hours	0.14 ppm (365 $\mu g/m^3$)	P	5	91	0.031 ppm (22%)	Rockwood (2001)
	Annual	0.03 ppm (80 $\mu g/m^3$)	P	2	20	0.003 ppm (10%)	Oak Ridge (2000)
NO_2	Annual	0.053 ppm (100 $\mu g/m^3$)	P, S	2.5	25	0.008 ppm (15%)	Oak Ridge (2000)
CO[f]	1 hour	35 ppm (40 mg/m^3)	P, S	–[g]	–	11.1 ppm (32%)	Knoxville (1999)
	8 hours	9 ppm (10 mg/m^3)	P, S	–	–	4.9 ppm (54%)	Knoxville (1997)
O_3	1 hour	0.12 ppm (235 $\mu g/m^3$)	P, S	–	–	0.116 ppm (97%)[h]	Oak Ridge (1999)
	8 hours	0.08 ppm (157 $\mu g/m^3$)	P, S	–	–	0.099 ppm (124%)[i]	Anderson County (2002)
PM_{10}	24 hours	150 $\mu g/m^3$	P, S	8	30	69.9 $\mu g/m^3$ (47%)	ETTP (2000)
	Annual	50 $\mu g/m^3$	P, S	4	17	23.2 $\mu g/m^3$ (46%)	ETTP (2000)
$PM_{2.5}$	24 hours	65 $\mu g/m^3$	P, S	–	–	50.4 $\mu g/m^3$ (78%)[h]	Harriman (2000)
	Annual	15 $\mu g/m^3$	P, S	–	–	18.4 $\mu g/m^3$ (123%)	Harriman (2000)
Pb	Calendar quarter	1.5 $\mu g/m^3$	P, S	–	–	0.0063 $\mu g/m^3$ (0.4%)	ETTP (2000)

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TABLE 3.2-3 (Cont.)

[a] CO = carbon monoxide; NO_2 = nitrogen dioxide; O_3 = ozone; Pb = lead; $PM_{2.5}$ = particulate matter $\leq$ 2.5 µm; PM_{10} = particulate matter $\leq$10 µm; and SO_2 = sulfur dioxide.

[b] The SO_2 (3-hour and 24-hour) and CO standards are attained when the stated value is not exceeded more than once per year. The SO_2 (annual), NO_2, and Pb standards are attained when the stated value is not exceeded. The O_3 (1-hour) standard is attained when the stated value is not exceeded more than three times in three years. The O_3 (8-hour) standard is attained when the 3-year average of the annual fourth-highest daily maximum 8-hour average concentration does not exceed the stated value. The PM_{10} (annual) and $PM_{2.5}$ (annual) standards are attained when the 3-year average of the annual arithmetic means does not exceed the stated value. The PM_{10} (24-hour) standard is attained when the 3-year average of the 99th percentile values does not exceed the stated value. The $PM_{2.5}$ (24-hour) standard is attained when the 3-year average of the annual 98th percentile values does not exceed the stated value.

[c] P = primary standard whose limits were set to protect public health; S = secondary standard whose limits were set to protect public welfare.

[d] Class I areas are specifically designated areas in which the degradation of air quality is severely restricted under the Clean Air Act; Class II areas have a somewhat less stringent set of allowable emissions.

[e] Values in parentheses are monitored concentrations as a percentage of NAAQS or SAAQS.

[f] The NAAQS have a primary standard only; the Tennessee SAAQS, however, have a secondary standard as well.

[g] A dash indicates that no standard exists.

[h] Second-highest value.

[i] Fourth-highest value.

Sources: 40 CFR 50; TDEC (1999); 40 CFR 52.21; DOE (2002e); EPA (2003b).

TABLE 3.2-6 Federal- and State-Listed Endangered, Threatened, and Special Concern Species on ORR

Scientific Name	Common Name	Federal Status	State Status
Mammals			
Myotis grisescens	Gray bat	E	E
Sorex longirostris	Southeastern shrew		NM
Birds			
Accipieter striatus	Sharp-shinned hawk		NM
Aimophila aestivalis	Bachman's sparrow		E
Anhinga anhinga	Anhinga		NM
Casmerodius alba	Great egret		NM
Circus cyaneus	Northern harrier		NM
Contopus borealis	Olive-sided flycatcher		NM
Dendroica cerulea	Cerulean warbler		NM
Egretta caerulea	Little blue heron		NM
Egretta thula	Snowy egret		NM
Falco peregrinus	Peregrine falcon		E
Heliaeetus leucocephalus	Bald eagle	T	NM
Lanius ludovicianus	Loggerhead shrike		NM
Pandion haliaetus	Osprey		E
Sphyrapicus varius	Yellow-bellied sapsucker		NM
Amphibians			
Hemidactylium scutatum	Four-toed salamander		NM
Fish			
Phoxinus tennesseensis	Tennessee dace		NM
Plants			
Aureolaria patula	Spreading false-foxglove		T
Carex gravida	Heavy sedge		S
Carex oxylepis pubescens	Hairy sharp-scaled sedge		S
Cimicifuga rubifolia	Appalachian bugbane		T
Cypripedium acaule	Pink lady's slipper		E
Delphinium exaltatum	Tall larkspur		E
Diervilla lonicera	Northern bush-honeysuckle		T
Draba ramosissima	Branohing whitlow-grass		S
Elodea nuttallii	Nuttall waterweed		S
Fothergilla major	Mountain witch-alder		T
Hydrastis canadensis	Golden seal		S
Juglans cinerea	Butternut		T
Juncus brachycephalus	Small-head rush		S
Lilium canadense	Canada lily		T
Lilium michiganense	Michigan lily		T
Liparis loeselii	Fen orchid		E
Panax quinquifolius	Ginseng		S
Platanthera flava herbiola	Tuberculed rein-orchid		T
Ruellia purshiana	Pursh's wild petunia		S
Scirpus fluviatilis	River bulrush		S
Spiranthes lucida	Shining ladies-tresses		T
Thuja occidentalis	Northern white cedar		S
Viola tripartita	Three-parted violet		S

[a] Status codes: E = endangered; NM = in need of management; S = special concern; T = threatened.

Source: DOE (2001f).

TABLE 3.2-7 Estimated Radiation Doses to Members of the General Public and Cylinder Yard Workers at ETTP

Receptor	Radiation Source	Dose to Individual (mrem/yr)
Member of the general public (MEI)[a]	Routine site operations	
	Airborne radionuclides[b]	
	ETTP only	0.1
	Entire ORR	0.8
	Waterborne radionuclides[c]	3.7
	Direct gamma radiation	1.8[d]
	Ingestion of wildlife	0.4[e]
Cylinder yard worker	External radiation	32–92,[f] 107[g]
Member of public or worker	Average natural background radiation in the State of Tennessee	42[h]
DOE worker limit		2,000[i]

a The MEI is assumed to reside at an off-site location or undertake the specific activities that would yield the largest dose. An average person would receive a radiation dose much less than the values shown in this table.

b Radiation doses from airborne releases were estimated by using an air dispersion model and took into account exposures from external radiation, inhalation, and ingestion of foodstuffs. Doses were estimated on the basis of the emission rate from ETTP only and from the entire ORR (DOE 2002d).

c The radiation dose would result from eating 21 kg/yr (46 lb/yr) of the most contaminated accessible fish, drinking 730 L/yr (193 gal/yr) of the most contaminated drinking water, and using the shoreline near the most contaminated stretch of water for 67 h/yr (DOE 2002d).

d Radiation doses would result from 250 hours of shoreline activity per year along the banks of Poplar Creek or near the K-1066-E cylinder yard (DOE 2002d).

e Radiation doses would result from ingestion of two hypothetical worst-case geese (a combination of the heaviest goose harvested and the highest measured concentrations of cesium-137 and strontium-90 found in released geese (0.3 mrem/yr) and a hypothetical worst-case turkey (0.1 mrem/yr) (DOE 2002e). Deer hunt activities were cancelled because of security concerns during the final quarter of 2001 (DOE 2002d).

f The range of annual average doses from 1991 through 1995 (Hodges 1996).

g In 1998, the maximum worker exposure from painting cylinders was 107 mrem/yr (Cain 2002b).

h Dose from natural background radiation ranges from 19 to 72 mrem/yr in Tennessee (DOE 2002d).

i DOE administrative procedures limit DOE workers to 2,000 mrem/yr (DOE 1992), whereas the regulatory dose limit for radiation workers is 5,000 mrem/yr (10 CFR Part 835).

TABLE 3.2-8 Estimated Hazard Quotients for Members of the Public near ETTP under Existing Environmental Conditions[a]

Environmental Medium	Parameter	Assumed Exposure Concentration	Estimated Chronic Intake (mg/kg-d)	Reference Level[b] (mg/kg-d)	Hazard Quotient[c]
Air[d]	Uranium	0.0014 μg/m^3	3.9×10^{-3}	0.0003	0.0013
Soil[e]	Uranium	6.7 μg/g	8.9×10^{-5}	0.003	0.03
Surface water[f]	Uranium	13 μg/L	7.1×10^{-6}	0.003	0.0024
	Fluoride	180 μg/L	9.9×10^{-5}	0.06	0.0016
Sediment[g]	Uranium	43 μg/g	1.2×10^{-5}	0.003	0.0039
Groundwater[h]	Uranium	25 μg/L	1.8×10^{-4}	0.003	0.24
	Fluoride	4,000 μg/L	1.1×10^{-2}	0.06	1.9

a The receptor was assumed to be a long-term resident near the site boundary or another off-site monitoring location that would have the highest concentration of the contaminant being addressed; reasonable maximum exposure conditions were assumed. Only the exposure pathway contributing the most to intake levels was considered (i.e., inhalation for air and ingestion for soil, sediment, surface water, and groundwater). Residential exposure scenarios were assumed for air, soil, and groundwater analyses; recreational exposure scenarios were assumed for surface water and sediment analyses. For all environmental media, only uranium and fluoride data of particular interest for this EIS are presented, although other substances are also measured.

b The reference level is an estimate of the daily human exposure level that is likely to be without an appreciable risk of deleterious effects. The reference levels used in this assessment are defined in Appendix F.

c The hazard quotient is the ratio of the intake of the human receptor to the reference dose. A hazard quotient of less than 1 indicates that adverse health effects resulting from exposure to that chemical alone are unlikely.

d For the uranium air concentration, the maximum average from six monitoring locations was used (DOE 2002e). HF was not measured.

e Current soil sampling data were unavailable; data presented are from LMES (LMES 1996c). No data were available for fluoride.

f For uranium, the value is the maximum average for downstream locations (DOE 2002e). Current surface water sampling data for fluoride were unavailable; data presented are from LMES (1996c).

g Current sediment sampling data were unavailable; data presented are from LMES (1996c).

h Groundwater data are not provided in current annual site environmental report (DOE 2002e). The concentration presented for uranium is from LMES (1996b). The value is the maximum annual average for all exit pathway monitoring locations because these are the locations where the general public could most likely be exposed in the future. Alpha activity was used as a surrogate measure of the uranium concentration. The well-specific concentration for fluoride was not available; the exposure concentration given is the drinking water standard. Several wells were stated to have fluoride levels in excess of the standard (LMES 1996b). The hazard index for fluoride could therefore exceed that presented. Several additional substances exceeded drinking water standards or guidelines in 1994 and 1995 monitoring; only substances of particular interest for this EIS are listed here.